Conference Proceedings

Monitoring and Management of Visitor Flows in Recreational and Protected Areas

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Preface

by

Arne Arnberger, Christiane Brandenburg, Andreas Muhar

The United Nations has designated the year 2002 as The International Year of Eco-tourism as well as The Year of Mountains. As a contribution to both, the Institute for Landscape Architecture and Landscape Management, Bodenkultur University Vienna, and its partners organised the International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas, January 30 – February 2, 2002, Vienna, Austria.

Tourism, in particular eco-tourism, is expected to double in the next twenty years, and a growing share of such travel will be to national parks and other protected areas as well as to other nature-based destinations. The predicted rising visitor numbers will lead to crowded recreation areas as well as stress on natural areas. The attractivity of the landscape is diminished and recreational needs cannot be satisfied. Species and habitats, which require highest conservation priority, are at risk of being decimated due to the high recreational use. In particular, in densely populated regions, recreational and protected areas close to conurbations and sensitive conservation mountain areas are exposed to rising recreational use. Additionally, an increased expansion of recreational infrastructure is being registered. World-wide, the consequences of nature-consuming and unsustainable tourism are being lamented by nature conservationists, by visitors as well as by the tourism industry itself.

The big challenge for nature management is to preserve areas with minimal human impact, in particular by leisure activities, while at the same time, zones must be found to satisfy recreational and educational needs. The development of visitor management plans as part of the management of protected and recreational areas is widely accepted by park managers as a way of reducing these conflicts.

The establishing of such visitor flow concepts requires accurate knowledge of visitor numbers and activities along with information on their needs and motivations. But in most cases information about the recreational activities in investigated areas is only passed on by word of mouth. These subjective evaluations are a spontaneous help for small-scale decisions, but are not suited for a successful long-term management, for large-scale plans and are not transferable to other areas. While monitoring of vegetation and wildlife in European recreational and protected areas has a long tradition, a systematic monitoring of recreational uses and visitor flows is rarely carried out.

Therefore, the demand for qualitative and quantitative, spatially related and standardised data about visitor numbers is striking, in particular for areas with high visitor numbers and for conflict zones.

In order to manage protected areas within acceptable ecological and social carrying capacities, one needs to monitor visitor numbers, leisure activities and behaviour, and deepen the understanding of expectations and motivations. Data on public use help to improve management in order to preserve or to improve biodiversity of parks while at the same time helping to satisfy the public`s need for recreation, to provide the recreationists the opportunity to find the sought leisure and recreation experience in the respective visited area, to "get away from it all". Useful data on public use contribute significantly to an optimal management of the protected area itself (best allocation of staff resources, the provision of visitor services etc.). The better the quality of information, the better the opportunity for good management. Also, the lack of acceptance of use-restrictions in recreational and protected areas by visitors and residents is a current problem of area management. Registering and considering visitor needs in park management can help raise the acceptance of protected areas and of conservation issues and objectives in both visitors and local residents. Thus, one objective of the conference volume is to demonstrate the importance of collecting data on public use and the importance of visitor management in recreational and protected areas.

The basis of every successful data collection on public use is the set of applied methods of visitor monitoring. In this conference volume a thorough exploration and debate of efficient and cost-effective monitoring and recording methods takes place. Advantages and disadvantages of various methods of recording qualitative and quantitative data (optical sensors, video surveillance, personal interviews, mailback questionnaires, choice modelling, decision analysis, GIS-applications etc.) are discussed and models to simulate and predict visitor flows presented. Different approaches to record public use and to manage visitors are demonstrated. Impacts on nature caused by leisure activities and new research results on recreation are described. Moreover, ethical aspects of applied methods, e.g. of video surveillance, are on the agenda.

This volume aims to support wildland and urban park managers in identifying best practices and techniques for monitoring visitors and it is also designed to aid in their everyday work both practicioners and researchers who are engaged in park planning and administration, as well as in research projects.

Andreas Muhar | Arne Arnberger | Christiane Brandenburg

Opening Address

by

Günter Liebel

The need to guide the tourism process and moreover to ensure sustainable developement has become a current issue for protected areas worldwide. The UNO has declared the year 2002 as the International Year of Ecotourism and the International Year of Mountains. Within the Convention on Biological Diversity guidelines on “Biological Diversity and Tourism” are prepared and the European Union at present deals with the chances and possible impacts of tourism on the Natura 2000 sites.

Tourism is one of the world`s fastest growing industries and its global impacts are immense and highly complex. Given that a high percentage of tourism involves visits to naturally and culturally distingiushed sites, there are clearly major opportunities for investing in the maintenance of biological resources.

In Austria the situation is less problematic as far as protected areas like national parks, nature parks or protected landscapes are concerned. About one quarter of the total Austrian surface is protected according to the various categories of site protection. Among these categories the five national parks hold a special position since they have to meet the criteria of the World Conservation Union IUCN and are managed by park administrations. They attract an increasingly large number of visitors and serve as a major educational place. There is free access to the parks and therefore no charge of entrance fees, a situation most common also in many other European parks. Due to this fact there hardly exist any standardized data on visitor numbers, visitor expectations, motivation or behaviour.

Managing tourism in a sustainable way however requires both a long-term perspective and careful consideration of the many ways in which touristic activities and environment interrelate. What is needed is a systematic approach and a tool kit for planning in order to provide the necessary resources for visitor management. Therefore it is important to provide standardized data and collect them as early as possible.

This conference contributes to extend the knowledge of different methods and techniques for visitor monitoring, plus offers an excellent chance for exchanging experience and expertise. For the Federal Ministry of Agriculture, Forestry, Environment and Water Management, being in charge of the Austrian national parks, a very good reason to support the event!

DI Günter Liebel
Federal Ministry of Agriculture, Forestry, Environment and Water Management
Head of Division II/4 “Nature and Species Protection, National Parks”

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Methods for Visitor Monitoring in Recreational and Protected Areas: An Overview

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Abstract: The objective of this paper is to present a systematic overview on methods used for visitor monitoring in recreational areas. Emphasis is given on quantitative methods such as direct observation, video observation, counting devices and registration books. The various approaches are discussed with regard to practical, legal and organisational aspects, such as costs, maintenance requirements, dependence on infrastructure (e.g. electricity), risk of vandalism or suitability for remote and ecologically sensitive locations.
For the design of a visitor monitoring scheme in a specific recreational area it is necessary to determine the best combination of devices and methods, depending on the objectives of the monitoring program. This relates also to the temporal resolution of monitoring activities (permanent, periodic, selective). In areas where the recreational use is largely depending on external factors such as weather, daytime and season, the representativity of a sampling scheme becomes crucial for the statistic validity of the obtained data.
As visitor monitoring can also be regarded as an interference with the privacy of the persons being monitored, ethic aspects of the application of the various methods must also be addressed.

INTRODUCTION

Monitoring of vegetation and wildlife in recreational and protected areas has a long tradition. In particular in national parks, the scientific interest in creating inventories and in observing the development of ecosystems has often been a driving force for the establishment of monitoring schemes. In many countries, systematic long-term research programs are seen as part of the duty of a national park service.

Opposed to that, a systematic monitoring of recreational uses and visitor flows is rarely carried out. This is particularly true for the situation in most European countries, where visitor monitoring, if at all done, is usually organised on an ad-hoc basis without systematic planning. Very often, results from improvised one-day countings are being extrapolated and used for management decision without consideration of the significance of the results.

The design of a monitoring project has to consider many practical, organisational, financial and also legal aspects:

Why should be monitored?

The goal of a monitoring scheme has to be clearly defined. Very often, it is unclear, whether a monitoring campaign is carried out to identify specific problems within a protected area, e.g. overuse, or simply to justify funding requests. Other goals could be to check the adherence to limitations of use, to minimise conflicts between user groups or to collect comprehensible data for planning decisions such as the allocation of infrastructure and services. Every such goal will require a different mix of monitoring methods.

What should be monitored?

From the definition of the goals of a monitoring scheme the measurement units can be determined:
Number of visits
Number of (individual) visitors
Visitor load (e.g. visitor hours)
Visitor flow (e.g. persons/hour/direction)
Visitor density (e.g. persons/length unit of trails)
Visitor activities etc.
In many cases it will be essential to register not only the visitors themselves and their activities but also some external factors which might have an effect on the visitation such as weather conditions, special events (e.g. sports competitions) or holidays.

Who should be monitored?

Not every person encountered in a park or recreation area is a visitor. The typical motives of a visitor are outdoor recreation or cultural appreciation (Hornback & Eagles 1999). Persons just passing through (e.g. by car on their way to work) or persons working in a recreational area such as forest workers, farmers or park employees should therefore not be considered as visitors. In order to report visitor numbers, they should not be included in use statistics. This distinction is only feasible in remote areas, whereas in urban recreation areas it is almost impossible to identify the motive of a person entering a park.

In any case, if the goal of a monitoring scheme is to quantify the interactions between humans and the ecosystem, the total number of persons has to be accounted, independent from the reasons of their presence.

Where should be monitored?

Very often, monitoring is primarily carried out at entrance points (e.g. park gates, parking grounds) or visitor centers. These are also the locations where counting stations can easily be installed (electricity supply, security etc.). This leads to an over-representation of short-time users or users with minimal activity radius (e.g. picnickers) in the usage statistics. If the goal of the monitoring activities is to quantify interactions between visitors and the ecosystems, visitor monitoring in the core areas of a park is essential.

It might be easy to select counting points in recreational areas with a limited number of entrance points or key attractions. In the European context, the more typical situation is an open road or trail network with multiple entrance points. This is particularly the case in urban forests. In such situations, numerous pre-tests will be necessary to determine the most significant nodes in the trail network for the placement of counting stations.

When should be monitored?

In most European countries, systematic long-term visitor monitoring is hardly ever carried out. The most frequent type of counting activities are single-day countings. Very often, expected peak visitation days (e.g. Sundays in early summer) are selected for counting campaigns, and the results from these days are then being used to alarm the public because of excessive use-levels.

From numerous monitoring projects both in urban and in remote locations we learnt that for the understanding of the dynamics of recreational uses it is essential to have data which cover all seasons and all other external influences such as weather, daytime etc. However, this does not mean that every single visitor has to be recorded: For our time-lapse video monitoring projects we found that in heavily used recreational areas a sampling time of 15 minutes per hour is sufficient (Brandenburg 2001).

MONITORING TECHNIQUES

Numerous techniques are available for the monitoring of visitor flows in recreational areas. In the following section a short description of each approach will be given. A summary of the techniques and their fields of application is given in Table 1 (see also Watson et al. 2000).

Interviews

Oral and written interviews are an integral part of visitor monitoring concepts. They provide mainly qualitative information about the needs and motivations of visitors, their origin, their habits and activities as well as their routes within a recreational area. When combined with quantitative data from counting stations, important conclusions can be drawn for the management.

Direct observation

<u>Roaming observers</u>: In many national parks, rangers also records of the number of people they meet during their inspections of the area. These data can be used as additional information within a data gathering process, in particular in remote areas, but need to be treated cautiously, unless the roaming is set up in a systematic way.

<u>Fixed counting stations</u>: Specific manned counting stations are usually only set up for short observation periods. However, personnel working at information booths, souvenir shops etc. can also be integrated in a long-term monitoring concept, provided that the circumstances are clearly described (keeping of records also at peak times etc.).

Indirect observation

<u>Automatic cameras, time-lapse video</u>: Video recordings or photographs are an excellent source of information for visitor monitoring. In order to maximise the operating time without maintenance (change of tapes), time-lapse video recorders can be used, which take images at fixed intervals (e.g. 5 seconds). Most of the devices available commercially had been developed for security surveillance of homes, public buildings, factories etc. and usually depend on standard electricity supply.

The main cost factor is the interpretation of the video images, in particular, if not only the number of persons has to be recorded but also other aspects such as group size, mode of transport (hiking, biking), direction of movement etc. First attempts to automate the interpretation with the help of digital image analysis had been promising (Muhar et al. 1995), yet the calibration of the system for different locations and under different seasonal and weather conditions turned out to be very difficult.

Current development directions are independence from standard electricity supply (e.g. solar panels with buffer batteries) and wireless transmission of image data. There are already commercial systems available which can transmit image data over a short distance via an infrared interface, a combination with mobile telephones seems also possible.

<u>Arial, satellite imagery</u>: Airphotos can only be used for the detection of users in open areas such as beaches, lakes, grassland, or roads. New high-

resolution satellite images such as those from the IKONOS project will probably take over the role of conventional airphotos in many fields of application. However, both types of images offer only a single snapshot of the recreational use, the acquisition of a time series is usually far too expensive.

Counting of access permits and tickets

Where access to an area is restricted either by a quota or by selling entrance tickets, it is very easy to keep records of the permits or tickets issued to visitors.

Records from commercial facilities such as cable-cars, ferries, or even restaurants (number of meals served) also form a good source of information, provided that private enterprises and park administrations are willing to cooperate.

Counting devices

As counting of persons in the field is very labour-intensive, automatic counting devices are often applied in order to reduce costs. Some these devices have originally been developed for road traffic counting and are of limited use for non-road traffic.

Turnstiles: The use of turnstiles is usually limited to entrance situation of areas with restricted access (e.g. fenced areas) and high visitor numbers. Visitor numbers derived from turnstile countings are very often over-estimated, in particular when the devices are not permanently guarded (children love to play with turnstiles) and serviced (unwanted freewheeling).

Photoelectric counters: Light barriers, active or passive infrared sensors, linked with data loggers are very useful counting devices. Their energy consumption is relatively low, therefore they can be installed as battery-supplied counting stations even in remote locations.

A big challenge for all types of counting devices is the site-specific set-up and calibration of the counting station: A counting signal can be triggered not only by visitors, but also by wildlife or - on windy days - by twigs. Visitors walking in groups, even visitors with very dark or light clothing might also be wrongly recorded (Gasvoda 1999). In our own projects, we found good correlations between monthly or daily sums of visitors and the corresponding sensor signals, however, on an hourly basis, the correlation was sometimes weaker. The results illustrated in Fig.1 could only be achieved after a long calibration phase.

A big disadvantage of most of these devices is that they usually only record the number of visitors but not their direction. Differential approaches (e.g. two light barriers at short distance) work only in settings with low use levels.

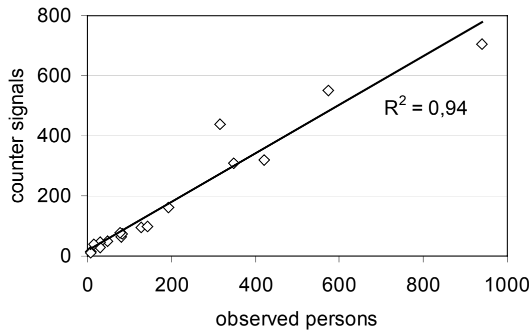

Fig.1: Correlation between light barrier signals and daily numbers of visitors at 16 counting days in the Danube Floodplains National Park

Pressure sensitive devices (Pneumatic tubes, mats): Various types of pneumatic tubes and other pressure sensitive devices have been developed, mainly for the detection of road traffic. When used for counting hikers, there is again a need for a good calibration to infer from the number of signals to the real number of persons (bikers will trigger a tube twice etc.).

Inductive loop sensors: These devices are extensively used for the monitoring of road traffic. As the signal is triggered by the movement of metallic objects, their application makes sense only for vehicle counting within a recreational area (including bike travel; also horseshoes might trigger a signal).

Self-registration

Trail registers: There are two types of trail registers: In many American parks trail registers are placed at trailheads on order to monitor the number of visitors, to check for permits and sometimes also to provide information for rescue teams about the intentions of a group. These data can be used to determine the number of persons entering an area and their routes, provided that the ratio between the total number of visitors and the number of persons actually registering can be estimated (Leatherberry & Lime 1981).

In European countries, registers at trailheads are uncommon, however, registers are sometimes placed in climbing routes, usually at the end of the most difficult section. They are then a good source of information on the number of persons actually mastering a route.

Summit books: It is again more a (Central) European tradition to place books on summits. The primary function of these books is not visitor registration but rather the provision of a “guest book”. It is very difficult to determine the percentage of persons actually signing theses books. As a general rule, the higher the number of visitors, the lower will be the percentage of registration. On the other hand, on “famous” peaks, more people will like to have their names in these books than on “normal” hikes.

Hut or campground registers: In many areas it is compulsory to register in a hut or campground when staying overnight. Therefore data derived from these registers can be quite reliable. The registration usually also includes data on the origin of the visitor and the next destination. Therefore, they can be a useful source for the determination of typical routes (Muhar 2001).

In some areas e.g. of the Alps, also day visitors register in huts, but the percentage of registered visitors can vary from hut to hut, depending on the placement of the register within the hut, the policy of the warden and also the weather: In dubious weather situations, more hikers would register in a hut and leave information on their next destination in order to be found by rescue teams.

Mapping of traces of use

Although it is obvious that there is a correlation between the intensity of recreational use and "traces" left by the users in the landscape, it is very difficult to conclude from the mapping of these traces to actual visitor numbers (Coch & Hirnschal 1998).

Garbage: The amount of garbage left either in bins or in the landscape certainly is not only correlated to visitor numbers, but also to individual behaviour and local traditions.

Trail deterioration, damage to vegetation: Long lasting effects of recreational use are often seen as an indicator for overuse, however, there are so many other factors that contribute to this (e.g. trail design). Also, once a trail is already damaged, deterioration will continue even with lower use levels.

Footprints and sandbeds: Footprint data are used extensively in wildlife monitoring. In areas with low use levels human footprints can also be counted. As the age of a footprint is difficult to determine, it would, again similar to a technique applied in wildlife studies (Angold et al. 1999), be possible to provide sandbeds which are checked and raked at regular intervals.

USEFUL COMBINATIONS OF METHODS

It is obvious, that in the design of a monitoring scheme a mix of methods will be considered in order to compensate for the disadvantages of single counting techniques and to derive additional information from comparisons and correlations.

As an example, temporally selective counting at many different locations can be combined with permanent video observation on a few selected sites. Once the correlation between the various locations has been established, an extrapolation of the number of visitors can be performed.

Also visitor counting at selected locations can be combined with qualitative interviews on the motivation of visitors and their routes in order to determine the visitor load in different sections of the area (Arnberger et al. 2000).

One of the big advantages of combined monitoring schemes is the possibility to crosscheck data from one method with data from a different method. Fig.2 shows the results of different approaches to determine the percentage of dogs kept on leash in the Danube Floodplains National Park. In this park it is compulsory to keep dogs on leash.

			visitor numbers	direction of motion	routes	distribution within area	group size	visitor charac- teristics (age, sex)	visitor characteristics (origin, expectations etc.)	behaviour
direct methods	interviews	oral interviews			x	x	x	x	x	x
		written interviews			x	x	x	x	x	x
	direct observation	roaming observers	(x)	(x)	(x)	(x)	(x)	(x)		(x)
		fixed counting stations	x	x		x	x	x		x
	indirect observation	automatic cameras	x	x		x	x	x		x
		time-lapse video	x	x		x	x	x		x
		arial, satellite imagery	(x)	(x)	(x)	(x)	(x)			
	counting of access permits	tickets sold	x							
		permits issued	x				x			
	counting devices	turnstiles	x	(x)			(x)			
		photoelectric counters	x	(x)			(x)			
		pressure sensitive mats	x	(x)						
		pneumatic tubes	x	(x)						
		inductive loop sensors	(x)	(x)						
	self-registration	trail registers	x	x	(x)		x			
		summit books	x	x	x		x			
		hut registers	x	x	x		x			
indirect methods	mapping of traces of use	garbage	x			(x)				
		trail deterioration	x			(x)				
		damage to vegetation	(x)			(x)				
		footprints	x	(x)		(x)				
		sandbed	x	(x)						

Table 1: Techniques for visitor monitoring and their fields of application

People were interviewed at a visitor information both about their willingness to accept this rule. At the same location the actual number of dogs on leash was counted. The results were almost identical. However, the data from a hidden video observation station a few minutes away from the information booth show a much lower percentage for the same day. On days when the information both was not manned, the percentage was even lower.

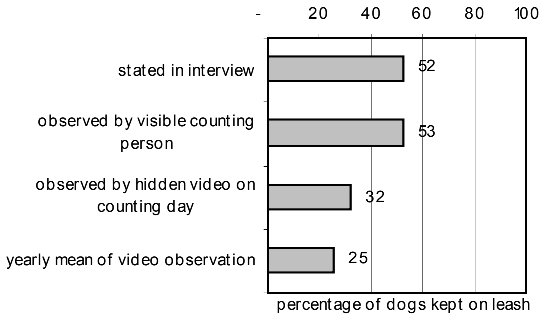

Fig.2: Rate of dogs kept on leash in the Danube Floodplains National Park, determined from different data gathering methods (Brandenburg 2001)

DISCUSSION

Ethic aspects

Some visitor monitoring methods can be seen as an intrusion into the private sphere of a visitor. This is true for most methods where images are taken (video recordings, automatic cameras), but also for other methods of hidden observation (human observers), in particular in remote locations, where visitors do not expect to be watched: In urban environments, people are already quite familiar with video surveillance, and it can even bee seen as a motive to visit remote areas, that one can behave there more freely, without being monitored.

However, as discussed in Fig.2, data on the behaviour of visitors derived from hidden observation can be much more realistic than from open observation (see also Vanderstoep 1986)

For our own research projects, we established a rule that every observation station (video camera) should be set up in a way, that it is not possible to identify individual persons in these images. The image resolution is just fine enough to count people and to identify e.g. their direction of movement, but not to identify the individual. As a second precaution, we do not use persons from the study areas as interpreters, who might be able to infer from identifiable behaviour to certain locally known persons. Nevertheless, we think that park managers should be very cautious when installing video cameras in remote locations; wherever possible, alternative solutions should be considered.

Vandalism

Counting devices in unguarded situations are of course exposed to vandalism. The mildest form of vandalism is the manipulation of devices so that they report no or wrong results, but sometimes gear will also be completely destroyed. We found that light barriers are in particular attracting vandals, even when we had the impression that they were well hidden. In such cases the application of totally buried counters (pressure sensitive devices) might be a useful alternative.

Costs vs. accuracy

Many devices currently used for visitor monitoring are mass products from the security surveillance sector. Therefore the hardware costs are no longer a big issue. The main cost factor are labour costs, for the installation and maintenance of counting devices, for conducting interviews or for the analysis of data (e.g. video interpretation). It is crucial for the success of a monitoring concept that from the beginning the required accuracy level is clearly identified. Reasonable accuracy can be defined as the level which is good enough to detect changes that are significant for management decisions (Hendee et al. 1990).

CONCLUSIONS AND OUTLOOK

A large number of techniques and methods have been developed for visitor monitoring.

From our point of view there are three key issues for the future developments in visitor monitoring:

<u>Awareness of decision makers</u>: First of all, there is still not enough awareness of the needs of visitor monitoring and management. At least in the European context, there is a big gap between the importance of recreation for the public and the resources invested into the management of recreational and protected areas as well as into research activities.

<u>Standardisation of methods:</u> It is very difficult to compare results from different areas when also different methods are applied. While for example within the US Forest Service a nation-wide monitoring program with standardised methods has been installed (English et al. 2001), not much has been done at the European level. On an international level, there are initiatives to establish standardised guidelines for visitor monitoring (Hornback & Eagles 1999). However, these initiatives did not have much response yet at national level.

<u>Development of more reliable automatic sensors</u>: As discussed above, privacy of visitors must be respected. Video monitoring, although well-tried, and delivering excellent results for further analysis, will always remain a criticisable technique in this context. We hope that in the future more reliable automatic counting devices with better options for analyses (e.g. direction of movement) will be available.

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Visitor Structure of a Heavily Used Conservation Area: The Danube Floodplains National Park, Lower Austria

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Abstract: National parks in close proximity to large conurbations are not subject to the normal conflicts between conservation and ecological tourism but to those between conservation and urban recreational requirements. The Danube Floodplains National Park, Lower Austria is situated to the east of Vienna, the capital city of Austria, with a population of 1.6 million. Between June 2000 and May 2001, visitors were monitored in the Lower Austrian part of the National Park. An analysis of the results of the interviews, as well as their integration with the results obtained using long-term video monitoring, counts by human observers and route analysis, led to the identification of specific visitor categories with individual behavioral patterns and spatio-temporal distribution. In particular, regular recreational visitors from adjacent residential areas were very concerned about overcrowding and would react to the high visitor frequency through a change in their habits. This alteration of visiting habits would lead to grave problems for the environmental management of the National Park.

INTRODUCTION

Conservation areas, such as national parks, in close proximity to large conurbations present managers and researchers with a variety of challenging problems, due to the high number of visitors and the multifaceted visitor structure (Heywood, 1993). The visitor structure is characterized by a high percentage of visitors who come from the adjacent suburbs and villages using the park for everyday spare-time activities, such as walking the dog, jogging, and picking flowers. Only a low number of tourists explicitly wants to visit conservation areas to experience nature (Arnberger, Brandenburg 2001). The temporal stress on such areas is not limited to the weekends or particular seasons; due to the varying motives visitors have for visiting the protected areas, there is a continual high daily visitor stress throughout the year. The management of protected areas is made even more difficult if a recreational area, which has existed for decades and been used intensively, is converted into a national park. Traditional behavior patterns, long-established claims regarding its use and excellent local knowledge make management measures, limiting its use for leisure time activities, even though inevitable from the conservation standpoint, more difficult. These national parks, therefore, are not subject to the normal conflicts between conservation and ecological tourism but to those between conservation and urban recreational requirements.

If there are particular attractions at one location within an already highly-frequented conservation area, such as a well-developed recreational infrastructure (parking sites, easy accessibility) or natural features, visitors will be attracted for a variety of reasons and needs. If visits by these individual groups coincide also temporally this can lead to conflicts between the groups, due to their specific individual requirements and high numbers, as well as to negative influences on the nature of the area. In order to develop strategies to mitigate negative consequences associated with use, managers must be able to quantify the types and amount of use that occur. Some sound knowledge of the visitor structure is, therefore, one of the most important challenges and tasks in the development of national parks.

The Danube Floodplains National Park stands between these two fields of interest - conservation and the requirements of an urban population for nearby recreational possibilities. Taking the most frequented access point of the National Park as a model example, a discussion follows on the visitor structure and the resulting problems for the management of the area. This visitor monitoring study (Arnberger, Brandenburg, in press), which combines long-term monitoring and survey data, was commissioned by the Danube Floodplains National Park Administration, Lower Austria.

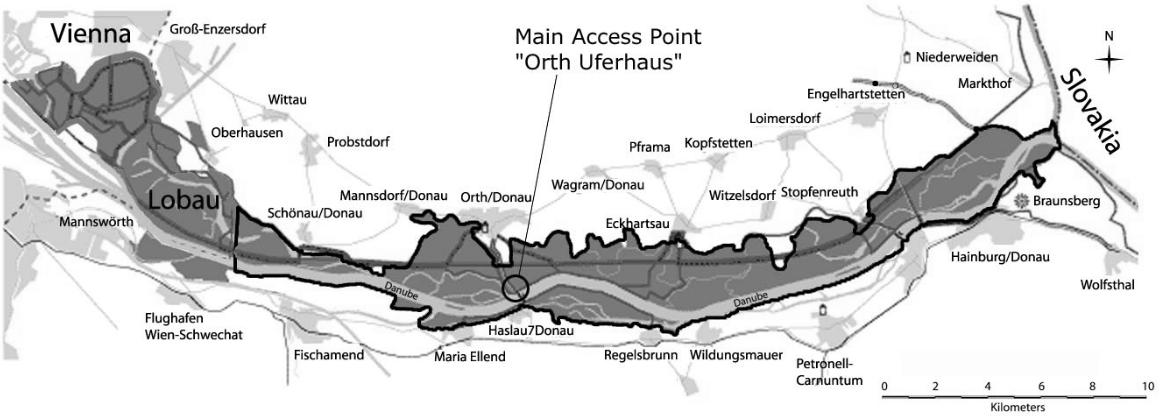

Fig. 1: The Danube Floodplains National Park, (the Lower-Austrian section is outlined in black)

STUDY AREA

The Danube Floodplains National Park is situated to the east of Vienna, the capital city of Austria, with a population of 1.6 million. The Lower-Austrian section of the National Park, with an area of 6.900 hectares, extends about 38 kilometers along the Danube river from Vienna to the border of Slovakia. In 1997, the Danube Floodplains, Lower Austria, were declared a National Park, and received international recognition, IUCN category II.

The location "Orth Uferhaus" is the most frequently used entrance. This entry point lies on the north bank of the Danube, south of the village of Orth, with a population of approximately 1,800. Orth is only 15 kilometers distant from the Vienna city limits. It is easy to reach this location by car - public transportation, on the other hand, is not optimal. The entrance "Orth Uferhaus" offers the visitors an abundance of attractions and manifold possibilities for recreation in the attractive environment of the Danube with its old arms. The "Orth Uferhaus" is well known for the following reasons:

- a traditional excursion restaurant with excellent cooking,
- a large parking area only a short distance from Vienna and the National Park,
- close to highly frequented transnational biking routes,
- close to the village of Orth,
- starting or meeting point for excursions into the National Park,
- hiking trails, possibilities for swimming, children's playgrounds, renovated mills,
- the only ferry across the Danube east of Vienna,
- boat rentals and a small yacht harbor.

METHODS

Between June 2000 and May 2001, visitors were monitored in the Lower Austrian part of the National Park. As the quality of data collected in short-term monitoring campaigns is heavily affected by statistical variations, the use of long-term monitoring is a very important complement to short-term, in-depth visitor observation and interviews. Therefore, the combination of long-term monitoring and survey data, obtained using various methods, permitted a thorough analysis of visitor activities.

<u>Permanent time-lapse video recording:</u> Video-cameras were installed at two access points to monitor recreational activities (see Leatherberry & Lime 1981) year round, from dawn to dusk. For the analysis, only 15-30 minutes of observations per hour were taken into account, but this had no negative impact upon the significance of the results (Brandenburg 2001, Muhar, Zemann & Lengauer 1995). Given the type of video system installed, it was not possible to identify individual persons, so anonymity can be guaranteed.

<u>Interviews:</u> At 11 main entrance points into the Park, visitors were interviewed on eight days; the interviews took place on a Thursday and the immediately following Sunday, in March, June, August and September. The survey was conducted on days with fine weather, to permit the collection of as much data as possible. The total sample size for this study was 394.

<u>Personal observations:</u> Additionally, at 11 main entrance points to the Park and on the days of the survey, visitors were counted; the results of counting were combined with video data for extrapolating the total number of visitors per year.

<u>Analysis of the visitor routes (frequency maps):</u> As part of the survey, visitors were asked to mark the route through the National Park which they took, or planned to take, on a simple map. By linking the data from the interviews, with the help of an Access database, an analysis by topic was possible and the respective routes could be made visible via GIS (Arnberger, Hinterberger et al. 2000).

<u>Infrared Sensors:</u> Infrared sensors were installed at six (entrance) points to monitor recreational activities, year round. The sensors were properly calibrated by test series and by counting persons.

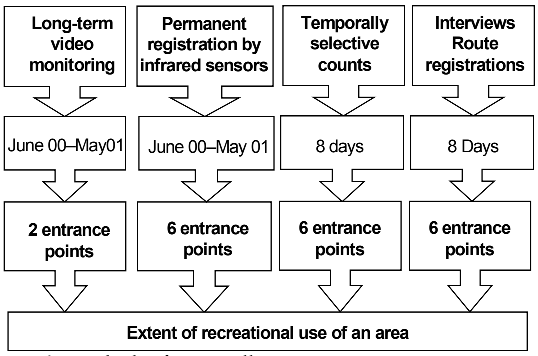

Fig. 2. Methods of Data-collection

OVERVIEW OF RECREATIONAL USAGE IN THE LOWER-AUSTRIAN SECTION OF THE NATIONAL PARK

From the video monitoring and counting data it could be calculated that there were close to 400,000 visits to the Lower-Austrian section of the National Park in the year of the study. The visitor density was calculated as 55 visits per year/per hectare. May was the month with the most visits, the fewest were registered in December. Sunday afternoons were the most highly frequented periods. One third of recreationists visited the national park at least once a week. The main users of the national park enjoyed biking and hiking, and a minority went jogging and canoeing. Only 4% of recreationists interviewed came due to motives focusing on the National Park (see fig. 3). More than 50% of the visitors to the National Park arrived in private cars.

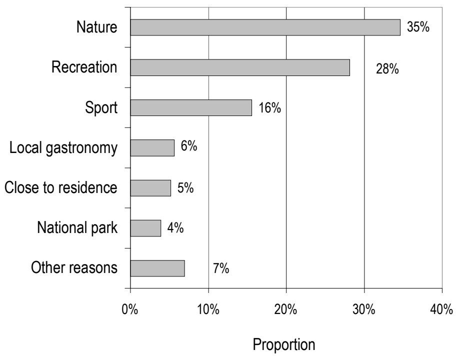

Fig. 3: Main reason for visit (n = 231)

QUANTIFICATION AND TEMPORAL DISTRIBUTION OF LEISURE-TIME ACTIVITIES AT THE MAIN ACCESS POINT "ORTH UFERHAUS"

The video observation of the access road to the location "Orth Uferhaus" showed 224,000 visitors entering the National Park, either on foot or using a vehicle, during the year of our research. The high season for visiting this location was the period between April and August. In May, 30,000 visits were registered. Itemized, according to the time of the year, we see that visitors using bicycles or motorbikes only arrive during the warm season.

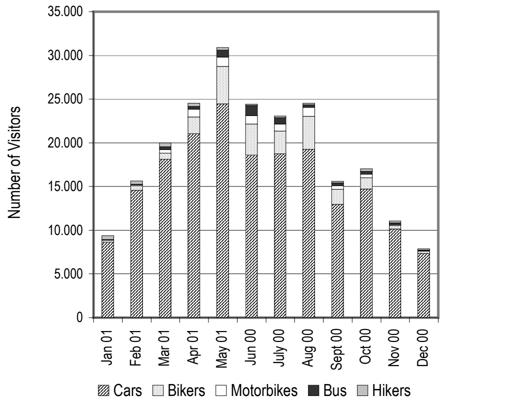

Fig. 4:Yearly progression of visitors according to means of transportation (Video-recording)

The highest visitor frequency was recorded on Sundays and public holidays. All user groups were concentrated on the weekends.

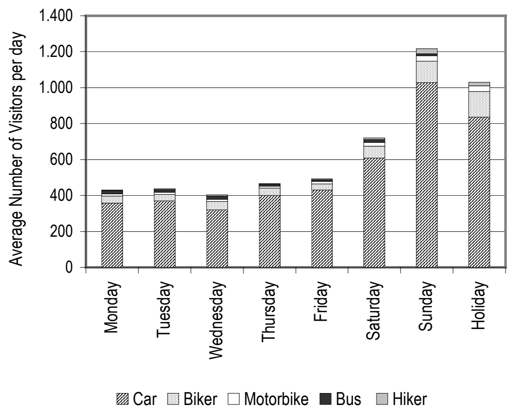

Fig. 5: Weekly progression of visitors according to means of transportation (Video-recording)

As can be seen, the highest frequency of visitors occurred on the weekends of the spring and summer. The daily results showed a peaking at noon and in the afternoon.

CATEGORY OF VISITORS AT THE LOCATION " ORTH UFFERHAUS"

An analysis of the results of the interviews, as well as their integration with the results obtained using video, counts and route analysis, led to the identification of five specific visitor categories with individual behavioral patterns and spatio-temporal distribution at this area. The linkage of video data with the data from our questionnaires concerned, principally, the choice of the means of transport (see fig. 6). Based on the results of a year-long video-observation the number of visits, were quantified according to the category of visitor.

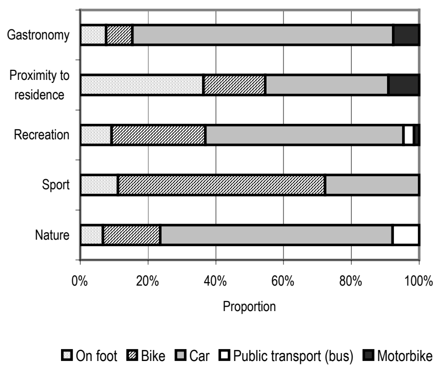

Fig. 6: Principal reason for visiting / according to means of transportation (n = 231)

The person interested in nature as visitor to the National Park

This person usually arrives by car or, sometimes, by bicycle to visit this natural region and/or the National Park. The main visiting periods are the weekends and spring.

The gastronomic- visitor

The gastronomic-visitor chooses this entrance solely because of the specialties offered in the "Ufergasthaus" restaurant. The National Park does not play a role in his decision-making process.

This category of visitor predominantly arrives by car, concentrated at noon (see fig.7). A hike through the national park is unusual.

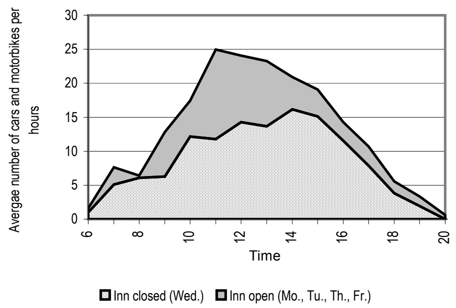

Fig. 7: Average daily progression, on workdays, of the number of cars and motorbikes travelling towards Orth, for the period October 2000 until Mai 2001. Video-observation.

The sporty, active type

This category of visitor usually arrives in the Danube Floodplains by bicycle or are joggers. The peak season is between April and August.

The person seeking recreation

The person seeking recreation predominantly arrives in the Danube Floodplains by car or bicycle. Weekend afternoons in spring and summer are the principal periods.

Characteristics	**Interested in nature and National Park visitor**	**Recreation seeker**	**Gastronomic visitor**	**Sporty, active**	**Visitors for whom the National Park is a part of the immediate environment**
Access	Car, bicycle (public transport)	Car, bicycle	Car (Motorbike, on foot, bicycle)	Bicycle, car, on foot	On foot, bicycle, car
Relative percentage at the location "Orth Uferhaus"	33 %	23 %	19 %	15 %	10 %
Main reason for visiting	To experience nature and the landscape, National Park	Recreation	Gastronomy	Sport	Proximity to home Recreation
Origin	Vienna, provinces	East Austria	Vienna	Proximity to the National Park, abroad	Settlements bordering on the National Park
Duration	More than 2 hours	Approx. 2 hours	Less than 2 hours	More than 2 hours	Less than 2 hours
Regularity of visiting	At least once a month	At least once a month	Less than once a month	Less than once a month	At least once weekly
Main day of visit	Weekend	Weekend	During the week and also at the weekend	During the week and also at the weekend	During the week and also at the weekend
Time of the National Park visit	All day	At noon and in the afternoon	At noon	All day	Early and late in the day
Average distance covered	7,6 km	10,6 km	3,4 km	16,5 km	8,2 km
Main season	Year-round, with peak in spring	Year-round, with peak in spring	Year-round, with peak in spring	Bicyclist between May and August, Joggers year-round	Year-round, with peaks in spring and early summer.

Table 1: Categories of visitors at the location Orth Uferhaus. Source: Surveys (n = 394(76)), Surveys of the route, counting, video-observation

Persons for whom the National Park is a part of their immediate environment

This group, from the nearby settlements (up to 1,5 km from the National Park), arrives in the National Park on foot, by bicycle or by car. The duration of their stay is the shortest of all visitor categories. They visit the National Park at the weekend and also during the week.

Due to the many possibilities offered, the location "Orth Uferhaus" is a center of attraction for visitors of the most varied categories. Approximately only one-third is really interested in the environment or the National Park. One hundred and fifty thousand visitors have other motives for their visit.

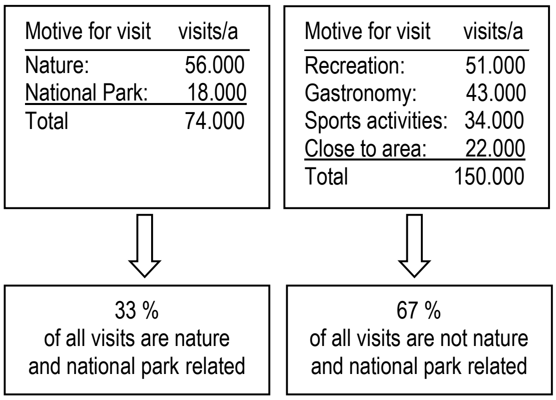

Fig. 8: Categories of visitors and frequencies at the main access point to the National Park

EFFECTS OF THE HIGH NUMBER OF VISITORS

Within the scope of our survey, visitors were also asked to give their views on the number of visitors. One-third was of the opinion of all visitors that the frequency was very high, particularly in the vicinity of the "Orth Uferhaus" and here, particularly at weekends in spring and in summer. Every second person interviewed at the access point "Orth Uferhaus" thought that there were a great number of or too many visitors. In particular, regular recreational visitors from adjacent residential areas were very concerned about overcrowding (see table 2).

	Residence adjacent to National Park	Residence in Eastern Austria	Residence in Western Austria or abroad
Appropriate number of visitors in the NP	49 %	71 %	83 %
Very many or too many visitors in the NP	51 %	29 %	17 %

Table 2: Occurrence of visitors with residence (n = 385;Pearson Chi-Square: Value: 25,347, df: 2, Sig. 0,000)

Those seeking recreation were asked to explain their reactions to the large number of visitors. This question is of particular importance for the management of the area because a spatial or temporal modification of the visitors to the byroads or to the evening or morning hours would lead to additional stress being placed on the animal world through leisure time activities. More than half of the interviewed groups, who stated that there were too many visitors in the National Park, alter their behavior. A change of their itinerary or other visiting times are the most common reactions to the high number of visitors (see fig. 8).

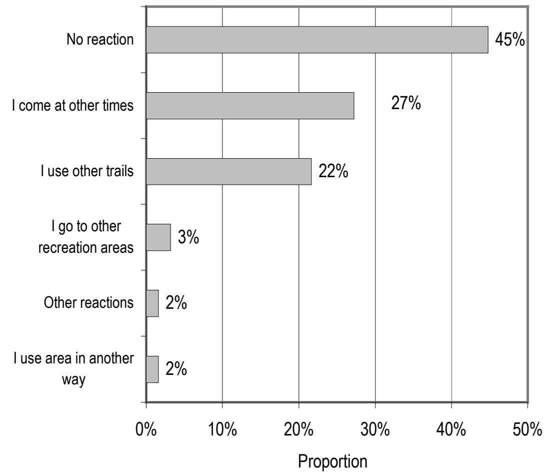

Fig. 9: Reactions to the large number of visitors (n = 125)

Above all, recreationists living in the vicinity or coming regularly, would react to the high visitor frequency through a change in their habits. Of those members of this group, 60% change the habits of their visits (see fig. 9).

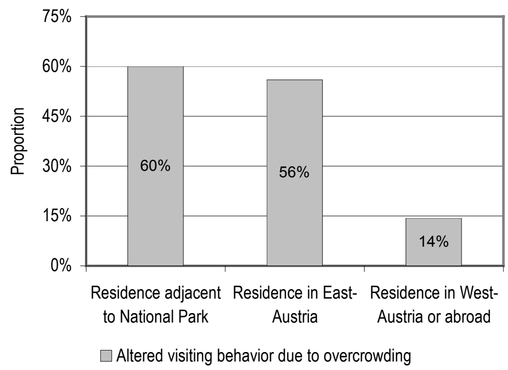

Fig. 10: Visitor reactions according to place of residence (n = 125)

This shows that visitors from Vienna and the other Austrian provinces partially oust the local population from their traditional surroundings. This alteration of visiting habits would lead to grave problems for the environmental management of the National Park. Due to the existing pressure, resulting from the large number of visitors, there are hardly any rest areas or rest periods for the endangered species. If there was an alteration in the habits of those seeking recreation, these animals would be concentrated into even smaller areas and their rest periods would be even more reduced. This pressure would lead to the environmental potential of the National Park not being optimally utilized, in respect to the number of species and individual animals (see also Sterl et al., in print). The extreme, permanent recreation pressure seems particularly critical from the point of view of wildlife ecologists as the National Park represents the only remaining migratory corridor between the Alps and Carpathians (Völk 2001). Therefore, overcrowding is one of the main, principal challenges for the park management.

CONCLUSIONS

The high visitor frequency at the location "Orth Uferhaus" and in the entire National Park is only caused, to a minor extent, by visitors to the National Park and other nature areas. The necessity for recreation, along with the traditional recreational habits of the Viennese, leads to high stress being placed on this conservation area. Seeing that suitable areas for this group of visitors to the National Park do not exist within the urban area of Vienna, or that these have already reached their social carrying capacities (e.g., the upper section of the Lobau in the Viennese section of the National Park), other nearby recreational areas are frequented. Urban inhabitants are now highly mobile and can, therefore, take advantage of more distant recreational offers. This is accompanied by traffic problems, particularly during the weekends, and an exceeding of the social and ecological carrying capacity of some sections of the National Park, such as near the entrance "Orth Uferhaus". Measures to regulate visitors in the area are necessary and can only be precisely targeted using the information on the types of visitor available from the visitor monitoring of the National Park.

In the neighboring residential areas, building is proceeding rapidly, an increasing number of city dwellers is looking for recreation in natural areas and motorization is increasing. It can, therefore, be assumed that there will be an intensification of recreational activities in the National Park. In addition, advertising and improvements to the recreational infrastructure (visitor centers) will also increase the reputation of the National Park. This will lead to visitors to the National Park being increasingly, explicitly addressed. These additional visitors will affect the quality of the outdoor experience of others and their own needs were not satisfied.

The National Park is not able to solve these described problems and tendencies by itself, a form of co-operation with the City of Vienna and the Government of Lower Austria is essential in order to establish sustainable measures in the areas of urban, regional and traffic planning which can be kept within, more or less, acceptable ecological and social limits. Measures taken at the source itself, such as improvements to the housing environment through the establishment of convenient green areas, in addition to a buffer zone around the National Park - particularly around the Viennese area - would be some possible approaches to a reduction of visitor pressure (Arnberger, Brandenburg 2001).

PERSPECTIVES

Through the linkage of data on year-long visitor frequency with the survey results and weather data (Brandenburg 2001) it is possible to develop a spatio-temporal model for the prediction of the flow of visitors to the National Park combined with their categories. This would be a proactive approach to managing carrying capacity. The realization that visitor behavior changes due to higher visitor density makes research into the social carrying capacity, as well as on crowding issues (Shelby & Heberlein 1986, Manning 1999), based on the types of visitors and in combination with long-term video data seem absolutely imperative. Additionally, data on visitor flow forms the basis for studies on the effects of recreational usage on the fauna (see Sterl et al. in press), particularly in respect to wildlife ecology and the flora.

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Developing New Visitor Counters and their Applications for Management

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Abstract: Developing visitor flow models for managing visitors to conservation areas is not possible without accurate visitor count data from the field. However, obtaining such counts in a reliable and cost-effective manner has proven to be more difficult than may be expected. Reasons for this are reviewed, and the features that park managers want in their visitor counting tools are discussed. Based on these demands, development of new visitor counters is underway, along with integrated systems for systematic collection and management of the data they provide. However, more effective direction is required from visitor flow models to guide the deployment of these new counter systems. This is an ongoing programme, and the presentation provided here summarises background information and progress to date.

INTRODUCTION

Information on visitor numbers is essential for a variety of strategic and operational planning tasks in park management, such as that carried out by the Department of Conservation (DOC). These may include:

- justification for visitor facility, service and staff provision;
- design standards for some visitor facilities and services;
- performance reporting on visitor service provision;
- relating use-levels to social and physical impacts;
- identifying demand trends and making forecasts;
- scheduling of maintenance tasks, staff allocations and resource provision; and
- linking particular sites into wider systems of visitor flow and impact modelling.

These are only some of the many management outcomes supported by visitor count data (Hornback and Eagles, 1998; AALC, 1994; Watson et al., 2000; DOC, 1992; AALC, 2000). The important point is that visitor monitoring is concerned with more than counting methods and technology - it is about providing fundamental visitor management data. The more reliable the data from visitor counting techniques and systems, the better the outcomes from its applications in processes such as visitor flow modelling. Without reliable data, no matter how good a model is developed, the old saying always applies - 'garbage in-garbage out'.

OBTAINING VISITOR COUNT DATA

Collection of visitor count data in conservation areas is not an easy task, given that many of them are remote, have few roads or towns, have many entry and exit points, do not have electricity supply, and usually have few staff present on-site. Moreover, visitor counting practice across park management agencies has generally been accompanied by uncertain specification of monitoring objectives, a wide variety of counting and sampling methodologies, and few examples of structured visitor monitoring frameworks to integrate count data and apply the information to management. In this context, visitor monitoring can often be characterised as an opportunistic exercise, involving a mix of different counting methods and techiques, and a strategic sampling of visitor sites that optimises data needs and site conditions with resourcing capacities.

Management agencies have a wide variety of counting techniques available to them (Table 1), of three broad types:

- Direct observations – using staff observers or camera recordings at sites
- On-site counters – devices to record visitor presence and store the counts at sites
- Inferred counts – other data counts used to provide on-site estimates

Management agencies will use some combinations of these counting approaches, depending on their particular information needs, visitor use patterns, site characteristics, operational resource capacities and staff capabilities. In an extensive interview study, Cope et al. (2000) summarised a wide variety of monitoring approaches taken by land management agencies in the UK countryside. In a previous study of the same agencies, Cope and Hill (1997) found that a high proportion of managers were undertaking some sort of visitor monitoring, but that the methods used were widely varied from place to place. Overall, these approaches were not co-ordinated or systematic, and many relied on on-site questionnaire surveys or car counts. With reference to more remote settings, a survey of over 400 US wilderness managers in multiple agencies (McClaran &Cole, 1993) found that 63% relied on 'best guess' estimates of visitor use and 21% used 'frequent field observation'. Only 16% had any systematic procedure for deriving their estimates (permits or counts). In a survey of 308 managers from across the four main park management agencies in the US, Washburne (1981:165) found that the techniques for measuring use-levels fell into four classes: 'best guesses' based on informal observations, trail registers, trail registers calibrated by visitor counters, and agency administered permits. Almost 40% were using the 'best guess' informal observations, although this approached 80% for the Fish and Wildlife Service, reflecting their more highly dispersed sites and low visitor use profile. Permits were used by about 40% overall, although this approached 70% in the National Park Service, reflecting their more defined visitor sites and extensive use of permit systems. Australian experience perhaps sums up this situation best. When reviewing the status of visitor monitoring in the several parks comprising the Australian Alps National Parks, the AALC (1994:29) stated that, "with the exception of Namadgi National Park, existing visitor monitoring systems are more 'opportunistic' than 'systematic'".

In more recent times, other technology options have developed. For example, most use-level estimates in the US National Parks Service now come from vehicle counters located on key access roads (Street, 2000). The higher population levels present in and around UK natural areas have allowed greater use of manual counting and visitor survey techniques (Cope and Hill, 1997; Cope et al., 2000). Many different counting techniques are used across different park systems in Australia (AALC, 1994), with the most common being – automatic counters, ranger observation and fee collection (McIntyre, 1999). Most agencies develop a blend of these different techniques, and some interesting new possibilities can be developed. For example, while vehicle counts are the most common technique across the State Parks of Victoria, in some places use estimates based on car counts were highly related to particular weather conditions. An inferential weather-based model and associated use-estimation formulae were applied, releasing the expensive car counters for use elsewhere (Zanon, 2001). In other cases, stratified sampling for visitor counts using observational surveys, combined with probability calculations and associated projections, may be used rather than monitoring by onsite counting devices (e.g. Gregorie & Buhyoff, 1999).

CHOICE OF COUNTER OPTIONS

All of these methods have advantages and disadvantages (Table 1), and the final selection of a visitor counting approach and technique will always be based on a necessary compromise between need for accuracy and practical capacity to measure. Assuming that appropriate management objectives have been determined for a visitor monitoring system, there are three main factors that will determine what combinations of counting techniques and sampling approaches are used: visitor use patterns, physical settings, and availability of resources.

Visitor Use Patterns

Visitor use patterns vary at different places and times, including the number of visitors, the activities they are engaged in, group sizes, and the areas and facilities that they use. These variations have different implications for counting strategies, depending on the scale of the monitoring system required. Many examples exist of different monitoring systems developed for application to individual parks as stand-alone units (e.g. Cope et al., 2000). This may be a relatively simple exercise of identifying strategic points where visitors can be counted such as key access roads or trails. Sometimes particular facilities such as visitor centres or accommodation sites can give strategic counts.

However, once visitors are within a park and are entering more remote locations, their activity tends to be widespread and diverse. Counting options become more limited, with techniques such as periodic observation combined with visitor counter devices being more applicable. These counters will not generally pick up distinctions between different visitor types and activity groups, (e.g. bikers and walkers). So in particular cases of need, specific observation programmes may be required to complement the raw visitor counts. However, collections of parks and other protected areas may be considered together, and strategic locations must be determined to represent the whole system. The strategy recommended by AALC (1995) is that a modest number of priority sites should be selected across the park system, which may be:

- places of specific management concern
- places where specific management actions are under consideration
- places which are considered representative of broader management issues.

Overall this suggests some hierarchy of visitor counts is required through a series of key index count locations, allowing some flexibility to undertake different site- and issue-specific counting as required. To maintain the internal integrity of a visitor counting system over time and allow

Observation	Descriptions – including advantages (+) and disadvantages (-)
Field observers	*Onsite recording of visit numbers by staff using hand counters or recording forms.* (+) - Accurate, flexible and mobile, can include descriptive data, can be permanent in some staffed sites, preferred means for calibration of other counts. (-) Costly in staff time, competing staff tasks and priorities, often used in unsystematic and opportunistic ways, less feasible away from permanent sites or key access ways.
Camera recordings	*Film/video onsite and visitors count carried out when returned to base. Sometimes time-lapse photography is used to give sample shots. Special cases have used aerial photograph survey samples.* (+) - Accurate, flexible and mobile, can include descriptive data, main alternative to observations for calibration of other counts. (-) - Costly and vulnerable equipment to use and maintain, staff time needed to interpret films, power requirements mean not a long-term option, less feasible away from permanent sites or key access ways, privacy issues.
Counters	
Mechanical	*Physical displacement/movement triggering an attached mechanical count device (e.g. hinged boardwalks, turnstiles, gates, doors, stiles). In some cases, the displacement of paired magnets has been used to generate counts.* (+) - Simple to build and maintain, low cost, built in to existing structures, long history of staff use and experience, can be linked to electronic loggers. (-) - Moving parts susceptible to wear, water, deformation and/or blockage, associated high maintenance, often detectable and subject to vandalism or false counts, no date/time references, specific on-site structures required.
Pressure	*Direct pressure triggering a sensor, transmitting a count to a data recording devices (e.g. pneumatic tubes, sensor cables, pressure pads, strain gauges).* (+) - Wide variety of technology for people and vehicles, can connect to variety of devices (electronic loggers, camera, video), easy to conceal, small size and weight, easier to protect from weathering, low power use, adjustable sensitivity and interval to exclude some false counts, can get time and date data. (-) - Needs careful sensitivity calibration when constructed, maybe temperature variable, limited battery life, subject to integrity of electronics, usually requires being built in to a structure.
Seismic and vibration	*Vibrations from direct pressure triggering a buried sensor, transmitting a count to a data recording devices (e.g. buried mats or tubes linked to sensor, geophones). Sonic vibrations have been investigated.* (+) - Easy to conceal, small size and weight, easier to protect from weathering, low power use, can get time and date data. No structures are needed, can be buried in paths, may identify bicycles. (-) - Soil type, compaction, moisture content, freezing and bury-depth can all affect sensitivity, as can footfall weight. Needs very careful sensitivity calibration at each site used. May undercount groups.
Active optical	*Light beams interrupted by visitor passing, transmitting a count to a data recording device (e.g. active infra-red, visible light beam).* (+) - Small size and weight, inexpensive, accurate, not temperature sensitive, long range, adjustable sensitivity and interval to exclude some false counts, can get time and date data. (-) - Needs careful alignment of transmitter and receiver (or reflector if not a through-beam system), alignment sensitive to disturbance, hard to conceal so susceptible to vandalism, lenses/reflectors may be obscured or soiled, higher power consumption, light-beam counters maybe highly visible.
Passive optical	*Change in infra-red signature triggering a count, transmitted to a sensor (e.g. passive infra-red).* (+) - Small size and weight, inexpensive, accurate, adjustable sensitivity and interval to exclude some false counts, can get time and date data, low power consumption. (-) - Variable detection range depending on object infra-red characteristics relative to background, may undercount groups if distance large, large sudden lighting changes may trigger false counts, lenses may be obscured or soiled.
Magnetic sensing	*Changes in magnetic fields from passing metallic objects, trigger a count to a data recording devices (e.g. induction loops, magnetic pads, countcards).* (+) - Small size and weight, inexpensive, loop/pad sensors buried so not easily detected, other sensor boxes/cards sometimes buried (or on surface), can get time and date data, can indicate vehicle type, adjustable sensitivity and interval to exclude some false counts. (-) - Primarily for vehicle detection (including bicycles), need sensitivity adjustment and calibration for different vehicle types and loadings, possibly needs specialised interpretative software, relatively expensive for sensor and download interface units.
Microwave sensing	*Detects changes in reflected radio waves from moving objects.* (+) - Small, can be set to detect vehicles or people, can be set to detect direction, can get time and date data, adjustable sensitivity and interval to exclude some false counts. (-) - Usually for vehicles, needs clear line of sight, set high making it hard to conceal, will undercount groups, cannot distinguish vehicle type, high power consumption, relatively expensive, not much park application to date.
Inferred	
Visit registers	*Voluntary self-registration of visits (e.g. track registers, hut books, visitor books).* (+) - Flexible and low cost, simple, can gather basic extra data, can link with safety check in/out processes, good indicator if well calibrated. (-) - Limited by voluntary basis, requires ongoing calibration, sites vulnerable to vandalism, response rates vary with site location, presentation, maintenance and advocacy, regular maintenance and checking required.
Permits Bookings Fees/charges	*Records from site or trip permits, facility or trip bookings, and of fee payments for facilities/trips.* (+) - Flexible and low cost, simple, accurate, can gather considerable extra data, can link with safety management processes, can cover concession activity clients. (-) - Permits not required in most NZ sites, non-permit visitors missed (day users, other activity groups, non-compliant visitors), applicable for areas/activities only where permits required. Bookings not required in most NZ sites, other visitors missed (day users, other activity groups), applicable only for areas, activities or facilities where bookings required. Fees only required for some facilities (huts/camps), other visitors missed (day users, other activity groups), applicable only for areas, activities or facilities where fees required, often major fee-compliance problems.
Indicative counts	*Counts of elements linked to visitor use (e.g. carpark use, accommodation, public transport, weather indexes and many other options).* (+) - May offer local calibration advantages if suitable option available. (-) - Highly opportunistic and variable potential at different sites.

Table 1: The main visitor counting options

calibration and indexing functions, some count sites should be permanent, some periodically rotating according to identified need, and others allowed on a case-by-case basis to meet particular short-term needs. This diversity of function indicates that a variety of count techniques should be available to managers.

Physical settings

The physical settings used by the visitors, and their behaviours within them will also affect what counting options are available to managers. Roads and tracks are obvious channels where visitor counts can be carried out, particularly if they are key access points. For some counting devices, locations where visitors are confined to single file are also required. Sometimes the physical layout of a visitor use system needs to be modelled to identify where different types of counts can be used.

When counter devices are being applied as the preferred counting option, as is often the case in New Zealand, climatic elements are also an important consideration. Water penetration has proven to be a particular problem for most kinds of counter devices, corroding metallic components and destroying electronics. If combined with sub-zero temperatures, the freeze-thaw cycles can seriously damage the structural integrity of counters. While low temperatures can reduce battery life, high temperatures may cause warping and deformation of structures holding counters. Sometimes mechanical parts may be jammed through soil or ice intrusion, or count sensitivity reduced by snow or run-off soil cover, leading to serious under-counting. And where such counters can not easily be concealed (e.g. unforested settings) problems with vandalism and tampering have been commonly identified.

Overall, the physical demands placed on counters in outdoor environments require that they be water-resistant, discreet, robust and include few if any moving parts.

Availability of resources

The main limitation to developing a visitor counting system will be the availability of staff and funding resources to operate a system. In the past many agencies have not identified the systematic collection of visitor data as being as high a priority as the collection of other biophysical data (AALC, 1994; Cope et al., 2000; Loomis, 2000;). This situation is changing as the importance of visitor data is being more widely recognised, and it's collection is more often systematically planned. For example, a very specific implementation program has been developed and applied incrementally in the Australian Alps National Parks over the last 10 years (AALC, 1994; 1995).

No matter how much funding is made available, the high number and diversity of places used by visitors across park management systems means that some compromise, in the form of a sampling solution, will always be required. Improved efficiency in counting accuracy, operational costs, strategic sampling strategies and data management processes will maximise the utility of a visitor monitoring system. The important point is that the visitor counting task must be seen as being only one component of a complete visitor data management system driven by a series of specific management objectives (AALC, 1994; 1995; Hornback & Eagles, 1998; McIntyre, 1999; Watson et al., 2000;). Such a system, based on traffic counts, has been established over the last five years in South Australia. This features a central reporting system, a standardised set of traffic counters, customised software interfaces, staff training procedures, and the capacity to integrate data from other monitoring modules when developed (NPW, 1999).

PREFERRED COUNTER FEATURES

Once the three main factors above have been addressed, the questions for managers then become which counting options to use. Given the nature of visitor use of New Zealand conservation areas, where permit and fee systems are rare, staff and resources are widely spread, electricity supply is absent, vehicle access is limited and environmental conditions are often harsh and variable, there is particular emphasis on having good visitor counters in the field. While the requirements of the overall visitor management system are the key determinants of data needs, sampling strategies, and the associated resource allocations for locating monitoring effort, park managers in New Zealand have also developed considerable experience in the actual operation of such counters. When asked what features they consider important in visitor counter hardware, their responses have been largely consistent (Raine & Maxey, 1996), and in accordance with similar managers overseas (Gaveda, 1999; Watson et al., 2000). The desired features commonly include:

- high portability
- lightweight construction
- accurate counts
- low maintenance
- low cost
- robust
- easily concealed
- low power consumption
- water resistance
- tolerant of temperature variations
- minimal moving parts or electronics.

Simplicity was a consistent theme. In some cases reservations were expressed about the value of having more sophisticated systems collecting more detailed data, due to the greater vulnerability of the hardware and software involved. "The responses also suggested that complex systems with cameras and date-stamps are not in demand"

(Gaveda, 1999:3). Furthermore, “The most surprising result of the survey was that enthusiasm for more sophisticated data collection came quite low on the series of priorities for counter performance. DOC staff cared much less for direction-of-travel and time-based data logging than they did for accurate, reliable performance” (Raine & Maxey, 1996:9).

Such preference for simplicity and reliability reflects the previous experience of managers with counter development. Manager accounts of their experiences with different types of counters (Raine & Maxey, 1996) show a highly variable success rate, with many examples of hardware and software failure. Manager preference for simple systems is therefore understandable, and there is often warranted scepticism about the promise of better results from new technology.

In addition, the purpose of the counts has not always been clearly specified, nor has any integrated data management system usually been available to collate count data and provide reporting options back to park managers, or to other potential users of the data. This failure to ensure data delivery back to managers in a practically useful way has added to scepticism about the value of visitor counting, counting devices and count modelling systems, and sometimes reduced commitment to their applications.

Recent developments indicate that this situation is changing, as shown by the development of new counter options and more integrated data management systems in Australia (NPW, 1999), and New Zealand. The remainder of this paper describes recent progress made in New Zealand in developing visitor counters and an integrated counting system.

NEW DEVELOPMENTS IN NEW ZEALAND

Two separate streams of work in the DOC have converged to provide the basis for an integrated visitor counting and reporting system. The first has been development of the Visitor Asset Management System (VAMS). The second has been initiation of a visitor counter development project within the Science and Research Unit of the DOC. Both are required to provide an adequate basis for the application of any visitor flow modelling tools.

Data integration through the VAMS

The VAMS is an interactive database based on key management information about the approximately 4000 designated visitor sites throughout the 30% of New Zealand’s land area managed by the DOC. Each specific site may be referenced individually from the database, and there is extensive site-specific information attached to each site. This includes the physical condition of the site and any facilities provided at it, the recreational setting and social values associated with it, and any management prescriptions and task scheduling required. The system is designed to allow new information fields to be added as required, including visitor count information. This provides a practical template for storing, accessing and reporting on visitor count data. Data may also be accessed in different ways from the central database to allow wider analysis processes.

Current development of these data management processes in VAMS accompanied by development of new visitor counter hardware, and associated data download and transfer software. This download and transfer function is provided through a handheld data logger (PSION Walkabout) to which count data may be downloaded from counters in the field, and transferred to the central VAMS database.

New Visitor Counter Development

Based on literature review, personal experience, and feedback from park managers, many of whom had experience of developing their own counting options in the past, the preference was for developing on-site counters as the basis for a counting system. Four distinct types of counter units were identified as being necessary for covering the general range of DOC visitor counting needs (Table 2). Where necessary for counter calibration checks and count projections using visitor flow models, these could be supplemented by other counting options, as described in Table 1.

A need for case-specific counter options was also identified for meeting more specialised management information needs, such as finding use levels for particular facility types (e.g. toilets) or visitor groups (e.g. mountain bikes). However, these were considered secondary priorities in the counter development process, and will be addressed on a case-by-case basis as required.

Developing the step counter

The step-counter was the first unit to be developed, and this has incorporated development of most of the data logging and VAMS integration software that will be required for operation of the other units. It is simply a modified wooden board incorporating a pressure sensor, and is placed on tracks as a frontboard in the lowest step in earth-filled or fully wooden step sequences (Figure 1). Its’ development was based on video recordings, field observations and research generalisations (e.g. Irvine et al., 1990; Templar, 1992; Crosbie, 1996), that in a series of steps in a stairway:

Counter Units	Proposed Setting and options
Step-Counter	Pressure-sensor built in to the vertical front-board of a back-filled earth step or multi-step structure. On a wide range of tracks from frontcountry to remote backcountry. *Development action –design new unit*
Boardwalk-Counter	Pressure/strain-sensor built in to a boardwalk path or bridge structure. On a range of tracks - mainly in the high-use frontcountry and the more developed backcountry areas. *Development action – design new unit*
Path-Counter	Pressure/vibration sensor buried under a hard path surface, or infra-red detection across it. On high use tracks with priority on full access (e.g. wheelchairs, prams, disabled, elderly - steps or boardwalks not present). *Development action – new application of existing units*
Vehicle-Counter	Pressure, vibration or inductive loop-sensor buried under road surface, or built into road structures such as bridges or culverts on strategic roads. *Development action – assess new design or new application of existing units*

Table 2: Counter types, settings and development options.

- Almost all walkers stand on the leading edge of the last step down, and almost none extend their stride to stretch over the leading edge from further back on the stair tread.
- Most walkers use the first step up and stand on the leading edge, and both these behaviours increase with increased stair height.
- Walkers scan ahead and hesitate to adjust their stride to the first step in an up-stair sequence.
- Preferred stair heights are 20-22cm, with greater step height increasing 'hits' by people on the leading edge.

The simple design and installation requirements of the step-counter has resulted in a robust unit that is simple, water proof, has no moving parts, and is relatively cheap (under € 300). Yet it also includes electronic capacity to store many thousands of records, including the date and time of each count made. When installed and operated according to instructions, the counter has proved to consistently and reliably produce a high 'hit rate' of counts. From visual and video-based field observations, around 95% of people descending, and 80% ascending consistently stepped on the counter. This gives an effective overall 'hit-rate' between 85-90%. Based on these observations, and feedback from field managers, the contact area on the leading edge of the step was increased in width to increase the hit-rate further.

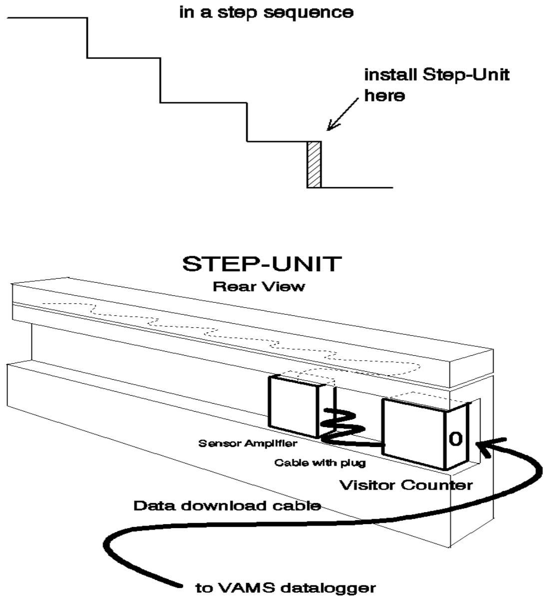

Figure 1: Step Unit construction and placement

While it must be acknowledged that such a counter can never be 100% accurate, the key point is that any discrepancy will be largely constant, and can be estimated using field calibrations. As long as any error is found to be consistent, its size is less important.

Other counters and applications

Work is underway on a counter design to be installed in the wooden boardwalks that are commonly used to protect sensitive soils and vegetation, or are provided as bridges over small streams. With the availability of step counters, and new boardwalk counters, a practical visitor counter option will be available for most of the tracks provided in natural areas by the DOC. In addition, passive infra-red detection units are currently being evaluated as the basis for development of a path-counter option. These will provide coverage of those more developed tracks where steps and boardwalks are not required. Work on vehicle counters has not yet commenced, as commercial units are available, and some count data can also be obtained from road management agencies. However, more site-specific information needs at access points to natural areas will require further development of more cost-effective vehicle counters.

The component software required for count logging, data downloading, integration into the VAMS database, and output reporting is being completed. This provides a complete link between counts taken in the field and data being available online to park managers. As the other counter options become available (e.g. path and vehicle), the effective coverage of visitor counting needs will increase to a wider range of sites. These developments will be reported on as they are completed.

CONCLUSIONS

The development of new counter units and associated data management systems is providing a more reliable and practical mechanism for park managers to collect visitor count data. However, even with correct counter installation, some error in counts is inevitable. These are acceptable as long as they are checked using field calibrations of observed and logged counts, the error levels found are relatively constant, and that the appropriate corrections are applied to the counts.

All of this work represents development and refinement of the counting mechanisms. However, only a small sample of the sites managed by the DOC can practically be monitored with these mechanisms. These must be selected according to a deployment strategy that provides representative coverage, and allows indexing and extrapolation of counts into wider visitor flow systems. This is the other main stream of work required to provide a comprehensive visitor counting system to park managers, and is currently being investigated.

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Predicting transgressions of the social capacity of natural areas

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Abstract: Within the urbanized Dutch society, the social function of forests and nature areas is becoming more and more important. The same holds for agricultural areas. However, planning and management tools for this social function are almost absent. This paper presents a tool to be used by policy makers at regional and higher levels. By means of a normative analysis the local supply of and demand for nature-based recreation are confronted with each other. Because of its normative nature, the analysis does not offer a good description or prediction of actual recreational behavior. However, it does offer insight into where, according to the policy norms, the local supply of nature-based recreation opportunities cannot accommodate local demands. The method has been applied nation-wide and outcomes are momentarily used to substantiate spatial claims to develop new recreation areas.

INTRODUCTION

Besides their ecological function, the social function of forests and nature areas is becoming more and more important in the Netherlands. This is signified by the title of the new act for nature management: "Nature for people, people for nature" (LNV, 2000). Also agricultural areas are changing from production to consumption spaces. However, data, norms, and planning tools for the social function are almost absent. This makes it difficult for policy makers to do justice to this function, especially in the Netherlands, where spatial claims for different functions often exceed the available amount of land. In this paper we will describe the development and use of a planning tool for the recreational function of forests and nature areas, as well as agricultural areas. The tool is intended to serve policy makers at regional and higher levels.

In this paper we will limit ourselves to the two most popular outdoor-recreational activities in the Netherlands: walking and cycling. Although these activities sometimes take place in a built-up environment, green environments are generally preferred. This is why in Dutch recreation policies the accommodation of the desire to undertake this type of activity in a green or natural environment is a common goal. Moreover, since it is seen as a basic type of amenity, this desire should be accommodated at a local level. Furthermore, meeting local demands at a local level is thought to help to minimize leisure mobility (by car).

The above policy goal raises the question when the local supply of nature-based recreation opportunities may be considered sufficient to cover the local demand for this type of opportunity. In this paper a method to answer this question is described, as well as its nation-wide application. For an extensive description of the method the reader is referred to De Vries and Bulens (2001).

The structure of the paper is as follows. To begin with, the inventory of the local supply of nature-based recreation opportunities is presented. This includes the normative determination of its social capacity. Second is the presentation of the local demand assessment, especially on the norm day: the day on which supply and demand should be in equilibrium. This is followed by the procedure for the confrontation of supply and demand. Fourth the outcomes of a nation-wide application of the method will be reported. Finally, the method and the practical usability of its outcomes will be discussed.

THE SUPPLY INVENTORY

The basis of the supply inventory is the GIS-database on land use of Statistics Netherlands (CBS). In this database 33 types of land use are distinguished. However, not all of these types have a reception capacity for nature-based recreation in the form of walking and/or cycling. Criteria that were used to decide which land use types had a positive capacity for land-based outdoor recreation are the following:

- it should be a predominantly green area with some significance for outdoor recreation
- by and large the type of land use should be publicly accessible
- 'man-made' attractions should not dominate the area; it should be a resource-based facility
- the reception capacity of the area should be significant

All infrastructure types were assigned zero capacity, even dirt roads. The latter may be of recreational significance, but capacities are assigned to areas (that may include recreational infrastructure). Area-wise the small roads themselves are of little significance. Residential areas were also assigned no capacity. Although they may be used for recreational activities, they were not considered green enough. Campgrounds and other types of holiday resorts were excluded because in general they are not open to the public.

A few refinements were made with regard to the remaining types of land use. To begin with, all nature areas that are known to be (completely) closed to the public, were also assigned zero capacity. A GIS-database compiled by Goossen and Langers (1999) was used for this purpose. The most important refinement deals with the category "areas for agricultural use, with the exception of cultivation under glass". As one might imagine, this is a quite extensive and diverse category. That is why it was split up into six subcategories.

It is known that not all types of agricultural area are considered equally attractive for recreational use. Especially very open areas are not very well liked as an environment for walking and cycling (see Renemann et al, 1999). Using a GIS-database developed by Dijkstra and Van Lith-Kranendonk (2000) agricultural areas with 95% or more low cover were defined as open agricultural land. The remainder was considered enclosed agricultural land.

Considered even more important was the density of the recreational infrastructure: quiet country roads, dirt roads, cycle and footpaths. Goossen and Langers (1999) developed a GIS-database that describes the density of this type of infrastructure for the Dutch countryside. It was decided to distinguish three levels of density: low, medium, and high. The average density in these three categories was 13, 37, and 74 meters per hectare. The three density levels were crossed with the two openness levels to create six categories of agricultural land.

Assigning capacities to land use categories

Before assigning capacities, first we have to determine what we mean by the term 'capacity'. Different types of capacity may be distinguished: social, ecological, physical, traffic. We defined capacity as the maximum acceptable user intensity of an area, predominantly from a social point of view. We placed an upper limit on this capacity: it can never be higher than the maximum user intensity that can be expected given an ample supply of the type of area. This proviso has been made to prevent that a capacity that 'technically speaking' is available, but will never be used in practice, will unduly influence the analysis. This may happen in case of low quality areas.

The capacity of a type of land use is expressed as the maximum acceptable number of people that can make use of this type of area per day, per hectare. Most of the capacity figures are derived from previous studies (LNV, 1984; Provincie Zuid-Holland, 1999). Only for agricultural areas the figures are based on the maximum number of people willing to recreate in this type of area, rather than the number of people that could 'technically' recreate in this type of environment. The density of the recreational infrastructure was considered a major factor.

In second instance the capacity figures, which used to be for the combined category of activities, were split up for walking and cycling. This was done according to best professional judgement. Although the exact division is open to discussion, it was thought helpful to be able to make a rough distinction between opportunities for walking and opportunities for cycling. In table 1 the capacity figures for different categories of land use are given in terms of the number of recreation places it offers.

Land use category	**Walking**	**Cycling**
wet natural	3	1
dry natural	6	2
agricultural (excl. greenhouses)		
- high density infra & open	0.3	0.9
- high density infra & enclosed	0.6	1.8
- medium density infra & open	0.1	0.5
- medium infra & enclosed	0.2	1.0
- low density infra & open	0	0.2
- low infra density & enclosed	0	0.4
Forest	9	3
Beach	8	0
city parks & green areas	8	2

Table 1: capacity figures for different types of land use (number of persons per day per hectare).

Some of the land use categories were also assigned capacities for other types of activities, such as sitting, playing & sun bathing. Parks, for example, were assigned a capacity of 90 for this more stationary type of activity. Specific recreation sites (within a larger recreation area) were assigned a capacity of 100 for this type of activity. However, for a large part these recreation areas consist of forest or nature areas, and were assigned capacities for walking and cycling accordingly.

THE DEMAND ASSESSMENT

In the demand assessment differences between people are not taken into account. This does not mean that such differences do not exist. However, a study by De Vries (1999) has shown that already at the level of small residential areas the population tends to be so heterogeneous that these differences average out to a large degree. As a consequence, only demand characteristics for the average Dutchman are needed as input. By multiplying this with the size of the population of a residential area, the total demand originating from that residential area is known. We will start with the latter.

Because the analysis takes place at a local level, the residential areas should be small is size. For this reason neighborhoods were chosen as spatial units of origin. The Netherlands is divided into over

10,000 of such neighborhoods. The average size is about 340 hectares. Statistics Netherlands (CBS) offers a register that includes the number of inhabitants of each neighborhood, as well as a GIS-database with the neighborhood boundaries. For the present situation the 1995-version of this database was used.

Since the supply capacity is defined on a daily basis, the demand for recreation opportunities also must be expressed on a daily basis to allow for a confrontation. However, while the supply capacity remains more or less the same for all days of the year, this obviously does not hold true for the demand. On some days the demand is much higher than on other days. That is why a norm day must be decided upon. This is the day on which supply and demand should be in equilibrium. Confrontation on a yearly basis does not seem very useful, since then days with overuse and days with underuse may average out. Traditionally the fifth or the tenth busiest day is chosen as norm day. We have chosen the fifth busiest day.

The percentages of the Dutch population that participate in the activities walking and cycling on this fifth busiest day have were derived from empirical material as far as possible. Two sources were used. On the one hand this was the 1995/'96 day trip study of Statistics Netherlands (CBS, 1997). This study offers data on day trips that last at least two hours (including transport). The average yearly number of such day trips with walking as the dominant activity is 4.3 (including jogging). The yearly average for bicycling is 2.8. These figures include non-participants.

Based on previous studies, it was assumed that 1.2% of the total yearly number of trips for this type of activity will take place on the norm day (Goossen & Ploeger, 1997). For walking and cycling combined, this is 8.6 % of the population (see also Provincie Noord-Holland, 1996). This leaves us with one problem: not all trips with walking or cycling as the dominant activity will last two hours or longer. And also, or especially, the short trips will make use of the local supply of recreation opportunities. This means that these short trips have to be added to the long trips. The assumption is made that after adding the short trips to the long trips the norm day will still be the same day.

The number of short trips to be added was determined using a different study, performed by the province Zuid-Holland (1998). In this study a sample of the population of this province was questioned regarding its recreational behavior on three days that were likely candidates for the norm day, namely sundays in the late spring with reasonable to good weather conditions for the time of the year. These data suggested a ratio of long to short trips of about one to one. Using this ratio, the participation percentages on the norm day would be 10.4% for walking and 6.7% for bicycling.

An alternative way of arriving at norm day percentages was based solely on the study of the province Zuid-Holland. This province conducted the same study twice: once in 1993 and once in 1997. In each year the figures for two sunny sundays were available. Averaging these figures over both sundays and both years led to the following percentages: 11.4% for walking and 6.2% for cycling. Compared to the previous figures, the participation rates are a little bit higher for walking and a little bit lower for bicycling. However, the province Zuid-Holland is among the most highly urbanized within the Netherlands. The aforementioned day trip study of the CBS shows that in highly urbanized areas there is a tendency to walk somewhat more and bicycle somewhat less, compared to the national average. That is why it was decided to stay with the first figures: 10.4% for walking and 6.7% for bicycling.

THE CONFRONTATION

By far the easiest way to perform a demand-supply confrontation would have been to look at the number of inhabitants of, for example, a municipality, and to confront this with the recreational capacity available within this same municipality. However, such a confrontation has several drawbacks. To begin with, not all municipalities have the same size. In the Netherlands sizes may differ by a factor 50! Furthermore, in such an analysis people living in a small, rather urban municipality would not be 'allowed' to make use of the excess capacity of a neighboring, more rural municipality. That is why a different type of procedure was chosen. This procedure will be described below.

The neighborhood was chosen as the smallest unit of origin. Using the center of a neighborhood as point of origin, a norm distance was selected. This is the distance within which the local supply should be sufficient to accommodate the local demand. In the present analysis the norm distance was set at 10 kilometers (airline). This is the average of the maximum distance from home after one hour of walking (5 km) and that for cycling (15 km) at a leisurely speed (by road). Another hour is required to get back home. A maximum trip duration of two hours, excluding the time used for stops along the way, is thought to cover the vast majority of the walking and cycling trips made by the Dutch. Note that transport by car to an attractive destination area is not included in this normative analysis. Consequently the time spent on traveling by car, or another form of motorized transport, should not be taken into account when determining the trip duration.

The next step was to determine the capacity that was available to each inhabitant of a neighborhood within this norm distance. However, there is an important distinction between the capacity that is within reach, and the capacity that is available on a per capita basis. For the latter it does not suffice to merely divide the total capacity present within the

10-kilometer zone by the number of inhabitants of the neighborhood. The same supply unit may also be within reach of other neighborhood centers. And the same capacity should not be allocated twice, or even more often.

To avoid this, we started our analysis at the supply side. First the GIS-data concerning the supply were converted from vector to grid format for ease of calculation. Gridcells of 25x25 meters were used, because some categories of land use are characterized by quite small continuous areas but very high reception capacities (e.g. parks). The reception capacity of such a gridcell is 625/10000 that of a hectare. The centers of the neighborhoods were also converted from a point into a grid theme. Next, for each supply cell it was determined which neighborhood centers were located within 10-kilometer distance of this cell, and what the total number of inhabitants of these neighborhoods was. Subsequently the capacity of the supply cell was divided by this total number of inhabitants. Finally, these per capita capacities were summarized for all supply cells within 10 kilometers of the center of a neighborhood. This cumulative figure gives the available capacity per person within the neighborhood. The above procedure was performed for each activity separately.

On a more technical note, the whole procedure was performed within ArcView, extended with the Spatial Analyst module. Especially the neighborhood statistics available within this module have been used. Scripts were written to make the analysis easy to repeat. The outcomes for each neighborhood were stored in new variables added to the attribute table of the neighborhood theme, one for each activity. This made them available for subsequent analysis.

If the available capacity per person for a given activity equals one, then for every person in the neighborhood there is a place to participate in this activity. To be more specific: a place within 10 kilometers of his or her neighborhood on every day of the year, without that social capacities are transgressed. However, since not all inhabitants will participate in the given activity on the same day, lower amounts of available capacity are acceptable. In fact, if we express the available amount per capita as a percentage of one, we have a supply figure that may be directly confronted with the participation percentage for the activity on the norm day.

By subtracting the supply percentage from the demand percentage neighborhoods with insufficient local supplies may be identified. In those cases the percentages are positive. By multiplying a positive percentage with the number of inhabitants of the neighborhood, the size of the deficit may be determined. This more or less completes the description of the confrontation procedure. A final note is that the procedure allows for the deficits of the neighborhoods to be aggregated to larger spatial units of origin, such as municipalities.

THE RESULTS

Using supply data for 1996 en demand data for 1995, supply and demand were confronted according to the procedure described above. In first instance the confrontation was performed for walking and cycling separately. In second instance the confrontation was repeated, but now under the assumption that walking and cycling are perfect substitutes for each other. This implies that a lack of supply for walking may be compensated by an excess supply for cycling.

A first result of the procedure is the available capacity per capita. Figure 1 shows a map for this characteristic when walking and cycling are assumed to be perfect substitutes. In this case the required capacity per capita is 17.1%. Not surprisingly, the capacity per capita is lowest in the most urbanized areas of the Netherlands. By multiplying the positive values of this characteristic that remain after subtracting the required 17.1% with the number of inhabitants, deficits in terms of recreation places are determined.

Table 2 shows the deficits for the Netherlands divided according to the four quarters (see figure 1). Clearly the deficits for both activities are highest in the West quarter: this quarter comprises over 90% of the total deficit in the Netherlands. Furthermore it may be pointed out that assuming a perfect substitutability between walking and cycling does not help much in reducing overall deficits. Presumably there are only a few regions in which a large deficit for the one activity can be compensated for to a considerable degree by an excess supply for the other activity.

Quarter	**Walking**	**Cycling**	**Substitutable**
North	19,800	0	4,300
East	3,000	0	300
West	338,200	169,800	488,300
South	15,200	1,600	8,700
Total	376,300	171,400	501,500

Table 2: Deficits for the four quarters of the Netherlands in 1995, using a 10-km norm distance (number of recreation places) .

To assess the sensitivity of the outcomes with regard to the norm distance, the analysis was repeated using a distance of 5 kilometers. The results show that although the deficits increase, the increase is rather small, given that local demands now have to be satisfied within a much smaller action radius (see table 3). While the potential supply surface decreases by a fourth, a national map (not presented here) indicates that the deficits increase mainly in regions in which isolated cities are found. When the region as a whole is quite urbanized, deficits now are more concentrated within the larger cities. On the other hand, in the residential areas just outside the 5-km reach of big cities deficits become smaller. There is a relocation of deficits, rather than an overall increase.

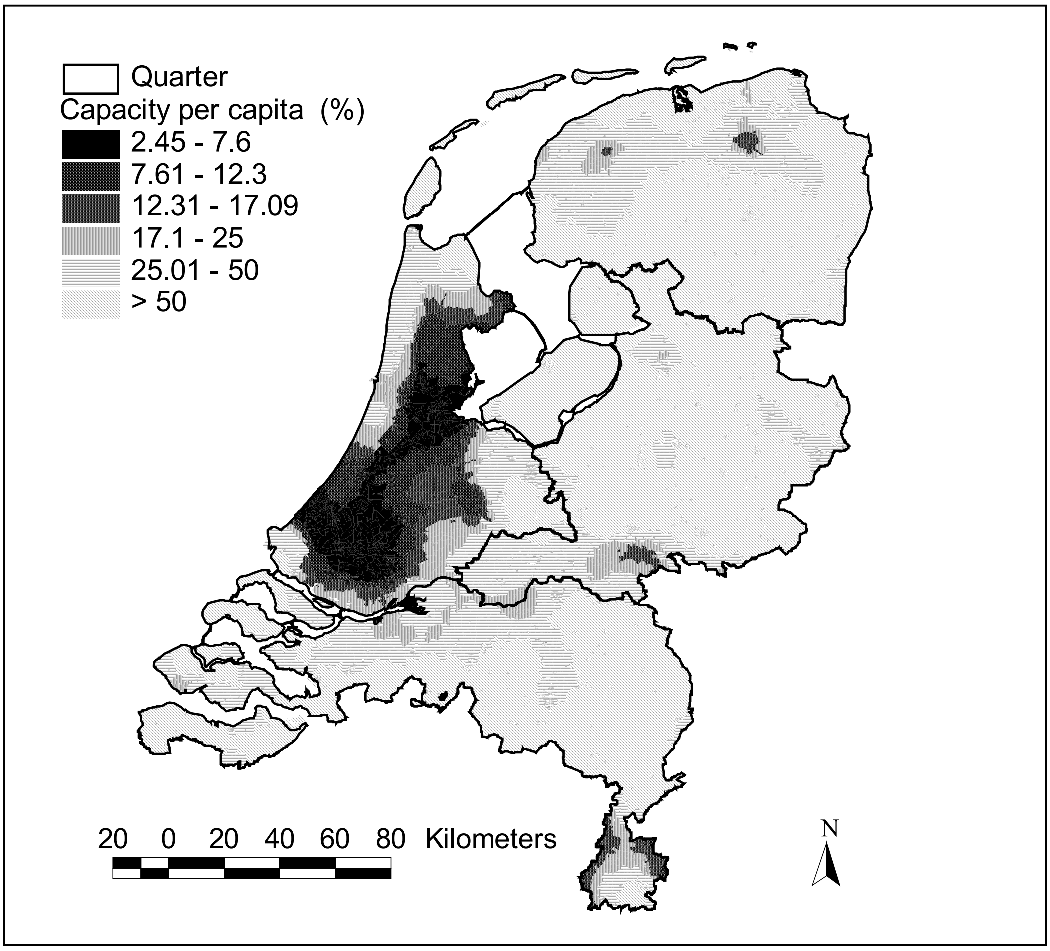

Figure 1: Available capacity per inhabitant for walking and cycling (when substitutable) in 1995, within a 10-km distance (by neighborhood).

Quarter	Walking	Cycling	Substitutable
North	28,200	4,900	22,400
East	21,200	2,600	14,800
West	378,400	188,300	535,600
South	40,000	9,900	37,700
Total	467,800	205,800	610,500

Table 3: Deficits for the four quarters of the Netherlands in 1995, using a 5-km norm distance (number of recreation places).

In first instance the deficits are expressed in terms of recreation places. They may be translated into deficits in terms of hectares. The conversion ratio depends on the type of land use. Suppose we use forests, as one of the most efficient land use types, to reduce the deficits that result when using a 10-km norm distance. In that case the amount of new forests required to eliminate all deficits within the Netherlands for walking & cycling under the substitutability assumption is (501,500/12 =) about 41,800 hectares. One should remember, of course, that usually new forests are not located on new land, but replace another type of land use. The recreational capacity of the afforestation area according to its present type of land use should be subtracted to get the correct figure for the gain that is realized.

DISCUSSION

In this paper a method to assess to what extent the local supply of recreation opportunities can accommodate the local demand for such activities has been presented. An important criterion to judge any new method, is its validity. Are the outcomes generated by the method valid? In answering this question it should be kept in mind that the present analysis is a normative one: it does not aim to describe actual recreation behavior as accurately as possible. This implies that empirical figures regarding actual behavior are not the ultimate criterion to decide on the validity of the method. Moreover, to the degree that the method is descriptive of actual behavior, it may become impossible to detect deficits: 'ought' and 'is' will coincide more and more.

On the other hand, if large deficits have no effect on the local population whatso ever, one may question the reason to match local supply with local demand. Although the latter is a policy issue rather than a scientific one, we would like to suggest a number of possible effects. We will only discuss 'direct' effects, i.e. concerning recreational experiences and behavior. To begin with, recreational behavior may not be affected by the supply to demand ratio. In that case more people than is considered desirable will make use of the local supply of opportunities. This may affect the quality of the recreational experience. Quietness is known to be highly valued aspect of the outdoor recreational experience (Reneman et al., 1999).

Recreational behavior may be affected by a bad local supply situation in at least two ways. People may participate less often, or they may decide to recreate further away from home. Empirical evidence from a study by De Vries (1999) clearly shows that a bad local supply situation (according to objective criteria) leads to a significant increase in car mobility. Moreover, the areas that show the largest deficits in the present study are by and large the same ones that are judged as poorly by Dutch citizens in this previous study. In this respect the face validity of the method seems high.

Other aspects of validity are robustness and reliability. To start with the latter, the method is highly reliable as far as the supply input data are concerned. The land use database is fairly accurate. As for the capacities assigned to each type of land use, this is a normative choice, not an empirical fact. The demand input data are somewhat less reliable. This is not because of the number of inhabitants of a neighborhood, but because of the participation rates on the norm day. Although the CBS day trip study is thought to yield reliable results, this study only deals with day trips that last at least two hours (including transport). The number of trips shorter than two hours had to be estimated. However, since two procedures to arrive at the total number of trips generated quite similar results, we feel confident that the demand input data are quite acceptable.

As for the choice of the fifth busiest day as norm day, once again this is a normative choice. However, indications based on a study by Visschedijk (1997) suggest that using the 10-th busiest day would not have led to drastically lower participation rates. For several forests, the number of visits on the 10-th busiest day seem to range between 0.85 and 0.90 of that on the 5-th busiest day. Of course, this not only benefits the reliability of the method, but also its robustness. Regarding this robustness, in this paper it was shown that halving the norm distance did not affect the outcomes as much as one might have expected beforehand.

Probably the method is the most sensitive to changes in the capacity assigned to the six categories of agricultural land use. As a whole, the category of agricultural land use is by far the largest in terms of the number of hectares concerned. Consequently, changing the capacity of this type of land use a little will already have a large impact on the supply capacity in many areas. For example, according the figures used here, the average capacity per hectare of agricultural land in the province of Zuid-Holland for walking and cycling is 0.8. The province itself uses a figure of 1.7 (Provincie Zuid-Holland, 1999). This results in a difference of more than 100,000 recreation places, or more than 8,000 hectares of forest.

The assigned capacities are normative figures: they are thought to indicate the social capacity of an area. However, the fact that they are normative, does not mean that the values are arbitrary. The logic is mainly based on the (expected) density of the recreational infrastructure and the visibility of other (recreational) users of the area. This is the reason for the high capacity figure for forests: a high density of infrastructure, combined with a low visibility of other users. This line of reasoning has also led to wet nature areas having a lower capacity than dry nature areas. However, the exact figures to be used remain open for discussion.

It may be noted that the method described here only deals with a quantitative confrontation of supply and demand. It gives an answer to the question whether there is enough space to accommodate the local demand for recreation opportunities. It tells us little about the quality, or attractiveness, of this space. In general a higher capacity per hectare is not meant to indicate a higher attractiveness. This is only the case for open versus enclosed agricultural areas, because here supply may easily exceed demand. Apart from this, recreation places are assumed to be substitutable regardless of the type of land use that generates them. Of course the method could be refined. For example, we could demand that at least 50% of the demand has to be satisfied by recreation places generated by forests and nature areas. This would be a first start to bring quality considerations into the play. Differences in attractiveness within a specific land use category are more difficult to take into consideration: these would require addition data.

After having discussed the validity and the limitations of our method, a next question is its practical usability. It it of use to our target group: policy makers and spatial planners at regional and higher levels? We are confident that it is. In a small country such as the Netherlands the spatial claims of different sectors (housing, infrastructure, industry, agriculture, nature, recreation) often exceed the available amount of land. This makes it important to be able to substantiate these spatial claims. It is also important to be able to quantify the claims. This is exactly what our method offers. For this reason the outcomes of a prognosis for the year 2020 according to this method, are being used by the Dutch Ministry of Agriculture, Nature Management, and Fisheries, under whose competency outdoor recreation falls.

Furthermore the method also shows where the supply deficits are largest. This makes it possible to evaluate the efficiency of spatial plans in reducing these deficits. This efficiency is not only affected by the type of area (land use), but also by the location of the new areas. Momentarily such an evaluation is performed for the province of Noord-Holland. Preliminary results suggest that not all planned recreation areas are optimally located in this respect.

In short, the fact that this newly developed method is already being used intensively, confirms it is of practical use. This does not necessarily imply that the method is a very good one (although we tend to think it does pretty well). It is also the case that up till now it is more or less the only one in its kind (as far as we know). Its use therefore also demonstrates the need for methods and tools to help policy makers and spatial planners to do justice to the social function of green spaces.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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GIS-Supported Network Analysis of Visitor Flows in Recreational Areas

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Abstract: The application of GIS tools for visitor monitoring facilitates a profound analysis of visitor flow patterns. Giving a visual impression of the distribution of visitors within an area via maps, interpretation of visitor use data is much easier and better. Furthermore, a GIS also allows to determine and analyse quantitative parameters of visitor use such as trail and visitor density. These parameters can also be used to characterise and compare different areas within a park. With a standardised approach, also comparisons between parks can be realised. Therefore, GIS is increasingly used in the area of visitor monitoring to assist recreation planners and park managers in their everyday work. This paper demonstrates how a GIS-based trail network analysis was used in the framework of a visitor monitoring project in the Danube Flood Plains National Park, Austria.

INTRODUCTION

Recreational areas located close to big cities are often used by high numbers of visitors and show a highly diverse visitor structure. As visitor numbers increase, there is a simultaneous increase in environmental impacts, crowding, and conflicts between different recreational types and users. Additionally, modern leisure activities and behaviour of visitors do often not fit traditional concepts of recreation. Therefore, an intensive monitoring of visitors in these areas in needed, in order to be used as prerequisite for successful and effective management.

Network analyses based on Geographic Information Systems (GIS) offer a possibility to analyse spatially referenced data describing traffic flows. While they have been used in road traffic planning for a long time, they have only rarely been applied to recreation planning and analysis. Here it is a very useful tool to trace out areas of potential conflicts between recreational use by visitors and the needs of fauna and flora (Volk, 1995, Roth et al., 2000), as well as conflicts between different groups of visitors having complementary interests or simply crowding too much. Once these conflicts and their potentials are recognized, the recreational infrastructure and the management scheme can be adequately adopted.

STUDY AREA

The Danube Floodplains National Park is situated east of Vienna, the capital city of Austria, with a population of about 1.6 million. One part of the national park, the Lobau, actually lies within the city boundaries of Vienna. The national park extends about 50 kilometres along the Danube river from Vienna to the border of Slovakia. In 1997, the Danube Floodplains were declared a National Park, and received international recognition in the IUCN category II. The Park is used predominantly by the Viennese and Lower Austrian population for everyday recreation purposes.

In order to deal effectively with the high number of visitors, the park management needs in-depth information on the leisure and recreational usage of the area. Therefore, the Institute for Landscape Architecture and Landscape Management at Bodenkultur University Vienna, commissioned by the Vienna City Council, forest department, and the National Park Administration, collected data on the number and structure of the visitors to the area as well as their spatial and temporal distribution.

METHODS

Investigations on the recreational use of the Viennese (western) part of the national park were conducted in 1998 and 1999. Between June 2000 and May 2001, visitors were also monitored in the Lower Austrian (eastern) part of the national park. Various different methods were applied for the monitoring of the visitor activities: permanent long-term video monitoring over one year, short-term visitor observations, interviews as well as route registrations.

Permanent time lapse video recording, installed at highly frequented access points, gathered information about the number of visitors entering and leaving Lobau from dawn to dusk.

At the main access points into the park visitors were interviewed about their motives, activities, expectations etc. The interviews took place on either four or eight days, at each case a Thursday and the following Sunday, once in each season. In order to obtain high data volumes, the survey was conducted on days of fine weather. In addition, at the same time also the total number of visitors at the main entrance points was determined. This temporally selective counting was combined with video monitoring data for extrapolating to the total number of visitors per year.

As part of the survey, visitors were asked to mark in a simple map the route through the national park, which they took or planned to take (see also Wang et al. 2000). All the trails contained in the Austrian topographic map 1:50.000 were considered. The trail network was digitised and the route information from the interviews was spatially referenced and stored into a database. In a first step, all records have been checked for topologic consistency (e.g. contiguous route segments). By linking the route data and interview results with the help of the Access database, an analysis by topic was possible and the respective number of visitors per segment of trail could be made visible on maps of the study area (Hinterberger, 2000).

RESULTS

Distribution of visitors

Figure 1 gives an overview of the spatial distribution of visitors within the Lobau. The map shows the parts of the park with high or low use levels. Heavily frequented paths could easily be identified and potential conflicts between user groups as well as between nature conservation and recreational goals were allocated. By linking the route information with other interview data, an analysis of routes by access point was possible.

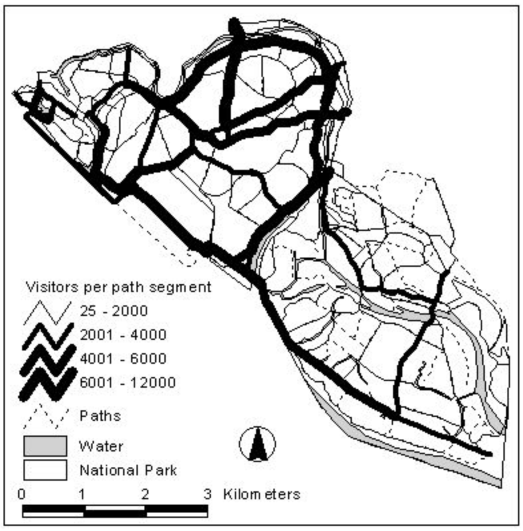

Figure 1: Spatial distribution of visitors in the Viennese part of the Danube Floodplains National Park, on 8 counting days

Figure 2 shows the routes of the visitors entering the Lobau at three selected entry points. At the entry point ‘Essling’ a settlement is very close to the national park. The visitors entering there are mainly staying in the area very close to this access point. The analysis of the questionnaire also showed, that these people are predominantly hikers and regular visitors. At the access points ‘Uferhaus’ and ‘Lausgrund’, in contrast, more bikers were observed. This is also reflected in the spatial patterns of routes reported by visitors passing these two observation points. The routes are fairly long and show high frequencies along the official bike trails within the national park. The video observation showed furthermore, that the numbers of visitors observed at these two stations are highly correlated, which is also represented in the routes.

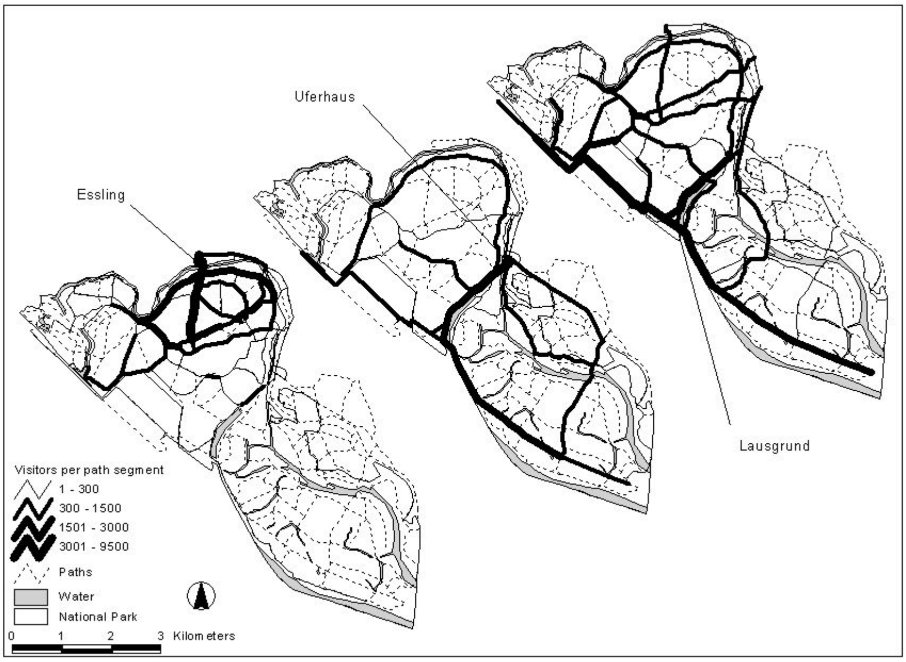

Figure 2: Visitor flow patterns by entrance point

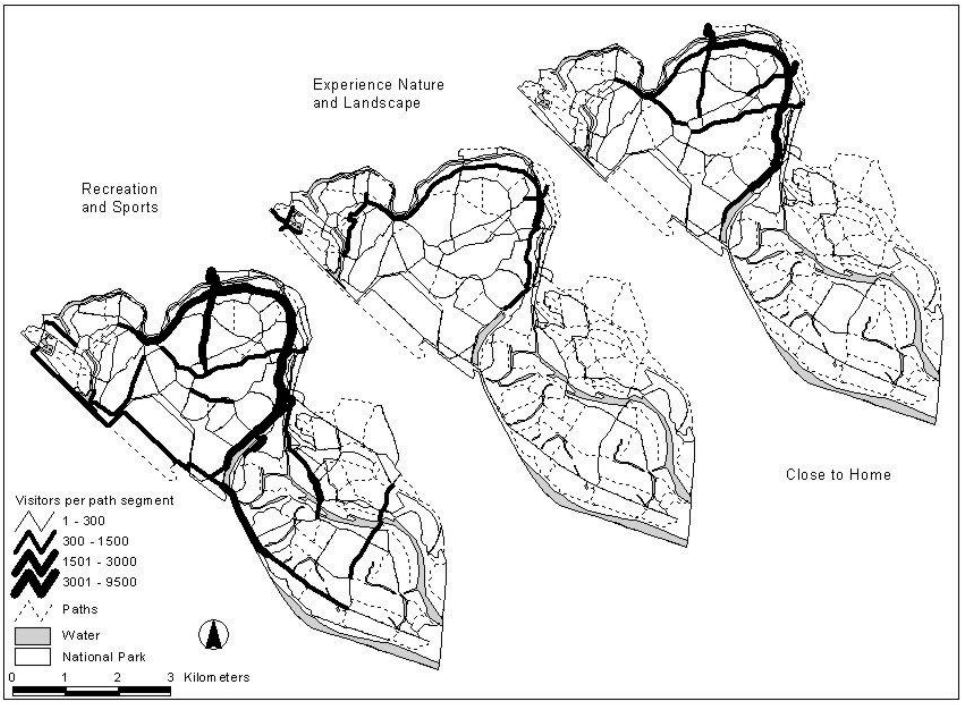

Figure 3: Visitor flow patterns by motivation

By linking the route data to other results of the questionnaire, the spatial distribution of recreationists by visiting motive can be analysed. Figure 3 shows use concentrations of nature related visits along the old branches, whereas visitors coming from the settlements adjacent to the Lobau tend to stay in the parts close their own residential area. Visitors who stated to use the Lobau for recreational and sportive activities, show a wider distribution over the study area.

Calculation of total visitor load

Route data obtained from interviews were also linked with visitor countings from permanent video recording, thus facilitating an estimation of the total visitor load during the one-year period of video observation.

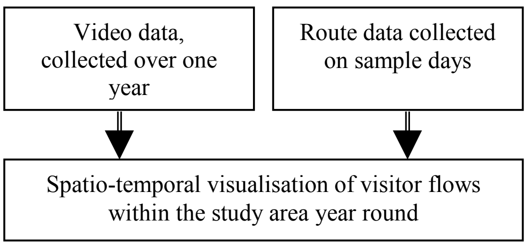

Figure 4: Combination of video data and route data

At the access point ‘Lausgrund’, for example, bikers were monitored by video recording as well as interviewed. Therefore, one knows both the patterns of routes taken by the bikers and the temporal distribution of bikers passing the station year round (see fig 5). This information can be combined in order to do some first and simple calculations of distribution of cyclists within the study area during the year.

The number of cyclists in the study area is particularly susceptible to the temperature, an increasing number was observed between April and September when the temperatures rise above 10°C (Brandenburg, Arnberger, in print). Consequently, also different spatial patterns of cyclists could be observed between April and September.

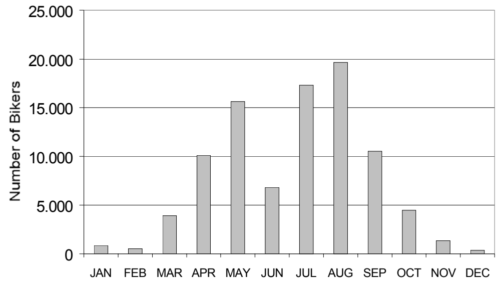

Figure 5: Bikers at access point ‘Lausgrund’ per month

Indices of Public Use

It is quite difficult to compare the amount of visitor use regarding pressure on resources in different parks due to different spatial characteristics such as size, shape and relief (Dawson 2000). Attempts have been undertaken to make the usage and the recreational impacts on various wilderness areas somehow comparable by defining indices of recreational infrastructure and use.

Table 1 shows two such simple indices for the two parts of the Danube Floodplains National Park. By combining these indices with actual visitor data from both the route analysis and the visitor counting, more refined parameters can be derived.

Indices	Viennese Part of National Park - Lobau	Lower Austrian Part of National Park
Entry points per km²	**0,9**	**0,8**
Kilometres of trail per km²	**5,9**	**3,8**

Table 1:Comparing study areas by representative numbers

Length of Routes

Analysing visitor routes with the help of GIS tools offers the possibility to explore also the length of routes. The shortest route reported in the Lobau was only 163 meters long, leading from the entrance point to a water pond and return. The longest route (27.8 km) was reported by a biker, spending his time in the Lobau on a Sunday in spring.

Seasonal variations of the route length could also be observed. First of all, the skewness of the histograms shows characteristic differences. In summer, many visitors only come to the Lobau to swim in the old branches of the Danube. These visitors tend to hike or bike only for a short distance in order to get to their favourite spot (Fig.6), where they often spend the whole day.

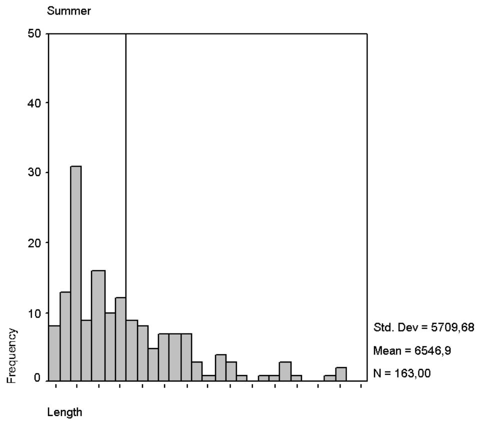

Figure 6: Distribution of route lengths in summer

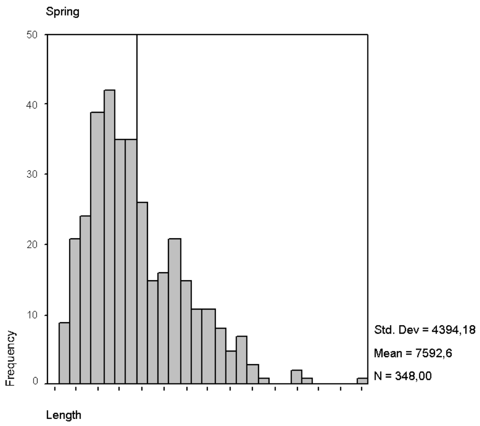

Figure 7: Distribution of route lengths in spring

In contrast, the distribution of route lengths in spring (Fig.7) is more symmetric and many of the distances are grouped around the mean route length. This shows, in measurable numbers that in spring people are moving around much more, spending time biking or walking instead of resting in one place for a long time. Also the means of the distributions of routes are slightly different. In spring the mean distance, taken by the visitors is bigger than in summer. As the number of visitors counted in spring is about twice the number of the summer visitors, the overall impact in spring is significantly higher.

Visitor load

The combination of video recording data with the mean route length allows a calculation of the visitor load, calculated as visitor kilometers per year within the area. This parameter gives an idea of the use intensity of recreational infrastructure, in particular the trail system. The results are also indices in order to compare different recreation areas.

In the Viennese part of the National Park the average route length is 7.26 kilometers. With 600,000 visits counted per year, this section of the National Park is charged by 4,356,000 visitor kilometers per year. Opposed to that, the Lower Austrian part had 390,000 visits with 4,356,000 visitor kilometers per year. Referring to the size, the trail network of the Viennese part is stressed by visitor kilometers more than three times as much as the Lower Austrian part. As the Viennese trail network is more dense, the visitor load per respective trail segment is about twice as high compared to the Lower Austrian part.

Study area	*Mean length of routes / total visitors per year*	*Visitor kilometers per year within area*	*Visitor kilometers per km² per year*	*Visitor kilometers per trail km per km² per year*
Lower Austrian part of National Park	***9.04 km (n = 340) / 390,000***	***3,525,600 km***	***51,100 km/km²***	***13,500 km/km/ km²***
Viennese part of National Park - Lobau	***7.26 km (n = 511) / 600,000***	***4,356,000 km***	***181,500 km/km²***	***30,800 km/km/ km²***

Table 2:Visitor kilometers per year within area

Trail Use Concentration

Ordering the path segments by intensity of use and plotting the total cumulative percent of visitor meters against the cumulative percent of trail meters, results in a graph representing the density of visitor use within an recreational area (see also Lucas, 1990).

In Lobau, for example, fifty percent of the visitor kilometers refer to about fifteen percent of the total trail kilometers.

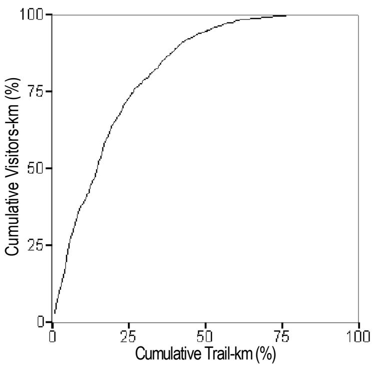

Figure 8: Graph of total travel in cumulative percent of visitor kilometers against cumulative percent of trail kilometers Viennese part, Lobau

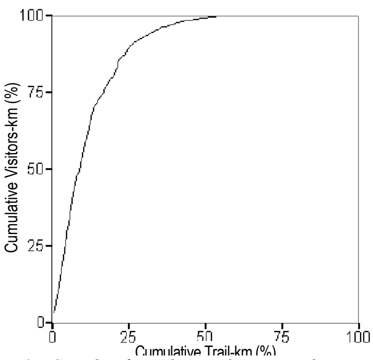

Figure 9: Graph of total travel in cumulative percent of visitor kilometers against cumulative percent of trail kilometers, Lower Austrian part

In the Lower Austrian part, however, fifty percent of the visitor kilometers refer to only nine percent of the total trail kilometers, which indicates an extremely high concentration of visitors on few path segments.

DISCUSSION AND OUTLOOK

The combination of data on visitor numbers, routes and visitor characteristics with the spatial functions of a GIS has proven to be a very useful method to investigate and analyse visitor flows in recreational areas.

One important next step will be to link our data with road traffic data from areas close to the National Park.

So far, our analyses were mostly explorative. Single models have been developed to predict total visitor loads (Brandenburg, Arnberger) depending on weather factors; however, the next step will be to apply these models in a spatial context.

To achieve reasonable models, the data gained from permanent video observation will play an important role and the connection of these data to the routes needs to be done very carefully. These models could also be improved by including information about the directions of the visitors´routes.

Concerning the conservation function of an area, the use of GIS in combination with quantitative data of the recreational use can help exploring the effects on fauna and flora caused by people spending their leisure time in recreational areas. Building more complex models of agents moving trough the recreational area (Itami et al., 2001), interacting with their surrounding according to a bundle of attributes they are applied with, should enable predictions about changes in visitor flow, if certain paths or entrances need to be closed.

Exploration of the visitors opinions in terms of comfort and attractiveness of paths will also be contributing to predictive models.

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Spatial Requirements of Outdoor Sports in the Nature Park Southern Blackforest – GIS-based Conflict Analysis and Solutions for Visitor Flow Management

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INTRODUCTION

The fascination of outdoor-sports has been growing in recent years. The affected areas offer numerous experiences of nature and activity in which the image of an exclusive outdoor lifestyle plays an important role. A continuous differentiation of classic outdoor sports into various new types of outdoor sports, including a very specific use of the natural landscape structure, is characteristic for this growth.

From an ecological point of view, this increasing use of landscape related to space and time, offers severe problems for the affected areas. Especially the multiple all-year of landscape bears a high ecological risk. The increasing pressure on nature and cultural landscape evokes numerous conflicts between protection and use of nature and landscape. Nevertheless, all outdoor sports activities have one thing in common: They depend on an intact natural landscape that offers the basis for an exclusive experience connected to outdoor sports activities.

The aim of the project is to analyse the differentiation of classic types of outdoor sports and the resulting utilisation of the specific types of landscape and area. The requirements for the area are defined from a sport scientific prospective and are judged from an ecological point of view. There are two important dimensions for the use of space through outdoor sports: Apart from the sole requirement of space, it is also very important to consider the time of use of the specific area. The multiple use of specific areas is often a crucial point.

RESEARCH AREA AND AIMS OF THE PROJECT

The Nature Park Southern Blackforest in the southwest of Germany was founded in 1999 and, with its 3300 km2, it is the second largest nature park of the country. The park consists of two geologically different sections: The western part is relatively steep and valleys are numerous. The eastern part is more flat. The medium height of the nature parc is 780 metres above sea level. The lowest regions are 222, the highest 1496 metres above sea level. The parc is by far the most important sports tourism region in southwest Germany. In the catchment area relevant for the daily tourism (radius of 100 km) there live more than 11 million people. Moreover, there is a high number of tourists from other parts of Germany and abroad. The Nature Park Southern Blackforest offers an extensive infrastructure for various nature sports, in summer as well as in winter. At the same time, major parts of the park are considered to be ecologically valuable areas. This is evident because of the existence of many nature conservation areas as well as „Natura 2000“-areas. They alone come to 40% of the nature park.

The development of an all-year sports tourism therefore brings about partially massive impacts. This research project aims to develop strategies that will be consistent in the future and to propose measures that enable an attractive development of outdoor sports in the region. The objective is to conserve the opportunity for experience and sports in an intact landscape and to suit the development of sports tourism to the needs of locals and guests.

METHODS

The methodology of the project can be structured as follows:

- mapping out and enquiry of sports infrastructure and data on nature conservation for the analysis of the status quo.
- Count of visitors and enquiring participant profiles with the help of various methods
- Development of a data base for the GIS-supported analysis of the collected data
- Interpretation of the findings and implementation of a strategic management
- Evaluation and monitoring of the strategic goals.

The use of geographical information systems serves as a basis for all those steps.

Analysis of the status quo

The basis of a serious planning is the recording of the infrastructure related to sports tourism and the up-to-date use of sports- and leisure opportunities. All activities and structures relevant to sports tourism were recorded: hiking, cycling, mountain biking, alpine skiing, cross-country skiing, water sports, climbing, paragliding, golf, trendsports and big sport events. At the same time, all relevant landscape ecological data has to be recorded (land use, digital terrain model, protected areas, traffic infrastructure). The collection of data was carried out by mapping out and questionnaires as well as by digitalising of maps. The aim was the implementation of an extensive data base.

Count of visitors and participant profiles

Apart from the mere inquiry of the sports related infrastructure, the basis for the next steps of the analysis is the recording of the spatial and time related distribution of the visitors. Because of the size of the park there could not be carried out an extensive count of visitors, so single model areas were chosen. For the recording of visitor numbers the outdoor activities hiking, mountain biking and cross country skiing were taken into account. Therefore, three different counting methods were used. The participant profiles were recorded with questionnaires.

Automatic count systems

These immobile systems count the visitor numbers at defined points or stretches. At the model areas, three such systems were installed. They consist of a light barrier and an electronic counter. All movements within a defined period of time are recorded for that specific stretch. The data collected allows the comparison of the visitor numbers of different days but does not give information on the overall visitor number.

Complete count

The prospective of complete counts is the recording of the overall number of visitors of an area. For this purpose counting personell at every parking place and every access counted every visitor and recorded their activities (hiking, biking, cross-country skiing, etc.).

Moment recording

By this method developed by Karameris (1982 and 1987) it is possible to record the distribution of visitors in a specific area. For this, the footpaths, MTB-trails or cross-country ski runs are parted into short stretches. A person hikes, rides or skies on the specific stretch and records the visitor number for a specific period of time. Popular stretches and points can be recorded this way. With the moment recordings average results are gathered which characterise the relative importance of the single stretches. Every stretch is only observed for a short period of time, so normally the actual use is much higher. To be able to compare the intensity of use of different stretches, the moment recording has to be combined with a complete count.

Implementation of a landscape information system

The gathering and preparation of spatial data, their evaluation, linking and carrying out in a strategic management is nowadays unthinkable without the help of electronic data processing. Systems which are able to take into account the spatial dimension apart from the objective dimension are mostly relevant for this purpose. For the strategic management of the nature park, most decisions made are based on spatial data. Because of this, the use of up-to-date geographical information systems (GIS) is indispensable.

GIS enables to collect, edit and analyse area related data digitally and to visualize it numerically or graphically. Additionally, apart from the administration of thematic data (attributes, key data) and geometric data (position, shape, size) GIS also allows topologic data analysis (space related). This data can be used for area overlay- and intersection-operations and complex terrain analysis.

For the Nature Park Southern Blackforest a specific GIS user surface was developed and implemented for the different requirements of the project, which also supports the further work of the employees of the nature park offices. All analyses described in the following are GIS-based.

CONFLICT ANALYSIS

Intensity of use

To quantify the intensity of use, the results of the gathered data, infrastructure, visitor counts and participant profiles (see 3.1 and 3.2), were related to each-other.

For the evaluation, crucial points are the real number of visitors and the intensity of use due to the specific activity.

The results suggest that beside the space and time related use of the natural landscape by a single activity especially the multiple use of the same landscape by several activities is one of the major conflicts.

Furthermore there are significant differences between the use in summer and winter. In summer mostly the whole area of the nature parc is affected. The intensity of use is relatively low because visitors are widespread throughout the whole area. In contrast, in winter the visitors are concentrated on single spots which results in a high intensity of use at these specific locations. (Fig. 2)

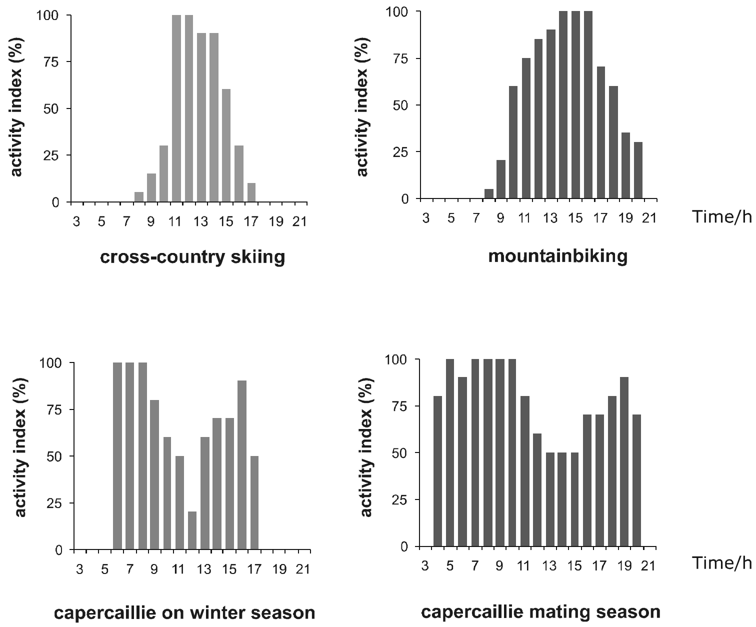

Fig. 1: Time conflict between capercaillie and cross-country-skiers and capercaillie and mountainbikers.

The example of the capercaillien (Fig. 1) illustrates the importance regarding the time of human activity compared to the time of animal activity (time conflict). The capercaillie is a bird species active during the day with specific peaks of activity in morning and evening. If the time of activity of the visitor coincides with the peak of the capercaillie's activity, the disturbance is high. On the other hand, peaks in visitor activities coincide with times of low activity, causes low levels of disturbance. Therefore different types of sports activities have different levels of disturbance on capercaillie. Due to their large action radius, mountain bikers, for example, use the landscape also after 7 p.m., a peak of capercaillie's activity. In consequence, capercaillies have to feed, mate and rear its young at times when mountain bikers use the same territory.

Potential for sports tourism in the Nature Park

Apart from the actual use of landscape through sports tourism, potential areas were singled out. As a result, areas were described which bear a high potential for specific sports activities, either for summer or for winter activities. These areas can be kept in mind for future planning.

Important factors for the usability for summer sports are the variety of landscape, the slope and the altitude. Variety of landscape can be measured by the number of changes of landscape characteristics (vegetation, use of landscape by agriculture, forestry, settlement, etc.) in a defined area, for example per km^2.

The slope- and altitude-impact on the potential is measured by the number and level of changes in altitude per km^2. High changes in altitude increases the number of potential sports activities in the area. The results suggest that almost the whole nature park area is excellent for summer sports activities (Fig. 2).

For winter sports, especially the reliability on snow is the most important factor. To calculate this, long-term data on precipitation and temperature were taken into account. In addition to this, morphologic parameters (altitude, slope, aspect) were regarded.

As expected, highest potential for winter sports could be found along the central mountain range which divides the park from north to south. Due to the higher impact of continental climate, the eastern parts of the park have a higher potential for winter sports than the western parts if the same altitudes are compared.

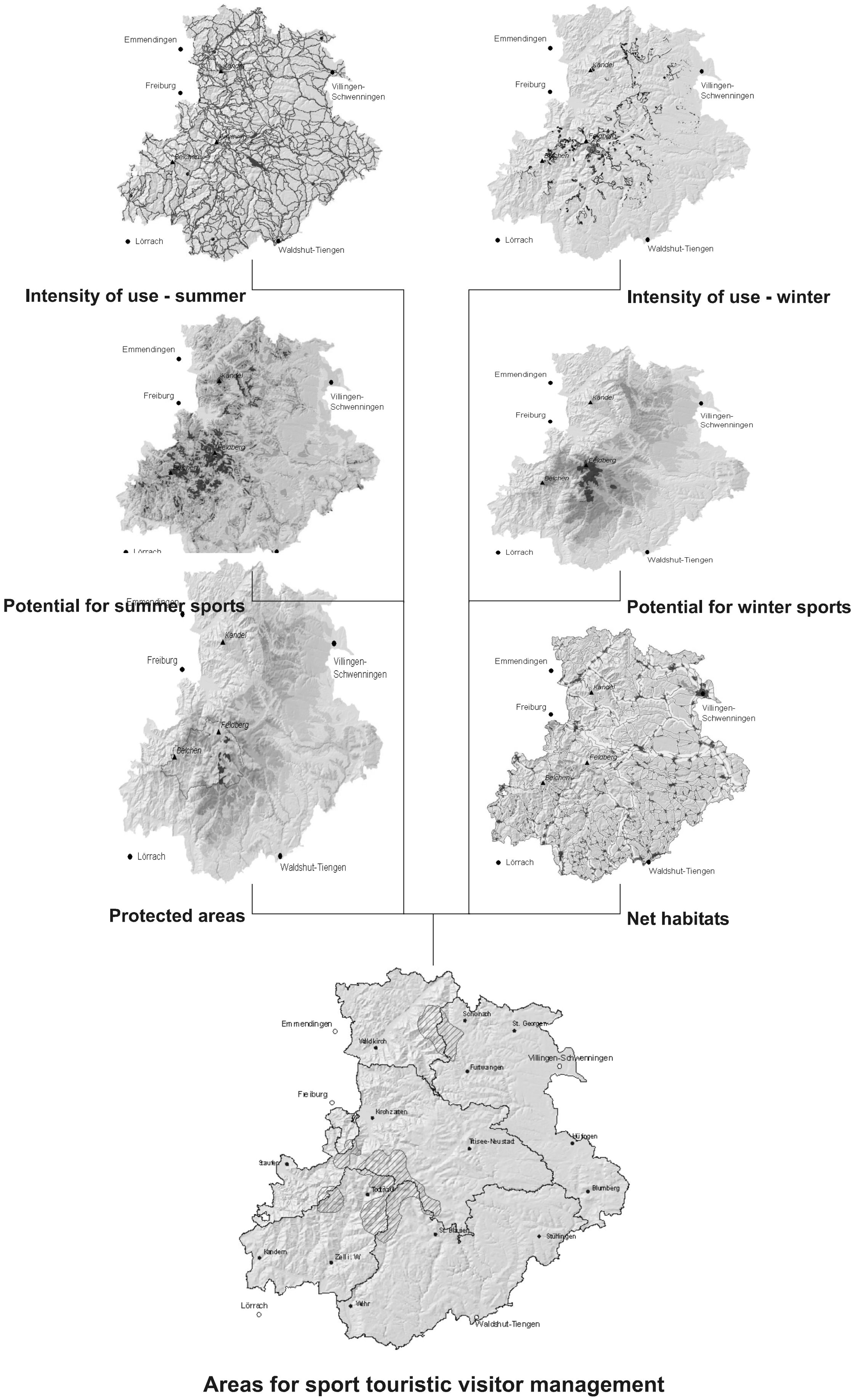

Fig. 2: GIS-based conflict analysis: calculation of visitor flow management areas for sport tourism.

Spatial conflicts

To figure out areas of conflict between nature conservation and sports activities further overlay and intersection operations have to be done in GIS.

The theme sport in landscape consists as described on two maps based on several layers: First the maps of the intensity of use, second the map of potential areas for sport activities (both separately for summer and winter; Fig. 2).

The theme nature conservation consists of protected areas and net habitats. For a large scale view the highest ranks of protected areas, “Naturschutzgebiet” and “Natura 2000”-areas, are respected. Net habitats are defined as areas, which are not intersected by settlements or traffic routes and therefore could function as potential habitats also for more demanding species.

Via different punching tools and with the help of different weight factors the themes are combined and overlayed by GIS. As a result, areas can be figured out which have a high potential for conflicts: On the one hand these areas show a high intensity or potential of sports use and on the other hand they are valuable areas for nature conservation.

Using this strategy our results display an area of 236 km² in the Nature Park Southern Blackforest with high potential for spatial conflicts. These are the areas with the highest requirements for the implementation of visitor flow management systems.

VISITOR FLOW MANAGEMENT FOR SPORT TOURISM

Channelling sport activities in designated areas with high potential for conflicts is a balance act. On the one hand the use of broad areas for sport activities should be enabled also in a high quality and on the other hand nature conservation has to be assured. Channelling measures have to be carefully planned and sometimes creativity is necessary to design an appropriate measure. Goal is always to minimize conflicts.

The level of possible adverse effects of sport on nature and landscape is determined by the factors intensity of use, kind of use, exact location, time and duration of activity.

The strategy for these designated areas is to channel and concentrate sport tourists by forming attractive sites for sport activities. Areas of concentration are either extraordinary resistant against impacts because of their natural characteristics or parts of a site are released which is the prize for protecting more valuable parts of the area.

Important tools to concentrate activities are skiing slopes, tracks and trails. They are part of a strategy which could be described as “channelling by offering comfort”. Therefore the guidelines for the Nature Park Südschwarzwald follow the principle “offerings are better then proscriptions”.

The components of a visitor flow management for sport tourism are shown in figure 3. As described, positive channelling measures are the heart of the strategy. Naturally it is important that sport activities in conflict areas are proper planned using the methods of landscape planning.

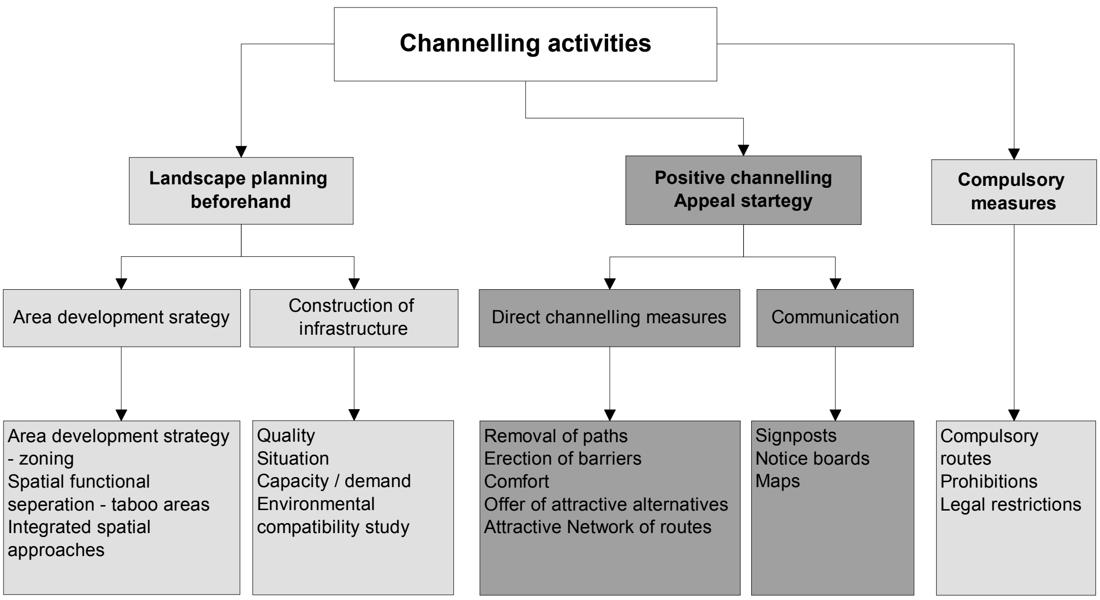

Fig. 3: Different aspects of a visitor flow management systems for sport tourism: voluntary channelling measures must become the central feature; compulsory measures should only be enforced as a last resort.

Compulsory measures are just the last solution. They should be used very careful for high sensible areas or when other measures lead to no success.

Basis for a successful implementation of a channelling strategy is co-operation between public authorities, municipalities, sport, forestry and nature conservation. Sectoral thinking has to be abandoned for an integrative approach.

EXAMPLES OF "GOOD PRACTISE" AND CHECKING SUCCESS

To perform the results of the research in designated conflict areas concrete projects have been initialised. Work groups were formed made up with all parties involved. These work groups escorted the implementation of the measures.

On basis of the carried out research on status quo and conflicts (as described above) infrastructure for sport tourism was newly designed. When rebuilding of trails (hiking, cross-country skiing, mountain biking) was done aspects of nature conservation and sport were respected. For example in the model-area called "Rohrhardsberg" the yore existing system of trails was strongly shortened. Parallel, the quality of remaining infrastructure was raised by offering new possibilities of trail combinations, resulting in a more attractive site.

In stretches highly valuable for nature conservation trails were abandoned and blocked. The trails were displaced in neighbouring less sensible zones.

Figure 4 shows an example of the application of the "ladder"-system used to create a new cross-country trail-system. With the help of short connection trails various skiing-possibilities are created and the disturbance-area can be minimized.

In the same time, in co-operation with the "Forstliche Versuchs- und Forschungsanstalt" (a governmental forestry agency of the federal state Baden-Württemberg), in the calmed down and valuable zones measures for melioration of habitats were planned and performed. Target species in the first line was the capercaillie. For a checking of the success of these measures a monitoring program is necessary. For this counts of visitors were done to proof the acceptance of the marked trail system. Simultaneously on basis of long term research habitat structures were mapped and analysed, as well as a intensive estimation of the stock was done.

A large proportion of nature sports activists will allow themselves to be channelled by convenience. This means extremely good and functional signposting (no profusion of signs), attractive sports opportunities (single trails for MTB, for example), concentrating and extending opportunities to allow the user to choose his own sequence of shorter course loops.

A good public relation and information could be reached by creating pleasing information material and meaningful maps. These information campaign is essential to impart knowledge and acceptance for the channelling measures.

Furthermore manuals exemplary for mountain biking and hiking were made, serving as guideline and information source for municipalities, sport organisations and tourist service providers. The manuals include (amongst other things) the ecological compatible and attractive (in the view of sport) installation of trails as well as sign posting and mapping of trails.

The manuals should help to implement the results of the "good practise"-examples to the whole nature park area.

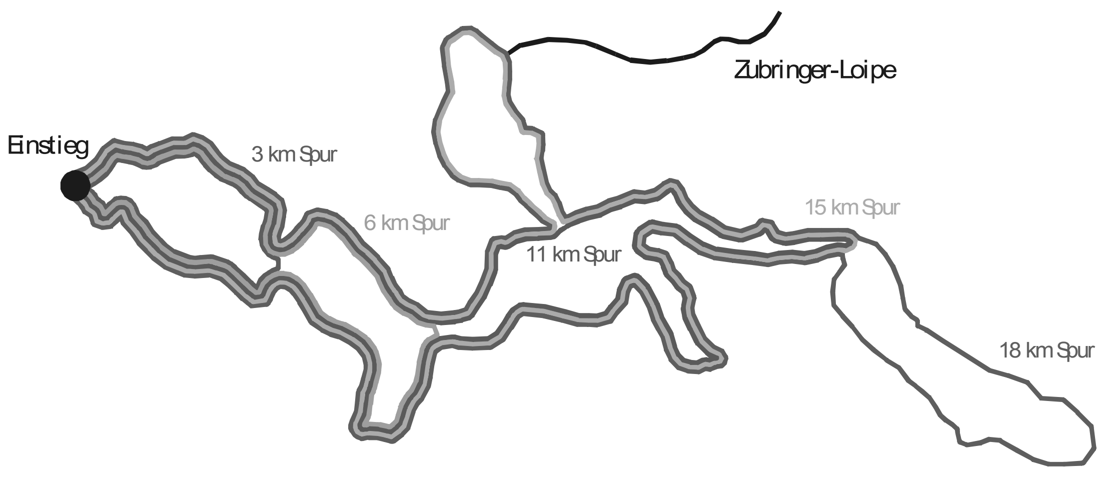

Fig. 4: Cross-country trails as result of the application of the "ladder"-system.

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Observation as a Technique for Establishing the Use made of the Wider Countryside: a Welsh Case Study

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Abstract: Surveying the use made of the wider countryside for recreation is problematic due to the scale of the area to be covered. In particular the distribution, numbers and activities of countryside visitors are difficult to ascertain using conventional methodologies such as questionnaires and counters. This paper describes an observational methodology that has been used investigate recreational activity in a 466 square kilometre area of Mid Wales. The results illustrate the countryside resources that are being utilised, the activities undertaken and the number of people involved. It is concluded that observation is a valuable tool in understanding the nature of recreation in the wider countryside.

INTRODUCTION

The strategic planning of recreation in the countryside is becoming increasingly important as a means of ensuring that the demands of visitors to the countryside are met whilst controlling any adverse effects that recreation may have on the environment. Strategic planning normally involves considering large areas of countryside such as the area contained within a national park or within an administrative boundary. Research has shown that such strategic planning is often based upon inadequate levels of information regarding countryside usage and is often based on nothing more than presumption (Curry and Pack, 1993).

To plan countryside recreation strategically a wide variety of information is required about the countryside and the visitor. Information requirements include:

- The countryside resources that are available for countryside recreation
- The constraining factors that may limit the use of areas for recreation
- The profiles of visitors
- The number of visitors
- The distribution of visitors
- The activities carried out by visitors
- The attitudes of visitors

Trends in visitor usage of the countryside

There are a variety of established methodologies for providing answers to many of these questions (such as questionnaires, focus groups and facilities audits). Many of these methodologies work at a localised site level but are not so effective when it comes to larger countryside areas. In particular, present methodologies find it difficult to establish visitor numbers, visitor distribution and the activities carried out by visitors in open countryside where visitor density may be low. This paper presents an observational methodology that can establish use, distribution and activities over areas of open countryside.

OBSERVATIONAL STUDIES

Observational studies, often labelled as 'naturalistic' and sometimes referred to as behavioural mapping, are characterised by the systematic and unobtrusive observation and recording of behaviour (Ely, 1981; Campbell, 1970; Glancy, 1986; Beer, 1987). When studying large or highly mobile mammals to establish distribution, resource usage and behaviour, researchers are forced into an observational approach (mammals are not known for their ability to fill in questionnaires or sit on focus groups!). Can we adapt the methods used to survey mammals to study *Homo sapiens?* An example of an observational approach is the national badger survey carried out in the United Kingdom by Professor Stephen Harris of the University of Bristol (N.C.C., 1990, Wilson, Harris and McLaren, 1997). This survey was carried out between 1985 and 1988 and repeated between 1994 and 1997. This survey sought to find answers to key questions concerning badgers such as how many badgers there were in the countryside, their distribution (both at a national and habitat scale) and whether the population was changing (both in numbers and distribution)? The methodology used for the national badger survey was based upon systematic observation for signs of badgers within randomly selected one-kilometre squares, selected in proportion to land area as classified by a land classification scheme, (Bunce, Barr, Clarke, Howard and Lane, 1996). Similar surveys have also been carried out on bats (Walsh and Harris, 1996a and b; Walsh, Harris and Hutson, 1995).

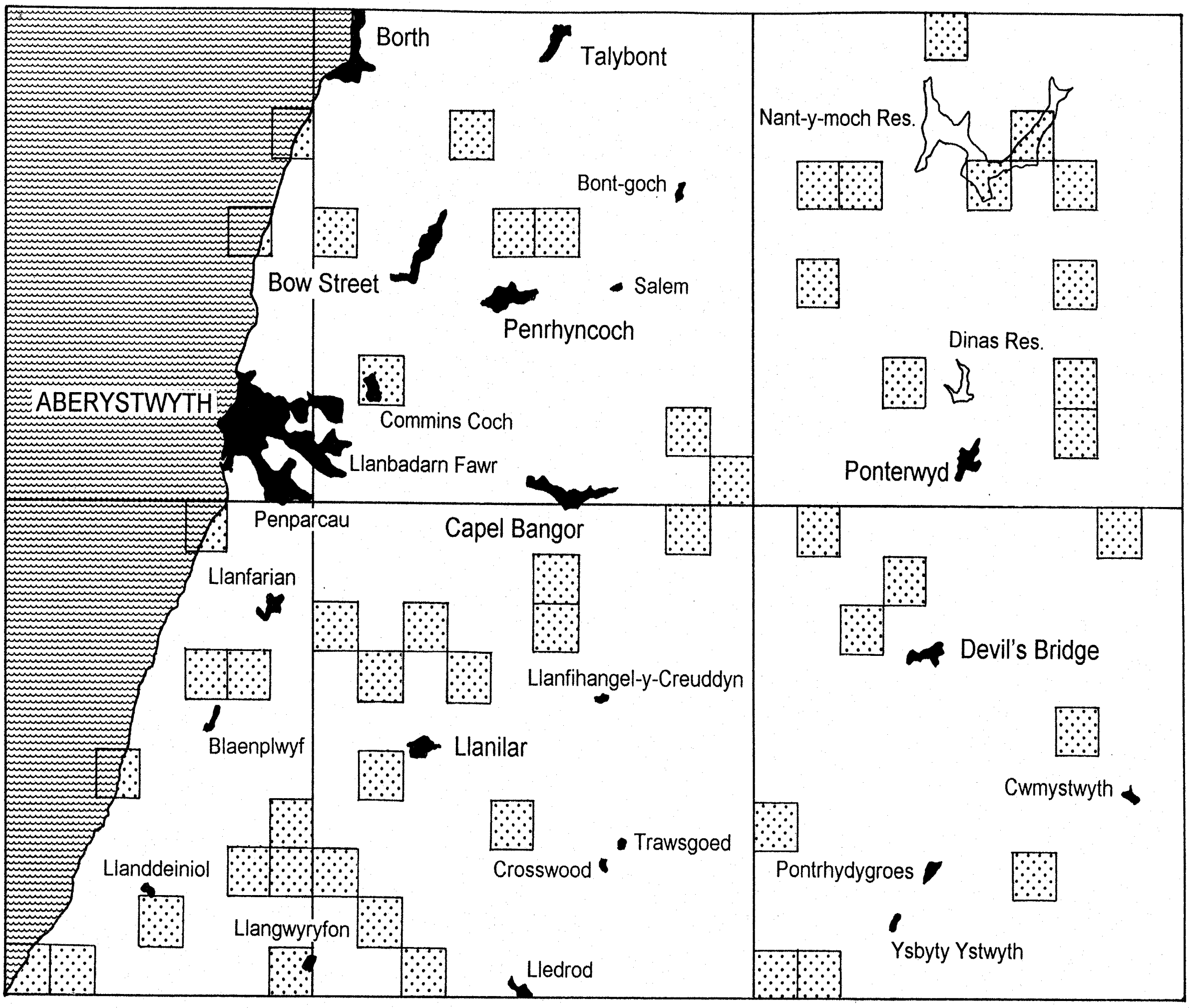

Figure 1. Map of the Aberystwyth area, showing the randomly chosen 52 Ordnance Survey one by one kilometre grid squares that were surveyed for the study

There are therefore tried and tested methodological approaches for systematic research through the use of observation, of mammal distribution, numbers and behaviour.

It can be noted that the issues the national badger survey tried to answer are very similar to the issues identified for countryside recreation, that of numbers using the countryside and distribution.

OBSERVATIONAL STUDY OF NORTH CEREDIGION

This paper describes a methodology, adapted from observational studies of mammals, that has been used to investigate recreational activity in a 466 square kilometre area of Mid Wales during the summer of 1996. This survey in particular sought to find out:

1. the activities people undertake as countryside recreation
2. the exact types of access people use when visiting the countryside
3. the types of countryside people visit
4. an estimate of the number of people using the wider countryside

This study was carried out in North Ceredigion in Mid Wales. An area described by six adjacent Ordnance Survey ten by ten kilometre squares, in a three by two rectangle, (grid reference of the South West corner being SN5/7) was selected, giving 466 Ordnance Survey one-kilometre grid squares containing land above the high water mark. From within this 52 one-kilometre squares (11.2% of the study area) were chosen using random numbers (Figure 1). The survey was conducted between the 4th and the 26th of August 1996. During this period each square was surveyed three times, once on a weekday, once on a weekend day and once over the three days of the August Bank Holiday weekend. Surveys were carried out between 11.00 a.m. and 6.00 p.m. with each surveyor covering no more than three squares in any one day.

INFORMATION GATHERING

Within each square all access routes considered to be open to the public were walked to assess the most appropriate positions from which to observe recreationalists and to collect information regarding the nature of the countryside within the square.

All legal access routes displayed on the Ordnance Survey map and observed on the ground within the square, were mapped onto an enlarged (1:10,000 scale) photocopy taken from a 1:25,000 Pathfinder Ordnance Survey (O.S.) map. Each discrete length of path was assigned a unique link number to which additional information was referenced. The length of each link was measured from the O.S. map using a digital opisometer, it is thus a plan measure and takes no account of the rise and fall of the terrain. The legal status of each link, as identified by the O.S. map, was recorded.

OBSERVATION OF DISCRETE AREAS

Each square was observed to record recreational activity. Pilot testing on the ground established that in most cases it is impossible to observe a whole kilometre square from one observation point. This problem was addressed by observing discrete areas within each square for a standard amount of time. A discrete area was defined as an area that could be viewed from one location or whilst walking slowly along a linear access route so that all recreational activity could be observed. In some cases this was just one field or length of footpath, whereas in others a whole square could be observed at one time (for example an open hillside). By careful observation of a series of separate discrete areas it was possible to survey the whole square such that each area within the square is observed for an equal amount of time. For this study each discrete area was observed for a period of five minutes.

The data from all the discrete areas within one square was combined to estimate the recreational use of the square. As an example, if a one kilometre grid square can be observed as four discrete areas recording will take twenty minutes plus the time taken to move between observation points. The net effect of this is that the whole square will have had the equivalent of a standard five minutes of observation.

For each person or group of people observed during the survey a location, description and activity were recorded with each person being allocated to a single activity code. Most categories of data were pre-coded, but each surveyor was also asked to give a written description (to validate the pre-coding). Where an individual was not observed on a linear access route another coding system was used to record the category of landscape they were in. During the observation of any one square each person was only recorded once. This meant that if an individual was recorded within one discrete area at the start of a square's observation that person would not be subsequently recorded for that square if rediscovered in another discrete area.

All recreational activity was recorded including the use of off road vehicles away from metalled roads. No attempt was made to record people within the curtilage of their houses or travelling through the countryside on metalled roads in motor vehicles. The nature of the study area and the random sample meant that no extensive urban areas were included and therefore the surveyors needed no urban definition or exclusion instructions. Data were entered onto a relational database (Microsoft Access) for analysis.

NATURE OF THE STUDY AREA

The results must be viewed in relation to the rural nature of the study area, which contains no intensively visited and managed sites such as theme or countryside parks. There are also no extensive urban areas with only one town of significant size (Aberystwyth: population size approximately 12,000). The landscape of the study area is a mixture of upland and lowland grassland with extensive areas of conifer plantations and to a lesser extent broad-leaved woodland.

RESULTS

Numbers and type of people observed within the study area

A total of 540 people were observed, of which 448 were classified as being involved in a countryside recreational activity. Of the 98 people not classed in this way 57 were working out of doors (agricultural workers) and 35 were classed as non-recreational utilitarian walkers (people shopping or walking from home to their car for example). The results given in Table 1 are calculated excluding these 98 people. It can therefore be said that in this survey 82.9% of people observed were undertaking some form of recreational activity.

Group size	Number of groups observed	Number of people observed	Percentage of people observed
1	57	57	12.7
2	57	114	25.4
3	22	66	14.7
4	20	80	17.9
5	5	25	5.6
6	5	30	6.7
8	3	24	5.4
10	1	10	2.2
17	1	17	3.8
25	1	25	5.6
Totals	172	448	100

Table 1. Group sizes of observed recreationalists.

The activities people undertake as countryside recreation

It can be seen from Table 2 that walking was clearly the most common activity with 48.7% of all observations being coded as this. A miscellaneous coding of "other static activities" comprised the second largest recreational category with 11.2% of people being observed sunbathing, talking or admiring the view. Cycling accounted for nearly 6.9% of the observations, with road bicycles out-numbering mountain bicycles. However, all cyclists seen were using metalled roads. A range of 14 other activities were observed. This illustrates the variety of countryside recreational activities undertaken within the study area.

Activity	Percentage of observations (n=448)
Walking	48.7
Other static activity	11.2
Sitting in a car	5.6
Picnicking	5.4
Cycling	6.9
Off road motor vehicle	3.6
Boating (sea)	3.6
Children playing	2.7
Horse riding	2.5
Fishing	2.2
Model plane flying	2.2
Camping	2.2
Swimming/paddling	1.3
Horse and cart driving	0.4
Collecting	0.4
Shooting	0.4
Kite flying	0.4
Reading information board	0.2
Total	100

Table 2. The activities ordered by percentage participation, that countryside recreationalists were undertaking when first observed.

Locations of recreationalists within the study area

The locations of observed recreationalists can be put into three categories with 148 people using public rights of way, 106 people on roads (excluding 12 people observed on unclassified tracks) and 182 people observed away from linear access routes. Of these 182, 40.6% were found near their cars in car parks, on the side of roads or in caravan and camping grounds (which occurred in 7 of the 52 sampled squares). The remainder was recorded in 6 categories with 37.9% being found on or near water bodies.

The linear access routes that people were observed using within the study area

To enable a comparison of the relative amount of use of different categories of linear access route, using analysis of variance, the data were transformed using the formula *log (x+1)* to create an approximately normal distribution with a variance almost equal to the mean. The analysis showed that there was no significant (at 95%) difference between the density of people (numbers per unit length) observed on public roads, public footpaths and the amalgamated category of bridleways, roads used as public paths (RUPPs) and byways open to all traffic (BOATs). These results show that the use made by recreationalists of roads, footpaths and other public rights of ways are in proportion to their length and no significant preference could be found (see Figure 1).

An estimate of the number of people using the wider countryside

For the observed squares an estimate of the average density of countryside recreationalists in any one five minute period of the study time frame was calculated at 2.87 people per km^2. From this it may be further estimated that 1,337 countryside recreationalists were at large in the wider countryside of the 466 square kilometres of the study area in any one five minute period between 11.00am and 6.00pm during the August survey period. However, this does not take account of known managed sites within the survey area that were not sampled or people touring in cars, but does reflect the use made of the wider countryside.

Number of recreationalists	Expected percentage of one km squares
0	21.3
1	12.3
2	9.1
3	7.3
4	6.1
5	5.1
6	4.4
7	3.8
8	3.3
9	2.9
10	2.6
15	1.4
20	0.8

Table 3. The probability (expressed as a percentage) of finding between 0 and 20 recreationalists within one by one kilometre squares within the study area of north Ceredigion.

From observations of the number of people found in each surveyed square a negative binomial distribution was found. From this data the *expected* negative binomial distribution of people for all 466 squares in the study was calculated (Fowler and Cohen, 1998) from the observed (52 surveyed squares) sample. The results from this calculation can be seen in Table 3. This calculated data predicts for example, that 21.3% of the surveyed one-kilometre squares contain no recreationalists at all and that 43.9% contains five or more.

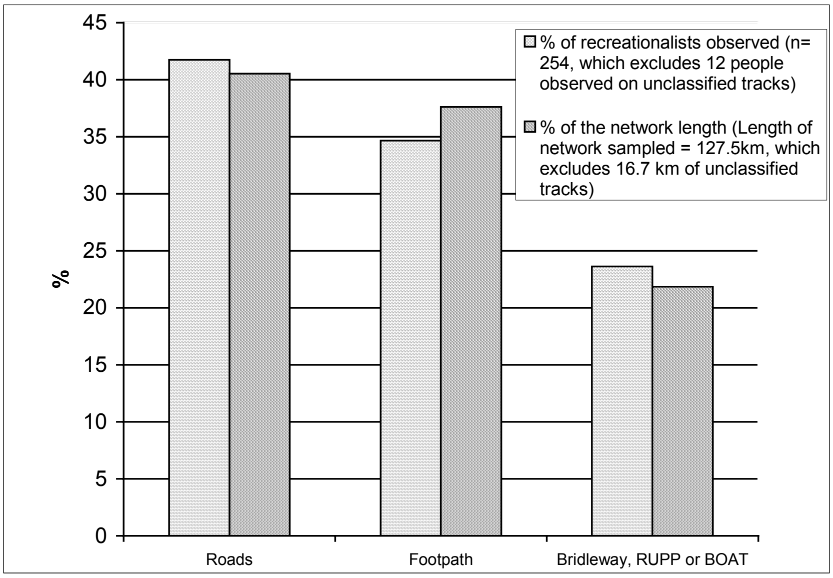

Figure 1. A comparison of the percentage of observed countryside recreationalists found on each category of linear access route and the percentage that each access route comprises of the whole rights of way network within the observed squares.

DISCUSSION OF RESULTS

The results must be viewed in relation to the rural nature of the study area which contains no intensively used and managed sites such as theme or countryside parks. There are also no extensive urban areas with only one town of significant size (Aberystwyth: population size approximately 12,000). It is also important to view each observation as one moment in time, as peoples' activities were coded using the activity in which they were first observed, which is often only a small element of their countryside trip. The results are records of observations of real behaviour and introduce a spatial element and level of detail not normally available to the countryside planner.

CRITIQUE OF METHODOLOGY

This study was undertaken to evaluate the potential of observation as a method of collecting data about countryside usage. While useful data were collected, several refinements to the methodology may be identified. Difficulties were experienced in establishing the legal status of access to certain areas. In particular, on O.S. maps access routes such as white roads do not have their status shown and public rights of way may be recorded inaccurately. The development of survey maps based upon the definitive map and the highways register held by the local authority would improve the accuracy, by confirming the current legal status and location of public rights of way. The status of unclassified tracks or white roads is likely to be an area of uncertainty until procedural or legal changes are made. In this survey no urban areas were encountered, but future application of this methodology is likely to include such areas. The adoption of a definition of 'countryside' may be required in these cases. A reliable definition is not easily constructed although it is suggested that, for convenience, areas of dense urban housing or industrial areas, often with dedicated pedestrian walkways or pavements are excluded. A clear and robust definition would be needed if future observational surveys were to be comparable.

The survey squares observed in this study were selected in a purely random manner and did not deliberately cover know busy recreational sites (in fact the study area contains no known sites which have a large visitor pressure such as country or theme parks or attractive villages). In future surveys it may be useful to ensure a large enough proportion of squares are sampled to ensure that the studies obtain a representative sample of heavily used managed sites as well as the wider countryside. Another issue not encountered within this study is how to record large numbers of people that may be observed at busy sites. It is suggested that one approach to this may be to subdivide the area into smaller areas that will allow for accurate recording.

CONCLUSION

It can be concluded that the use of observation of discrete areas of the countryside as outlined in this paper is a viable and practical method for analysing recreational behaviour of the wider countryside. It provides a truly systematic method of recording real behaviour and distribution. In comparison to other methods this type of survey allows for the collection of information about countryside usage which is beyond that collected by traditional methods. As such it provides a valuable and additional tool to aid the understanding and planning of countryside recreation. It is important in any study of countryside usage to ensure that data collected is comparable over time and space. For future studies using this technique it is therefore important to standardise the method and sampling frame used. Future studies using such a standardised approach could then provide the first regional or national picture of the abundance, distribution and behaviour of countryside recreationalists. Such data could provide a baseline upon which trends in recreational behaviour can be analysed. The method is considered to be very adaptable and could be used to gather important information on many facets of the behaviour and use made of the countryside that have not been covered in this study.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Understanding Visitor Flows in Canada's National Parks: the Patterns of Visitor Use Study in Banff, Kootenay, and Yoho National Parks[1]

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Abstract: Parks Canada and its stakeholders are seeking to better understand visitors' movements, behaviour, and motives to support ecological integrity and sustainable tourism. Traditional market research describes these dimensions one at a time, but few studies have focused on the segmentation needed to addresses all three dimensions together. This study develops a complex visit typology and compares its practical value to a more common segmentation approach: visitor origin. Results suggest that both approaches have practical value, but that the post hoc visit type approach is more useful as a management tool for describing visitor movements.

INTRODUCTION

Canada's system national parks and park reserves represents thirty-nine natural areas of Canadian and global significance. The Government of Canada has given Parks Canada – the agency that manages the system – the mandate to protect these special places as examples of those natural areas for public understanding, appreciation and enjoyment in ways that leave them unimpaired for future generations.

Parks Canada has adopted the principle of ecological integrity to fulfil this broad mandate. An ecosystem is considered to have integrity "when it is deemed characteristic for its natural region" and its "native components (plants, animals and other organisms) and processes (such as growth and reproduction)" are intact (Parks Canada, 2000).

Together, the mandate and definition of ecological integrity are consistent with the definition of sustainable tourism as that which:

"...meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future... leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems." World Tourism Organization (2001)

Parks Canada is developing an integrated science strategy so that natural, social, and cultural sciences can work together in support its mandate. In the tourism area, this requires support from external stakeholders because the agency does not have jurisdiction over all aspects of a park's tourism system. An effective social science strategy will need to accommodate those perspectives, including:

- **Physical/Spatial**: Those with this perspective feel that tourism has an ecological basis, so planning should be based on spatial patterns and capacities to minimise the negative impacts of tourism on the environment. Planning is used to redirect, concentrate, or disperse visitor use to minimise impacts in sensitive areas.
- **Economic Perspective**: Those with this perspective see tourism as a means to promote growth and development. Planning emphasises economic benefits and ways to efficiently create income and employment benefits. It is seen as being equal to other industries.
- **Community Perspective**: Those with this perspective see tourism in its social and political context. The planner is a facilitator who helps host communities define desired outcomes in socio-cultural terms. Host communities – on the "factory floor" of the tourism industry – thus acquire the control they need to help balance tourism development.

1 The author acknowledges the partnership between Parks Canada, Alberta Economic Development, and the Banff – Lake Louise Hotel Motel Association that sponsored the research described in this paper. Visit typologies were developed in conjunction with Accord Research, University of Calgary.

Getz (1987) proposed a theoretical perspective that integrates these approaches in a way that is consistent with sustainable tourism and ecological integrity:

- **Integrated Perspective**: Tourism is a system that should offer lasting and secure livelihoods with minimal depletion of resources, degradation of the environment, cultural disruption, or social instability. Planning is integrated with other planning processes and with its own implementation.

The Tourism Optimization Management Model (TOMM) is a recent innovation that operationalizes Getz' integrated model (Manadis Roberts Consultants 1997; Jack 1999). It views tourism and visitor use as a system and seeks to optimize its outcomes based on a broad understanding of its function (McArthur, 2001).

Those with knowledge of a system's function can manipulate it in support of established aims (Bellinger *et al*, [n.d.]). In tourism, this requires an understanding of visitor volumes and visitor behaviour. Research can foster an understanding of tourist activity, the patterns in visitors' behaviour, and monitor and predict the change that tourist activity brings (Consulting and Audit Canada, 1994; McArthur, 1996).

The literature offers few studies that describe visitor use based on travel behaviour and spatial distribution (Flognfeldt, 1999). Specifically, the optimization literature does not suggest how best to describe visitor behaviour in ways that relate directly to management of outcomes. This is important for protected heritage areas, where visitors' behaviour can have significant long-term impacts on resources.

Recent literature has discussed the relative value of demographic, geographic, psychological, and behavioural segmentation bases (Moscardo, Pearce, and Morrison, 2001), but few studies have compared of the effectiveness of different segmentation solutions to respond to the challenge of optimization.

Moscardo *et al* suggest that the traditional approach uses *a priori* demographic variables, or variables that are chosen before the data are analysed. They point to numerous studies that have found significant relationships between visitors' origin and both travel behaviour and satisfaction.

While demographic descriptions are the norm, some argue, "Demography is not destiny" and advocate *post hoc* segmentation, determined by the data rather than by the researcher (Adams, 1997). These segments, then, can be described with geographic variables (Moscardo *et al*, 2001).

Regardless of the approach, effective visitor segmentation would describe visitor use reliably in several dimensions, producing segments that are:

- **homogeneous** (unique from each other, but internally consistent);
- **durable** (over an extended period of time);
- **measurable** (can be identified and counted with reasonable accuracy);
- **responsive** (a unique marketing approach required);
- **relevant** (to the organisation commissioning the research);
- **accessible** (easily reached via one or more media);
- **substantial** (large enough to warrant attention); and
- **compatible** (with existing markets) (Moscardo *et al*, 2001).

The study by Moscardo *et al* compared the value of geographic origin versus activity participation in Australia's Wet Tropics region. That study focused on visitors to the Australian rainforest, but the study's sample size was too small to make clear conclusions (n=549).

Like that study, this one compares the relative value of *a priori* visitor origin segments and a more complex *post hoc* approach to determine which is most useful from several different perspectives. The *post hoc* approach is based on 1,127 respondents':

- level of the pre-trip importance placed on different visit opportunities;
- activities in each of the parks' main visitor nodes; and
- parties' reported spending in Banff National Park.

Each base is compared against the eight criteria for effectiveness to evaluate the two segmentation approaches. It uses data collected in a study of visitors to Banff, Kootenay, and Yoho National Parks of Canada in the summer and autumn of 2000, but reports only the findings of the Banff sample.

BACKGROUND

Banff, Kootenay, and Yoho National Parks are among the country's most recognised tourist destinations. Over six million visitors from Canada, the United States, and overseas enjoy the parks each year, spending hundreds of millions of dollars in their hotels, restaurants, and stores. Yet, as representative examples of Canada's natural heritage – and as a World Heritage Site – the integrity of their resources is an national and international issue.

Last year, three organisations joined together to study visitor use of Banff, Kootenay, and Yoho National Parks: Parks Canada; Alberta Economic Development; and the Banff Lake Louise Hotel Motel Association. They wanted a single, reliable base of commercial, economic, and ecological data to describe visitors' movements in the parks and the outcomes of visitor use.

Each organisation approaches tourism in the parks from a different perspective:

- **The Banff - Lake Louise Hotel Motel Association** works on behalf of the parks' tourism industry and the communities of Banff and Lake Louise to help achieve common commercial and political goals (Banff - Lake Louise Hotel Motel Association [n.d.]).
- **Alberta Economic Development** is the provincial ministry that provides leadership for Alberta's economic development. Besides seeking to stimulate growth in the tourism industry, the ministry promotes trade and helps to attract investment in the province (Alberta Economic Development, 2001).
- **Parks Canada** is the federal agency responsible for Canada's system of national parks and national historic sites. Its mandate is to ensure the ecological and commemorative integrity of the resources in its stewardship in ways that foster understanding, appreciation and enjoyment by this and future generations. (Parks Canada, 2001).

DATA COLLECTION

The data for this study was collected in a study of visitors to Banff, Kootenay, and Yoho National Parks between June 12th and October 13th, 2000. Similar but separate research methods and instruments were used to sample from three populations:

- visitors travelling as part of a commercial tour, including those in motor coaches and vans;
- those travelling via scheduled carriers (trains and buses); and
- independent visitors (those travelling in personal vehicles, on foot, or by bicycle).

Brief personal interviews with a randomly selected sample of group leaders established population parameters (available in English and French; park residents, employees, and commuting workers were excluded from the sample). A mail-back questionnaire collected more detailed information from selected respondents (available in English, French, German, and Japanese).

This paper focuses only on independent visitors to Banff National Park. These results are based 5,405 personal interviews and 1,127 returned questionnaires (representing 41% of those who were given a form).

Results were weighted to correct for response bias by origin (local residents were under-represented in the up to the questionnaire) and to reflect the number of visitor party entries by gate and date. Thus, all results are presented as the actual number of independent visitors (or visit parties, where noted).

HYPOTHESIS

This study uses a null hypothesis: *A priori and post hoc segmentation will be equally useful as market segmentation techniques.*

If there are no significant differences in usefulness, the results will suggest that traditional segmentation bases – like origin – can represent the complexity of visitor use.

But if the null hypothesis is rejected – and one type is shown to be more useful than the other –then that approach may be a useful tool for:

- defining a complex tourism system;
- helping stakeholders understand the outcomes of that system and the relationships between those outcomes; and
- helping them cooperate in support of sustainable tourism.

RESULTS

Defining A Priori Segments: Visitor Origin

Visitors' origins were divided into seven categories that reflect the proportions of visitors by origin in previous research in the parks (see Figure 1). Because the survey's unit of analysis is the visit-party, one questionnaire was distributed to each party in the sample. For this reason, Figure 1 also shows the origin of survey respondents.

The two are similar enough to be considered the same, so this paper will substitute respondent origin for visitor origin.

Defining Post hoc Segments: Visit Types

To develop meaningful visit types, three types of information were analysed:

- importance of 16 visit opportunities to respondents' visit decision;
- their reported activities in each of the parks' visitor nodes; and
- reported spending in Banff National Park.

The segmentation was a multi-step process. First, a principal component analysis was applied to the respondents' reported importance levels. It used a varimax rotation and component scores were calculated for the rotated components. Then a hierarchical cluster analysis was applied to the components score using Ward's clustering method with squared Euclidean distances. A three-cluster solution was selected based on the agglomeration schedule. Finally, the cluster centres from this solution were used as initial clusters for a 3-cluster, k-means cluster analysis.

	Origin of all Visitors**		Origin of Respondents++	
Visitor Origin	Estimated Number of Independent Visitors	Pct. of Visitors	Estimated Number of Independent Visit Parties	Pct. of Visit Parties
Alberta	336,774	21.4%	112,300	20.6%
Other Canada	275,064	17.4%	93,260	17.1%
U.S.A.	523,669	33.2%	195,024	35.7%
U.K.	94,063	6.0%	38,376	7.0%
Germany	115,573	7.3%	40,005	7.3%
Other Europe	85,729	5.4%	18,288	3.3%
Other International	57,970	3.7%	34,239	6.3%
Unreported	88,400	5.6%	14,841	2.7%
Total	**1,577,242**	**100.0%**	**546,333**	**100.0%**

** The survey asked for the origin of each visitor in the party. The first two columns illustrate the origin of all visitors in the surveyed parties, weighted up to the estimated number of parties.
++ One respondent (over the age of 16) was randomly selected from each visit party to answer on behalf of the group to minimize response bias on the basis of origin, age, and sex.

Figure 1: Origins of Visitors and Respondents

Visit Type	Est. No. of Independent Visit Parties	Pct. of Independent Visit Parties
Getaway Visit	241,462	44.2%
Comfort Visit	188,656	34.5%
Camping Visit	116,215	21.3%
Total	**546,333**	**100.0%**

Figure 2: Visit Types

	Visit Type							
	Getaway Visit		Comfort Visit		Camping Visit		Total	
	Est. # of Parties	% in Type	Est. # of Parties	% in Type	Est. # of Parties	% in Type	Est. # of Parties	% in Type
Alberta	102,537	42.5%	2,721	1.4%	7,043	6.1%	**112,301**	**20.6%**
Other Canada	51,358	21.3%	22,441	11.9%	19,461	16.7%	**93,260**	**17.1%**
U.S.A.	59,583	24.7%	96,296	51.0%	39,145	33.7%	**195,024**	**35.7%**
U.K.	10,388	4.3%	22,326	11.8%	5,662	4.9%	**38,376**	**7.0%**
Germany	4,830	2.0%	10,400	5.5%	24,775	21.3%	**40,005**	**7.3%**
Other Europe	978	.4%	7,496	4.0%	9,814	8.4%	**18,288**	**3.3%**
Other International	6,395	2.6%	18,752	9.9%	9,091	7.8%	**34,238**	**6.3%**
Total	**241,462**	**100.0%**	**188,657**	**100.0%**	**116,214**	**100.0%**	**546,333**	**100.0%**

Figure 3: Relationship between Visitor Origin and Visit Typ

The resulting segments are presented in Figure 2 and are briefly described below:

- The largest proportion of park visits are categorised as **Getaway Visits** (44%). These are often day trips or 2-3 day visits that that tends to focus on a specific activity or area.
- About one-third (35%) of the visits are categorised as **Comfort Visits**. These visits tend to use the parks' hotels and restaurants... and its visitors spend the most money.
- The final visit type is **Camping Visits**. In addition to its range of accommodation and restaurant opportunities, the parks offer an ideal destination for camping and recreational vehicle touring.

A chi-square analysis suggests that visit type and respondent origin are strongly related (p=0.000, Goodman Kruskal tau = .209; see Figure 3). Getaway visit type parties are mainly from the host Province of Alberta, neighbouring British Columbia, and bordering American states. Half of the Comfort visit type parties are from the U.S.A., with almost no parties from the Province of Alberta. Finally, the Camping visit type is about one-third American (34%) but features a disproportionately large number of German visitors (21%).

Comparing the Two Segmentation Approaches

The variables selected for the comparison were selected for their relevance to the three funding partners for the study. Together, these organisations represent the interests of many of the stakeholders in the park's operation. The variables put into the analaysis are:

- party-visit spending in Banff National Park
- importance to visit decision of opportunities to learn about Canada's natural and historic heritage; and
- propensity to stay in a hotel, motel, or bed and breakfast facility while in Banff National Park.

Table 4 compares the overall results, results for each segmentation approach, and statistical analysis for each item.

Party Visit Spending in Banff National Park

Visitor spending is the basis for analysing the economic impact of tourism and visitor use. This is essential information for stakeholders who wish to understand the economic dimension of visitor use.

Visitors were asked for the total amount (in Canadian dollars) their party spent in Banff National Park during their current visit, including taxes, tips, and prepaid expenses, using cash, credit card, and debit card. They were then asked to indicate the proportion of this total that was spent in each of nine categories. Note that only the aggregate total is used in this analysis.

International respondents report the highest party spending, except for German respondents. Albertan respondents report the lowest amount. The differences are statistically significant, and ETA squared results suggest that visitor origin explains 11.2% of the variance in spending.

Using the *post hoc* approach, Comfort Visit parties report the highest party spending. Albertan respondents report the lowest amount. The differences are statistically significant, and ETA squared results suggest that visitor origin explains 17.6% of the variance in spending.

Thus, for spending, results suggest that the *post hoc* visit type segments explain more of the differences between respondents.

Importance of Opportunities to Learn About Canada's Natural and Historic Heritage

Parks Canada manages special examples of Canada's heritage for public benefit, including public understanding, appreciation, and enjoyment of their significance. The agency wishes to better understand the importance that visitors place on learning to address the mandate in a client-focussed manner.

Visitors indicated the importance of 16 different opportunities on five-point scales where 1 was "Not at all important" and 5 was "Very important". Two of the opportunities relate directly to the Parks Canada mandate: opportunities to learn about Canada's natural and historic heritage. Some other items on the list include: opportunities to enjoy time with friends and/or family; see wildlife in its natural environment; and mix outdoor experiences with modern comforts.

Results suggest a significant relationship between both items and the *a priori* origin segments. European respondents from outside Germany report the highest importance scores for historic heritage, while all others report similar levels of importance. The ETA squared results suggest that origin explains only 1.8% of the variance. International visitors – especially those from Germany – report the highest scores for opportunities to learn about Canada's natural heritage, whereas North Americans report relatively low scores. In this case, origin explains 13.5% of the variance.

Using the *post hoc* approach, the segments report similar levels of interest in opportunities to learn about Canada's historic heritage. The differences are statistically significant, but visit types explain less than 1% of the variance. There is a more pronounced difference for the importance of learning about Canada's natural heritage, but the segments explain only 1.5% of the variance.

Thus, for the importance of learning opportunities, the *a priori* origin segmentation explains is more effective.

Propensity to stay in commercial accommodation

The survey asked visitors to list their specific activities in each of the park's visitor nodes.

The *a priori* origin approach illustrates significant differences, with the segments explaining 10.8% of the variance. International respondents report the highest propensity, although German respondents are only slightly higher than Canadians.

The *post hoc* visit type approach also shows significant differences, although the segments explain 24.5% of the variance. Not surprisingly, Comfort Visit parties report the highest propensity to use commercial accommodation and Camping Visit parties report the lowest.

Thus, for spending, results suggest that the *post hoc* visit type segmentation explains more of the differences between respondents.

Assessing the Value of Each Approach

The findings support those of Moscardo, Pearce, and Morrison (2001), that each approach has its merits. This section compares the two approaches to the eight criteria established in the introduction.

Homogeneous: Both approaches develop distinct segments with little internal variation. The origin approach was more effective for visit motives, but neither approach explained much variance. The visit type approach explained more variance for spending and hotel use. Moscardo *et al* also had mixed findings, although in different areas. That study found that activity-based segments were more useful for describing participation, interests, and image; but that origin was more useful for describing transportation used, age, party composition, and visit history.

At first, the visitor origin approach seems to be more **durable** and **measurable,** as most people change residence infrequently and residence data are simply captured and objectively reported. Visit types, on the other hand, are based on more data and the analysis is subject to judgement.

Mean Party Visit Spending

Overall Mean = $698   Standard Deviation = $1,122

	Mean	S.D.
Alberta	$164	$424
Other Canada	$411	$578
U.S.A.	$992	$1,300
U.K.	$903	$651
Germany	$296	$173
Other Europe	$674	$863
Other International	$1,037	$1,338
Sig. < 0.001 ETA squared: 0.112		

	Mean	S.D.
Getaway Visit	$290	$474
Comfort Visit	$1,308	$1,557
Camping Visit	$434	$469
Sig. < 0.001 ETA squared: 0.176		

Importance of Opportunities to Learn about Canada's Historic Heritage to Visit Decision

1 = Not at all Important, 5 = Very Important

Overall Mean = 2.7   Standard Deviation = 1.2

	Mean	S.D.
Alberta	2.7	1.4
Other Canada	2.8	1.3
U.S.A.	2.6	1.2
U.K.	3.2	1.2
Germany	2.8	.9
Other Europe	3.1	.9
Other International	2.7	.9
Sig. < 0.001 ETA squared: 0.018		

	Mean	S.D.
Getaway Visit	2.7	1.3
Comfort Visit	2.8	1.1
Camping Visit	2.8	1.2
Sig. < 0.001 ETA squared: 0.001		

Importance of Opportunities to Learn about Canada's Natural Heritage to Visit Decision

1 = Not at all Important, 5 = Very Important

Overall Mean = 3.2   Standard Deviation = 1.3

	Mean	S.D.
Alberta	2.8	1.5
Other Canada	2.9	1.4
U.S.A.	2.9	1.3
U.K.	3.6	1.0
Germany	4.4	.8
Other Europe	4.2	.9
Other International	3.9	1.0
Sig. < 0.001 ETA squared: 0.135		

	Mean	S.D.
Getaway Visit	3.0	1.4
Comfort Visit	3.3	1.2
Camping Visit	3.5	1.4
Sig. < 0.001 ETA squared: 0.015		

Propensity to Stay in a Hotel or Motel During This Visit

Overall Propensity = 37%

	Propensity
Alberta	12%
Other Canada	22%
U.S.A.	48%
U.K.	66%
Germany	27%
Other Europe	41%
Other International	57%
Sig. < 0.001 Goodman & Kruskal tau = .108	

	Propensity
Getaway Visit	23%
Comfort Visit	74%
Camping Visit	6%
Sig. < 0.001 Goodman & Kruskal tau = .245	

Figure 4: Comparing Geographic and Visit Type Segments

Note, however, that the same visit types emerged independently in both the summer and autumn samples, suggesting that the visit type approach has some stability. And the stability of the visitor origin approach may be questioned, since Calgary is one of Canada's fastest-growing cities (changing in size and composition); the proportion of international visitors to the park has grown significantly in the past decade; and events like those on September 11th can quickly change a market's composition. Visitor origin has an advantage, but not by a wide margin. This supports the findings of Moscardo *et al*.

Responsive: The findings suggest that the most useful approach depends on the situation. The visit type segments explain much more behavioural variance and origin segments may possibly respond better to messages based on visit motives (although neither approach explained more than 10% of the variance). Findings suggest that pre-trip information could be targeted at geographic segments with messages that reflect their unique interests patterns, but that activity information is best targeted to on-site visit type segments. This differs from the findings of Moscardo *et al*, who found that activity-based segments explained more motive variance.

Relevance is in the eye of the beholder. Those who wish to appeal to visitors' interests may be best to pursue origin segments, but those interested in visitors' activities in the park – and their movements through it – would find more value in the visit type approach. Strategies to influence the tourism system may investigate similar *post hoc* approaches. Moscardo *et al* came to a similar conclusion, but for different reasons. In that study, activity segments were better predictors of visit motives.

Accessible: Without these findings, visitor origin segments seem more practical for pre-trip and en route information and for building awareness. But with the results, it is clear that visit type segments are accessible – and more useful – for targeting on-site activity information. Results suggest where to find each segment, and which activities to target. Moscardo *et al* suggested that visitor origin segments were generally more accessible.

Substantial: Both approaches provide segments that are large enough to warrant attention. In recent years, data miners and proponents of 1:1 marketing have suggested that new models may render this criterion obsolete. Many successful enterprises cater to individuals or to very small niches, or create new segments when the opportunity is truly unique (Behrens, 1987). But, when faced with a need to describe the outcomes of visitor use, market segmentation is still an appropriate activity. This supports the findings of Moscardo *et al*.

Assessing **compatibility** is beyond the scope of the variables used for this paper, although the survey did include items to help assess this criterion (*e.g.*: desire for solitude versus desire for companionship). Moscardo et al did find support for their activity-based segments on this criterion.

SUMMARY

Visit type segmentation was more useful for predicting variables of relevance to the development of park tourism and management of its facilities. It should be more useful to managers who wish to assess the size, competitiveness, and compatibility of segments within the market. They were also shown to be relatively stable and reasonably accurately measured.

The visitor origin segments performed well on accuracy of measurement and pre-trip accessibility. They were also related to participation in specific activities, but less than visit types.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Monitoring Low Volume Walker Use of a Remote Mountain Range: a Case Study of the Arthur Range, Tasmania, Australia

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Abstract: Registration data are the major source of information about bushwalker (hiker, tramper, rambler) volumes and basic characteristics in the Arthur Range within the Tasmanian Wilderness World Heritage Area. This paper describes the problems encountered with the existing registration system and the simple and practical solutions adopted to address them.

INTRODUCTION

Twenty per cent of the land area of the Australian state of Tasmania is listed as World Heritage Area (WHA) and is managed by the Parks and Wildlife Service. This is a rugged, glacially-formed mountainous region of exceptional natural beauty. Along with some regions of New Zealand and South America, it used to be part of the ancient supercontinent of Gondwanaland. The three areas are linked in their geology, flora, fauna and weather—wet, windy and westerly.

Figure 1.The location of the Arthur Range within the Tasmanian Wilderness World Heritage Area..

Within the WHA lies the Arthur Range, renowned amongst Australian bushwalkers (hikers, trampers, ramblers) for its walking opportunities and weather, both of which are unparalleled in the country. Federation Peak (1224m), the highest peak in the range, was first climbed by Europeans in 1949, and a visit to this peak is still considered a rite of passage for many serious bushwalkers. Road access was first extended to within 10km of the Range in the 1960s and currently the entire range receives fewer than 1000 walkers each year.

Apart from an entry fee that is only collected at large, well-staffed sites, there is no walker regulation in Tasmania. Registration books have always been the major source of information about overnight track use in the WHA being an inexpensive information-gathering tool for a track network most of which is remote, low use (by European or North American standards) and infrequently visited by Service staff. Registers are located at all track heads to the Arthurs, and on the summit of Federation Peak itself.

During the late ‘80s, there was some evidence that use of the Arthurs was expanding rapidly. Serious consideration was given towards more restrictive management, such as a quota-based permit system to regulate walker numbers. During the ensuing public consultation, it became obvious that the existing registration data was inadequate. In short, the information was poorly accessible and difficult to interpret as it was plagued with missing data. The accuracy of the data pertaining to intended route was suspect while no reliable information was collected about actual patterns of use. This was a major problem because—and as detailed below—walkers frequently change their plans due to weather and the terrain. Consequently, anecdote was resorted to as a major source of information. This was not acceptable when dealing with the public over access issues: clearly more accurate and reliable information was required.

In 1997 additional resources were allocated to walker monitoring in the range. Some simple, practical and cost-neutral changes were made—and are described in this report—that resulted in a standard of information that both management and the public found acceptable. The revised system is by no means perfect but in the world of modern protected area management perfect systems are usually not practical or affordable. Modern land managers have to make do with what is *acceptable* within resource constraints.

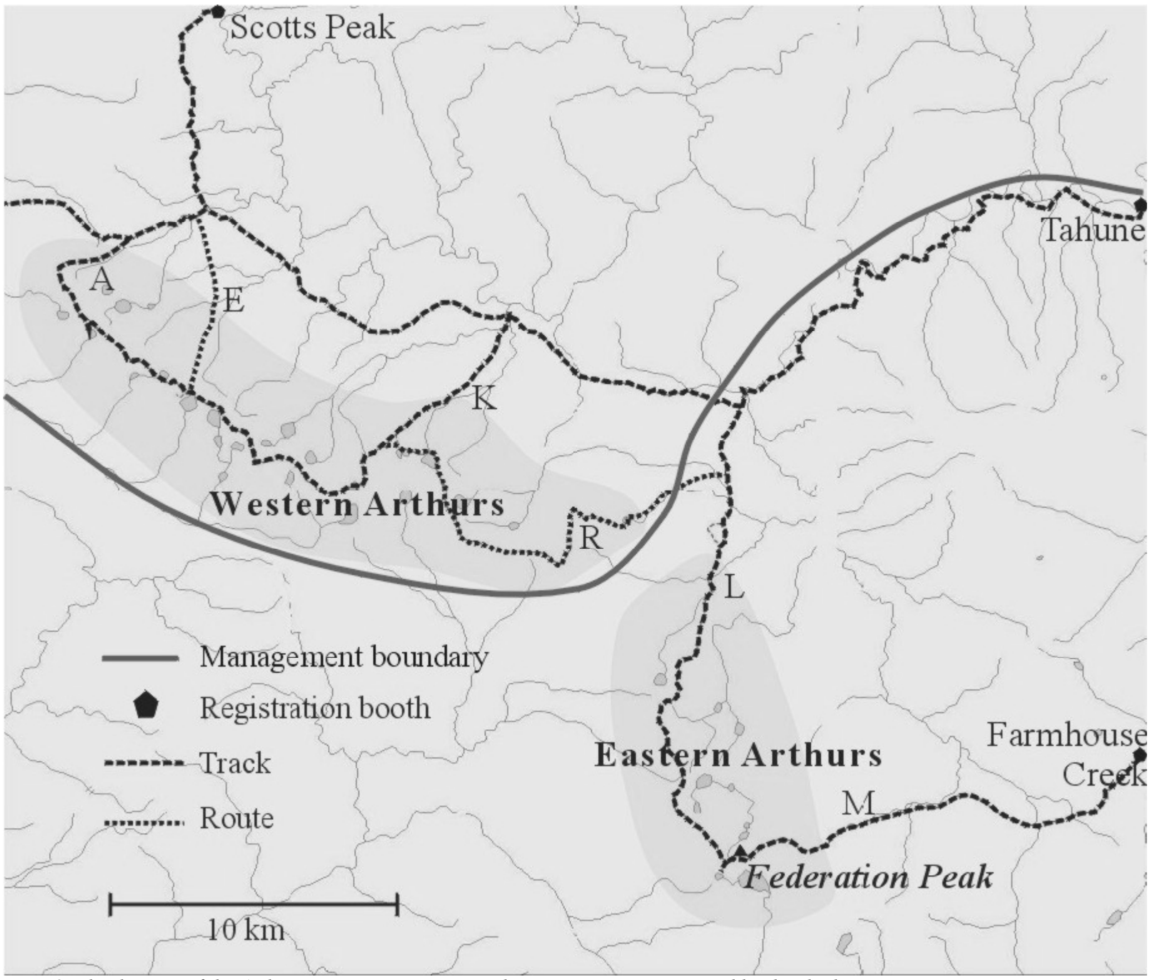

Figure 2. The division of the Arthur Range into Western and Eastern sections, as noted by the shading..

Topography of the range

There are three major track heads servicing the range (Scotts Peak, Farmhouse Creek and Tahune, see figure 2). The range itself is divided into eastern and western sections that are treated as two separate destinations by most bushwalkers. Federation Peak is the major destination in the eastern section, and is accessed by either routes L or M. In the Western Arthurs most walkers follow rough tracks along the skyline amongst the glacial lakes and small rugged peaks that feature on that part of the range. Most walkers access the range via route A, and there are three further escape routes, E, K and R, along the range so a large number of permutations of route are possible. Most tracks are formed, with the exception of routes E and R, which are pads or routes only. Given the ruggedness of the range and the ferocious scrub, walkers stay to tracks and routes so that prediction of movement through the range is straightforward if the access and egress points are known.

PROBLEMS AND SOLUTIONS

As stated in the introduction, there were four problem areas with the available information pertaining to walker use of the Arthurs prior to 1997. These were problems with missing data; lack of knowledge of actual—as opposed to intended—patterns of use; perceived unreliability of existing intention information and poor accessibility of data. These problems were addressed by the simple application of information management tools: through better coordination of field operations, changes in register design, data handling and reporting.

System coordination and administration

A district management boundary bisects the range (figure 2). Both districts had different operational systems and maintenance and collation of registers in the two districts was undertaken independently, even though walkers' routes cross these boundaries at will: many start at a track head in one district and end in the other. One district changed the registers over and collated data every month. The other changed the book over every year and data collation was not undertaken in the district at all.

Frequent field servicing of registers is desirable as this means that missing data due to theft of registers or their running out of pages is minimized. However this must be balanced against the considerable cost of travelling to the register stations. In this example one district was expending too many resources in servicing registers, while the other district was expending too few. The optimum for the two districts was quarterly servicing.

Prior to 1997, districts manufactured their own registers and this required many hours of tedious photocopying and binding. Districts are now supplied with a stock of registers that are made up in head office, and all they need do now is swap over the register during the quarterly visit. This has freed time for district staff. It has also meant that all registers meet a standard format and standard of quality as office equipment in Head Office is usually a higher standard than in the district. Unused pages from old registers are recycled in new registers.

The major paradigm shift of the entire exercise was the recognition that registers from different track heads should not be treated as independent entities, especially when there are through routes connecting them. Failure to recognise this results in *n*-tuple overestimation of walkers on that through route, where *n* represents the number of registers servicing the route. That the registers should be treated independently was something that simply evolved over the lifetime of the Service, but has now been eliminated from all walker monitoring systems maintained by the Service.

Furthermore, prior to 1997 handling the data from the registers was treated as a clerical chore. Data was entered verbatim from the register to database without any data checking. Obtaining valid information from the register requires that the person working with the data is an experienced walker in the area.

What this meant in effect was that all data handling became a head office task. Optimally, districts should be in control of their own data management systems as they have first priority need for the data. However in order to address the problems described above, it was necessary that the work be done in Head Office. In fact, the districts were happy to relinquish the task so long as information was accessible.

Register design

A standard design was devised in 1992. This required the registrant to sign across a row that spanned two A4 pages. While a vast improvement on the blank-page, journal-style logbook it replaced, the 'new' format was contributing to the problem of missing data. Registrants were breaking rows across the two pages; they overlooked columns and they were frequently confronted with books where the wrong pages were bound next to each other. Changing the format to a single, landscape orientated page (figure 3) resulted in better compliance for all items across the row. The width of the page does limit the amount of information that can be requested, but that means that the management agency has to limit their data requests to only the highest priority information.

Limit information requests to one item per column. Better compliance results when only one item of information is requested per column. In the 1992 format, we asked for party leader's name and address in the first column. After 1997, we asked for party leader's name in the first (for cross matching parties for through routes) and origin in the second. This resulted in an improvement in compliance from a yearly average of 75% (SD 5.9%) of parties in the 5 years preceding the format change, to a yearly average of 98% (SD 1.0%) over the 4 years since the new format was introduced.

Use unambiguous column headings. Use column headings that cannot be misunderstood. For instance, ask for walk start date and finish date rather than 'length of trip in days' which people often interpret as 'number of nights'. Never say that an item is optional, and never include 'if' in a column heading (see below).

Scotts Peak Logbook

For search and rescue purposes, in case you are reported overdue

The route number may be on the map in front of you. If not, describe your route in 'sidetrips/other routes' column

Complete on finish of walk

Party Leader's Name	Party Leader's postcode or overseas country of origin	Contact phone no. or car rego	Route No.s	Sidetrips/ other routes	Walk start date	Walk finish date	No. in party		Where did you start the walk?	Return signa- ture	Date	Where did you actually walk?
for example Z. Smith	5024	088 9999999	31		1/1/99	5	3	complete on finish of walk	here (scotts peak)	ZS	4/1/99	Lake Oberon return (from Moraine A)

Figure 3. Revised register format

If you want information, ask for it. As already stated, one of the insurmountable problems with the Arthurs walker data was not knowing what routes were actually walked, as opposed to what was intended. There was no provision within the registers for that information. In 1992, the registers included a column for people to sign out and to state where they started their walk (even though the data was collected it was never systematically used). In 1994, this was expanded to include a date that the trip was finished. Finally, in 1997, a further column was added which asked ‘if you changed your walk from your intentions, list actual route here’.

It was found that some registrants were filling in the confirmation columns at the start of the walk. Also, the use of the word ‘if’ confused some walkers. So, two further changes were made in 1999: the confirmation block was made physically separate from the intentions block in the registration, and the column header was changed to ‘where did you actually walk?’ (see figure 3). The few remaining entries where walkers fill in the confirmation column at the start of the walk can usually be detected by the characteristics of the handwriting.

Compliance with the ‘where did you walk’ column was 90% in 1999/00 and 84% in 2000/1. So far, there has been no consistent association between route walked and whether confirmation details are provided. However, of those who did provide these details, about 45% walk a shorter route than intended.

Installing a temporary register on route K for 15 months between 1998 and 2000 validated information obtained in the confirmation section of the register. Almost complete agreement was obtained between details provided in the confirmation columns in the track-head registers and the information collected in the temporary register. This confirmed that those people who confirmed a particular route on route K were physically there. Furthermore, very close agreement has been found between the Federation Peak summit and track-head registers.

Use of auxiliary information in registration booths

Maps are located within each of the permanent registration booths. The more frequently undertaken routes in the area are drawn on the maps and each is given a code number. This can make registration easier for walkers as they just have to write in a number rather than write the route out in painstaking detail. This practice has been in place many years.

For the track manager, however, route codes are only useful if they accurately represent where people are walking. Inappropriate route codes were in place in the Western Arthurs, which lead managers to believe that a certain pattern of use existed when in reality it did not.

The map in the major booth (Scotts Peak) was renewed in September 1997. The old map contained a code that described a circuit that included routes A and E. Prior to 1997 it was believed that up to 40% of registrants were attempting the A to E circuit. Route E is untracked and management were concerned to keep it that way, so the route code for A to E was deleted from the new map to deter people from using it. The results were surprising.

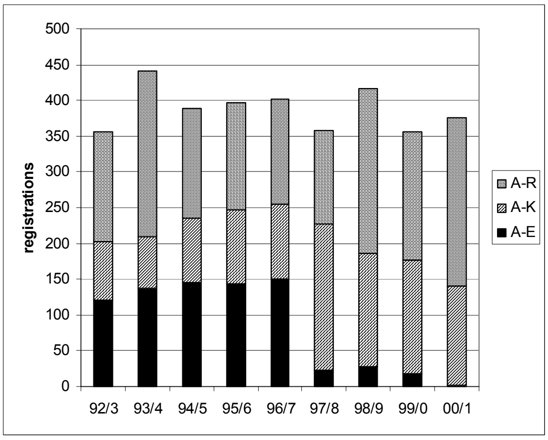

Figure 4. Registrations by route for Western Arthurs, November to March. The route code for A-E was removed from the booth in September 1997.

Numbers registering for A-E route dropped from 150 in 1996/7 to 20 in 1997/8 (figure 4). It became clear over the next few years that substantial numbers of walkers were walking to one of the lakes on the hardened route A and then returning on A, and not walking E at all.

Route codes can only be used where there are few choices of route and those routes are unambiguous. Where there is any doubt, plenty of space should be provided to encourage walkers to describe their route in detail.

Registration compliance rates

Knowing what proportion of the total visitor population to the Arthur Ranges signs in the registers is essential. Not knowing this in the past is one of the reasons why the data were treated with suspicion.

Some of the ways that compliance can be determined (eg. Watson *et al*, 2000) simply are not appropriate for the area. For instance, one method requires an observer near the registration booth to see who registers and who doesn’t. However, during the busiest time of the year—a couple of weeks in January—the busiest booth will average three parties departing per day. Likewise, in order to calibrate the track counter installed at the top of route A, an observer should watch parties walking over the counter and compare counts. During the busiest time of the year, it may take one week to observe 40 passes. Movement-activated cameras, of course, would be the ideal solution, but in the current climate these are not politically acceptable.

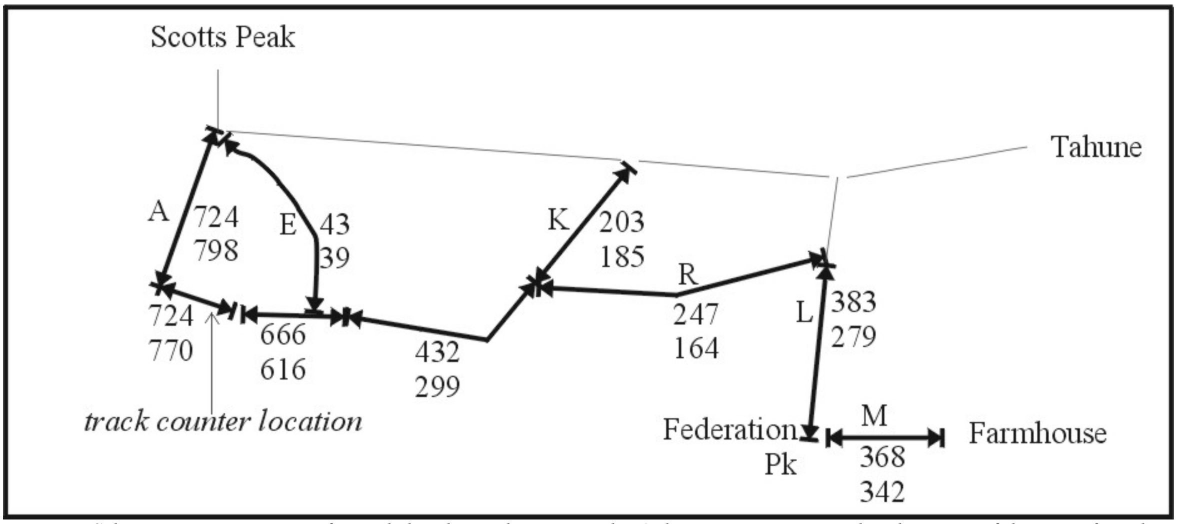

Figure 5. Schematic segment map of intended and actual passes in the Arthur Range. Not to scale. The upper of the pair of numbers adjacent to each arrow denotes the intended number of passes for that segment, and the lower, the actual number of passes as determined by registration confirmation details

The results of walker surveys conducted in a similar areas of the WHA over the past three years have suggested that the registration compliance rate for overnight walkers is 90% or higher.

Reporting

Inaccessibility of data was the final problem identified with the Arthurs data. This was addressed in two ways.

Firstly, registration data is now published regularly as part of the routine yearly reporting cycle, along with frontcountry visitor numbers. Prior to this, data were published sporadically. While stating the obvious, if the data is not made available, the data will not be used.

The more difficult problem is knowing what to report, given the complexity of what is being reported. A simple approach, that has been received very favourably by managers and public alike, is a track segment map of walkers and/or passes per segment. This illustrates how use is distributed across the range, and how this differs when actual use is compared to intended use.

Given that most walkers' intended and actual routes are known, and that those routes are linear, it is a simple matter of allocating the number of passes or walkers to each defined track segment by some simple manipulations of the data (figure 5). These maps do not take registration compliance into account. Also, for those who do not confirm their route, it is assumed that they completed what they intended.

As a crude guide to the accuracy of the system, track counter readings can be compared against predicted number of actual passes. A seismic counter is installed at the location identified in figure 5. The counter is only crudely calibrated, in that Service staff check that it counts on single walker passes. Its behaviour under real life conditions is not known. These counters will record animal (wombat) passes as well, but these are not taken into account. However, the agreement between the predicted value and the counter value provides some reassurance that our predictions are not orders of magnitude in error, which is the first objective of the exercise.

LIMITATIONS OF THE REVISED SYSTEM

The system as described has proved to be useful when monitoring areas where routes are linear. When routes are more complex, as is the case in more open country where people do not stay on tracks, linear maps are not possible. However, zone maps can be produced instead.

Track-head registration data is not useful in predicting use of side-routes. Use of side-routes occurs on the spur of the moment and depends on weather and group dynamics.

The system is labour intensive and is not appropriate for high use areas. Roughly speaking, office time required for data handling is about eight hours per 1000 walkers.

SUMMARY

This paper has described the process by which the walker monitoring system in the Arthur Range was improved by implementing some simple and practical changes in system coordination, data handling and reporting. Another round of public consultation relating to management of walkers in the Arthur Range will proceed in 2002, and it is anticipated that the improved quality of data pertaining to use of the range will assist in providing better environmental and recreational outcomes.

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Monitoring of Recreation-Affected Forest Stands in the National Park Losiny Ostrov

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Abstract: The effect of recreation on the forests of National Park Losiny Ostrov located within the boundaries of Moscow is examined. The methods of monitoring of recreation-affected forest stands are represented, and the preliminary results of their application for the revealing of the most damaged forest areas are discussed. Some practical measures are suggested in order to redistribute visitor flows across the territory of the most visited part of the national park.

INTRODUCTION

The monitoring and management of visitor flows are very urgent for the National Park Losiny Ostrov. Being organised in 1983, the park inherited high recreation loads, which have always existed in the forest massif of Losiny Ostrov, as it is surrounded by dwelling and industrial regions. The population of adjacent districts of Moscow reaches 2 mln people and that of Mytishchi, Korolev, Balashikha, and Shchelkovo (other cities of Moscow conurbation) exceeds 500 000 people. Let us take into account that new dwelling regions will be built in the peripheral part of Moscow and the nearest suburban areas. Therefore, the population of the regions bordering with the national park is expected to increase, as well as the recreation loads.

The major goal of the national park is to preserve the natural forest and wetland ecosystems under the conditions of an intensive daily recreation. For this purpose, a very accurate monitoring of the status of natural ecosystems is needed in order to detect and prevent their degradation at initial stages.

CHARACTERISTIC OF THE TERRITORY OF THE NATIONAL PARK LOSINY OSTROV

The National Park Losiny Ostrov occupies the territory of 120 km^2. This is a whole forest and wetland massif, dissected by the Moscow Circle Highway. Approximately 35 km^2 of forests are located within the boundaries of Moscow itself. The territory of Losiny Ostrov is a slightly wavy plain with an absolute altitude of 140-165 m above the sea level. It includes the chain of low moraine hills, the glaciofluvial terraces of the Yauza River, and the floodplain itself. The soil cover is represented by loamy or sandy-loamy soddy-podzolic and gley soddy-podzolic soils (Podzoluvisols and Gleyic Podzoluvisols, according to FAO Classification); Yauza floodplain is occupied by eutrophic bog soils (Histosols). The forests represent the most important recreational resources of the national park. They are quite diverse: lime, pine, and indigenous spruce forests constitute 11, 17, and 24% of the territory, respectively. A significant part of the national park (41%) is occupied by secondary birch forests. Despite the neighbourhood of urban areas, the natural complexes of the national park, especially of its central part, possess a high biological diversity: the list of plants found at the territory of Losiny Ostrov includes approximately 600 species, that of birds, more than 150 species, and that of mammals, almost 40 species. It is this relative wilderness of nature, which attracts multiple visitors.

RECREATIONAL SITUATION IN THE NATIONAL PARK LOSINY OSTROV

The direct calculations of visitor flows were made in 1990s by the students of Moscow State University. The observations demonstrated that in peak days, up to 150 000 visitors could be present at the territory of the national park simultaneously (Butorina & Chizhova, 1996). The researchers from the International Forest Institute (Moscow) calculated the recreation carrying capacity of the territory and real recreational loads on different functional zones. The calculations revealed the 5-6-fold exceeding of the carrying capacity, especially in the peripheral part of the national park (Project of Forest Management, 1998).

High visitor flows cause multiple negative effects on the ecosystems of Losiny Ostrov. Some of them are listed in Table 1.

Recreation activities	Character	Effect	Ecological consequences
Visitor flows along roads and paths	Linear		Introduction of non-typical plant species along roads; waste
Picnics	Point	Logging, emergence of new fireplaces surrounded by severely disturbed areas	Formation of multiple hot spots of forest degradation
Spontaneous out-of-path recreation	Spatial	Emergence of multiple new unmanaged paths	Soil compaction, disturbance of soil aeration and moisture regime, losses of organic matter, disturbance of soil vegetation cover, enfeeblement of trees, and degradation of an ecosystem as a whole
Recreation + dog airing	Linear or spatial	Disturbance of wild birds and animals	Reduction of the number of ground-nesting birds and small mammals, concentration of animals in the central part of the national park

Table 1. Ecological issues of mass recreation in the NP Losiny Ostrov

In addition, disturbed ecosystems loose their aesthetic properties, which enhances the advance of visitor flows towards the central undisturbed part of the national park. As a result, the area of recreation-affected natural ecosystems enlarges.

In order to regulate the visitor flows, several strategies are used in the national park.

Functional zonation based on recreation intensity (Figure 1). The central part of the park forms the nature conservation zone where the access is allowed to a limited number of visitors (mainly, researchers). This zone is designated to maintain the ecological stability and biological diversity of the whole national park. The most visited peripheral part forms the recreational zone, which is designated for a short-term outdoor rest and recreation. The belt between them is a buffer zone designated for regulated recreation and ecological education. However, at present, the functional zonation should be revised, because the real recreational situation does not correspond to the existing boundaries of functional zones. Figure 1 demonstrates that some areas of the nature conservation zone are at the same time the most visited ones.

Ecological education. Together with preventing the violations of the regime of the national park, the ecological education helps to reduce the effect of the most aggressive human activities, such as logging, fires, mechanical damage to trees, picking up rare plant species, etc. Another important aim of ecological education is to transform spontaneous visitor flows into organised groups. The effect of such groups on the nature of the national park can be controlled. At present, the national park offers 11 ecological excursions; the summary carrying capacity of the ecological roots is ca. 50 000 visitors annually (calculated according to Kalikhman et al., 1999). However, their real carrying capacity is limited by the number of rangers and level of management.

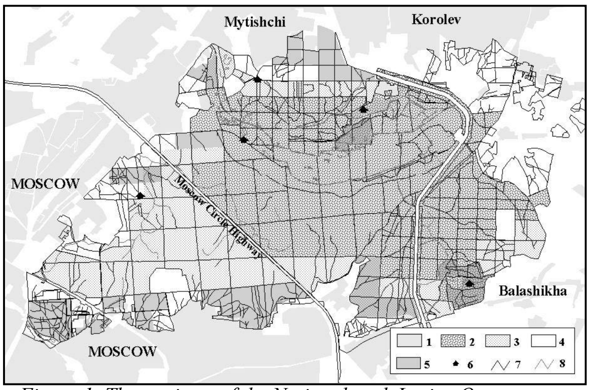

Figure 1. The territory of the National park Losiny Ostrov: (1) urban areas, (2) nature conservation zone, (3) excursion zone, (4) recreational zone, (5) areas with the highest recreational loads, (6) visit-centres, (7) major pedestrian roads, and (8) rivers and streams

Management of the recreational zone and, especially, roads and paths. It should increase the recreational carrying capacity of the elements of NP territory: paths, sport and playgrounds, banks of ponds, etc. In addition, the attraction of visitors to some well-managed areas should remove the visitor flows from those parts of forest ecosystems, where high recreational loads are not desirable. Unfortunately, the recreation infrastructure in Losiny Ostrov is very primitive and the level of service is very low. For example, there are no special service areas in our functional zonation.

The prospective goals of the management of the recreational zone are: (a) the maintenance of the biodiversity and (b) the formation of recreation-resistant forest stands. This envisages a detailed analysis of the structure of forest fund, the determination of the most and least damaged ecosystems, and the alternation of species and age structure of the forests of the recreational zone. For this purpose, the visitor flows and their effect on the ecosystems should be evaluated.

Although the direct calculation of visitor flows is the most widespread method, we avoided using it in our monitoring studies. There are several reasons for that.

The territory of the national park is paled fragmentarily, so there are many uncontrolled entrances and paths.

Significant length of park boundaries with dwelling regions, which are the sources of visitor flows, demands a large number of accounting persons, so the work becomes too expensive.

The intensity of visitor flows varies with season, day of week, period of the day, weather conditions and many other factors. As a result, an almost continuous account is needed to get reliable results.

Direct calculations give an absolute number of visitors, but not the spatial distribution of recreation effect. At the most, it characterises the recreation loads on basic linear elements, while in the NP Losiny Ostrov, the spontaneous out-of-road recreation causes the greatest damage to forest ecosystems.

However, we do not underestimate the results of direct account. They can be used successfully in sociological studies and planning of the development of recreational and tourist infrastructure, especially in the most visited sites.

METHODS OF COMPLEX MONITORING

The programme of monitoring of recreation-affected forest stands is a part of the general complex programme of forest monitoring in the NP Losiny Ostrov. The latter is based on the results obtained at permanent observation sites (Shapochkin and Lameborshai, 2000). However, the permanent observation sites are point objects and do not characterise the spatial distribution of negative factors. The recreational monitoring was initiated in order to detect the most damaged forest areas and elaborate the strategy of redistribution of visitor flows across the territory of the NP. The works are rather ecosystem-oriented than visitor-oriented, therefore, the status of forest ecosystems was the general criterion of acceptable visitor flows.

The current research programme partly includes the traditional methods of evaluation of recreation effect, which were elaborated in the former USSR in 1970s (Mukhina, 1972; Chizhova and Smirnova, 1976; Kazanskaya et al., 1977). However, the methods of complex monitoring of recreation-affected forest stands elaborated by M. S. Shapochkin are much wider.

According to this complex approach, the monitoring studies include three stages.

1. Selection of monitoring objects

The unit of monitoring is the forest inventory unit, i.e., a forest area with a homogeneous species and age composition of the tree layer, soil, and vegetation cover. In order to characterise the studied territory in a representative way, the forest inventory units are selected in proportion to the share of each species and age class in the whole forest fund of the territory and distributed evenly across the territory. Hence, a statistically reliable sampling is made. Each forest inventory unit is characterised by several circle test sites. The number of test sites (from 3 to 10) is determined in accordance with unit size and density of forest stands. Within a unit, the test sites are located regularly with the interval of 25-30 m in a latitudinal or longitudinal direction, depending on unit configuration.

2. Field observations

The tree layer, which determines the properties of a forest ecosystem, was characterised by tree species, considering the ecosystem biological productivity expressed via the basal cover of trees and wood storage.

From the centre of each test site, the trees are accounted using standard forest survey devices (angle gauge or prism). A qualitative characteristic of sanitary status of each accounted tree is given according to a 6-gradation scale. The following gradations are set: 1 – healthy, 2 – weakened, 3 – strongly weakened, 4 – declining, 5 – dead-standing trees of a current year, and 6 – dead-standing trees of previous years. The centremost trees are used for more detailed observations, the predominating species being represented by 3 and accompanying species, by 1 tree each. For these test trees, the height and diameter are measured, and the samples of timber are bored out in order to determine the radial increment during the last 10 and 20 years. The distance from the site centre to the three nearest trees is determined in order to calculate the number of trees per hectare, which characterises both ecosystem productivity and aesthetic properties.

The lower layers of forest communities were characterised by Dr. V. I. Obydennikov and his colleagues from Moscow Forest University. The undergrowth, grass, and moss layers of studied forest inventory units are described using the series of small observation plots. The status of undergrowth is evaluated quantitatively via the number of young trees per unit area and qualitatively, via its viability. It is a very important characteristic of ecosystem self-reproduction capacity. For grass and moss layers, the number and abundance of species and projective cover are determined. The decrease in projective cover and increased percentage of photophilous species and weeds determine the degree of recreation effect.

Sometimes, the visual determination of the category of tree sanitary status is not reliable. In connection with this, visual observations and measurements of tree increment were completed by anatomic analysis of wood tissues, which were conducted by the Assistant Professor of Moscow Forest University V. D. Lomov. The samples of wood tissues of the trees of different species and sanitary status were collected at the circle test sited. The tissues of trees growing under optimal ecological conditions were regarded as control samples. Wood samples are conserved for further xylotomic studies. The series of characteristics is determined, such as the width of annual layer, width of early and late wood, thickness of tracheid membranes, their lifetime, etc.

The recreation effect on soils is characterised by soil compaction and changes in some morphological and chemical properties. The compaction is measured by a durometre and expressed in kg/cm^2. Soil compaction is measured both under tree canopy, where the vegetation cover looks undisturbed, and at disturbed fragments of soil cover of a circle test site, such as paths, areas around fires, etc. The measurements are made in 3-5 replicates. The percent of bare soil surface (without vegetation cover and forest litter) is evaluated and considered as an important indicator of the degree of recreational digression (Kazanskaya, 1972). The thickness of forest litter and upper humuc horizon is measured, the latter being sampled. The content of moisture, organic matter, and base cations, and soil acidity are then determined.

The series of field measurements should be repeated each 5 years. For the most visited and endangered sites, the frequency of observations can be increased.

3. Data Processing

The data of field observations provide an integral characteristic of studied forest inventory units. For each unit, the following values are calculated:

- basal cover of trees by species and categories of sanitary status,
- mean weighed category of sanitary status, which is an integer indicator of unfavourable ecological conditions,
- radial increment of test trees, which is then recalculated into the volume increment, and the losses of volume increment with time are determined, and
- mean weighed percentage of bare soil and soil compaction.

These calculated parameters make it possible to reveal the critical areas of forest stands. The following critical values are set (Table 2).

Measured and calculated values are mapped, and the indirect characteristic of spatial distribution of the effect of visitor flows is obtained.

The losses of volume increment and organic matter are used to calculate the ecological damage, which is represented in financial equivalent per unit area. For this purpose, the computer programme created in the All-Russian Research Institute of Forestry is used.

Parameter	***Unit of measure***	***Critical value***
Mean weighed category of sanitary status	***none***	***2.5***
Losses of annual increment	***%***	***Exceeding normal values by the factor of 2 and more***
Percent of bare soil	***% of test site area***	***25***
Stage of recreational digression	***none***	***transition from stage 3 to stage 4***

Table 2. Critical values assessed for the characteristics of recreation-affected forest stands.

DISCUSSION OF PRELIMINARY MONITORING RESULTS

In 2001, the first stage of field observations was conducted in the recreational and excursion zones of the city part of the national park. Here, the secondary birch forests constitute approximately 60% of the forest fund. The rest is represented by pine and lime forests, spruce and oak forming fragmentary stands. Twenty-seven forest inventory units subjected to the recreational loads of different intensity were studied. Nineteen of them are represented by secondary birch forests and 6, by pine forests of both natural and artificial origin. The age of examined forest stands varies from 30 to 150 years and the relative density of stands, from 0.3 to 0.9. The species composition of the tree layer is either simple or complex, the predominating species constituting from 30 to 100% of the stand. To characterise this sampling, 127 circle test sites and 455 test trees were examined.

The mean weighed category of sanitary status of studied units varies from 1.5 to 3.0. For the majority of units, this index is between 1.5 and 2.5, i.e., they are referred to the category of weakened. Two units, located at the distance of ca. 1 km from the boundaries of the national park at the intersection of two roads, are classified as strongly weakened. Seven of the rest 25 units comprise the fragments of strongly weakened forest stands. These areas should be considered in the first turn, when the redistribution of visitor flows is planned. Healthy forest stands with the category of 1.4 were observed only at 3 separate test sites at the distance of more than 1.5 km from the park boundary, and no completely healthy forest inventory units were found. That is, healthy stands occupy only 2% of the studied area. This points to a general trend towards the decline of forests in the city part of the national park. Hence, a very accurate monitoring of their status is needed in order to prevent their degradation.

The vegetation cover and upper soil horizons of many test sites are damaged. On paths, the forest litter is destroyed completely, the thickness of the humus horizon is reduced by 25-50%, and the soil is compacted significantly. Bare soil surface constitutes up to 15-20% of the area of some test sites. At the same time, 25% of test sites have an undisturbed soil cover. When the percent of bare soil surface exceeds 5%, the compaction of the upper soil horizons is observed. The mean weighed soil compaction of disturbed forest units is 3-4 kg/cm^2, while normally, it constitutes 1-2 kg/cm^2 in forest soils. Soil compaction on paths and around fires reaches 15-20 kg/cm^2. The spatial distribution of the percentage of bare soil and soil compaction demonstrates that the forest stands located within a 1-kilometer belt along the boundaries with dwelling regions are the most affected by recreation (Figures 2 and 3).

At present, no forest stands with the 4th degree of recreational digression were found, i.e. all studied ecosystems have a potential for self-regulation and reproduction. However, the area with a pre-critical 3rd stage of recreational digression demands an immediate improvement. It should include:

- the reconstruction of path net in order to make the existing paths more comfortable for visitors and concentrate the major visitor flows along these managed roads,
- the creation of a dense artificial undergrowth, which will prevent the penetration of visitors into the forest massif and give refuge to birds, and
- the organisation of some new playgrounds or lawns to attract the visitors there.

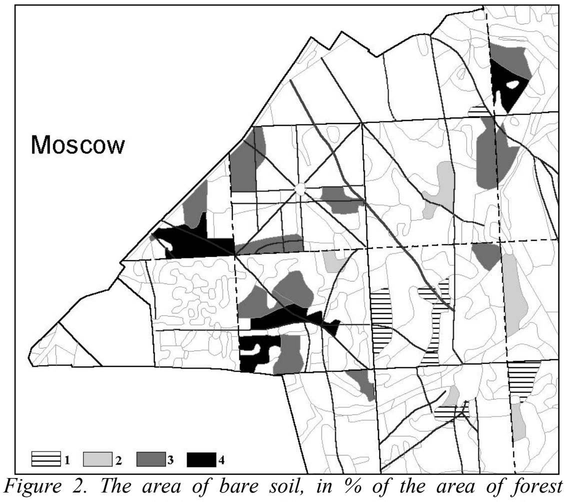

Figure 2. The area of bare soil, in % of the area of forest inventory units: (1) below 1%, (2) 1-5%, (3) 5-10%, and (4) 10-25%. Here and on Figure 3, solid lines represent major pedestrian roads

In addition, some corrections in GIS layers must be made. For example, the area with the highest recreational loads must be enlarged, as compared to that represented at Figure 1.

The preliminary analysis of the composition of vegetation cover demonstrates that typical forest species predominate at the majority of test sites.

Figure 3. Soil compaction, kg/cm^2: (1) 1.0-2.0, (2) 2.0-2.5, (3) 2.5-3.0, and (4) >3.0

Meadow flora and weeds appear only along roads, broad paths, boundaries of playgrounds etc.

The coefficients of correlation between the examined characteristics were determined in order to reveal their interrelation. The coefficients proved to be low, which points to a complex character of interrelation among the intensity of recreation and the status of forest ecosystems. The highest coefficient of correlation (equal to 0.38 at $P = 0.90$) was found between the sanitary status of forest stands and the area of damages soil and vegetation cover.

We expect that the equations of multiple regression will make it possible to reveal the most important factors determining the status of forest stands, and probably, to reduce the number of measured parameters.

CONCLUSIONS

The monitoring studies indicated the appropriateness of the complex monitoring methods for the evaluation of visitor flow effect on the forest ecosystems of the National Park Losiny Ostrov.

The results obtained can be used for the compilation of thematic maps and new layers of geoinformational systems, as well as for the calculations of ecological damage.

The first stage of monitoring studies revealed the areas where the forest stands are in a pre-critical status, according to the category of sanitary status of trees and percent of disturbed soil and vegetation cover. Immediate measures reducing the recreation press must be undertaken in these areas, including the improvement of roads and passes, creation of artificial undergrowth, and translocation of visitor flows to other areas.

The analysis of increment losses, anatomic features of wood tissues, and soil chemical properties is expected to provide a more detailed information about the status of recreation-affected forest stands. The statistical treatment of obtained data will help to determine the leading factors of forest degradation and the interrelations among the characteristics of forest stands and recreation effect.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Recreation Monitoring at the Dutch Forest Service

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Abstract: In 1996 the former Institute for Forestry and Nature Research (now Alterra) started to develop a system to monitor the recreational use of forests and other grounds owned by the Dutch forest service. The aim was to determine the number of visitors, their activities and the percepted quality. This information provides a valuable management tool for targeting of resources. The system uses three methods to gather the information:
1. Monitoring vehicle and bicycle use at the sites by using traffic counters with induction loops installed in the road (all year round).
2. Visual counting of visitors at all entrances (on 12 days during the year).
3. Survey of visitors (on 12 days during the year).
When the system is fully implemented their will be a network of 48 sites. All of these will be monitored by using this method once in every 10 years, on average 5 sites a year.

INTRODUCTION

Management of nature parks need data about the recreational use of their areas in order to control and direct the flow of visitors. Several sociological founding studies were carried out by the former Institute for Forestry and Nature Research, now Alterra (Visschedijk 1997a, Visschedijk 1997b) before the set up of a recreation monitoring system (Visschedijk 1998a). The number of visitors to a site, the recreational use as well as the quality of the experience are monitored. It serves as a knowledge base for the future.

METHODS

The study was carried out in several areas managed by the Dutch forest service across the Netherlands, among which Ugchelen-Hoenderloo. This area serves as an example for this paper (fig 1).

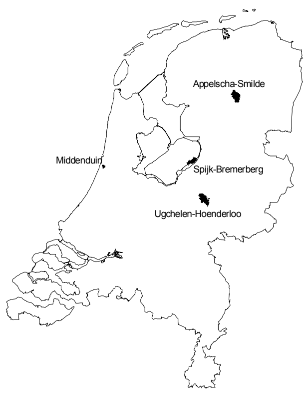

Fig 1. Location of monitored forests.

1. Monitoring vehicle and bicycle use at the sites by using traffic counters with induction loops installed in the road (all year round).

The use of traffic counters enables one to gather information about the number of passing vehicles and bicycles all year round. The counters automatically register the numbers and also provide other details such as date, time and speed. With this information it is possible to see the variation in use throughout the year.

2. Visual counting of visitors at all entrances (on 12 days during the year).

Counting all the site-entrances visually is essential for determining the exact number of visitors. With traffic counters is it impossible to cover the complete site, only cars and bicycles can be counted and you don't know how many people are for instance in the vehicles. In combination with the figures from the traffic counters it is possible to calculate the number of visitors during a certain period of time.

3. Survey of visitors (on 12 days during the year).

With the visitor surveys information is gathered among other things about activities, use of facilities, number of visits a year, place of residence, duration of visits and last but not least the percepted quality of the site.

The quality-score is generated by asking the visitors their opinion about 17 items concerning outdoor recreation. First through 17 thesis about recreation in general in which the visitors are asked about the importance of the items (general importance), in the next question the same thesis are asked in connection with the visited site (verdict).

Then the questions are combined, the answers about the site itself are weighted by the answer about the general importance of a certain subject. Table 1 shows the weightfactors.

		General importance				
		Very unimportant	Unimportant	Neutral	Important	Very important
Verdict	Very negative	-1	-2	-4	-6	-8
	Negative	0	-1	-2	-3	-4
	Neutral	0	0	0	0	0
	Positive	0	1	2	3	4
	Very positive	1	2	4	6	8

Table 1. Quality-scores

When an item is being considered as very important by the visitor, then his verdict about the item in the visited site can raise a score between -8 and +8. However, when an item is qualified as unimportant then a score is between -2 and +2. When an item raises a total average score of more than 1 the quality is qualified as being sufficient.

Since this system of monitoring is only carried out in 48 sites, there was a need to get information about all the other grounds of the Dutch forest service. Since counting is too expensive to be done in all sites, in the sites not covered by the monitoring network visitors are going to be given a questionnaire which they can fill out and send back by mail. Through extrapolation we try to predict the unknown factor, the number of visitors.

SOME SELECTED RESULTS

Results of traffic counters

The trafficcounters give year-round information about the number of cars and bicycles. With this information the 10th busiest day is determined. The 10th busiest day in Ugchelen-Hoenderloo was the 25th of July. Figure 2 shows the division of vehicles per day where every bar represents a day. The black bars indicate the days where interviews were held and visual counting took place.

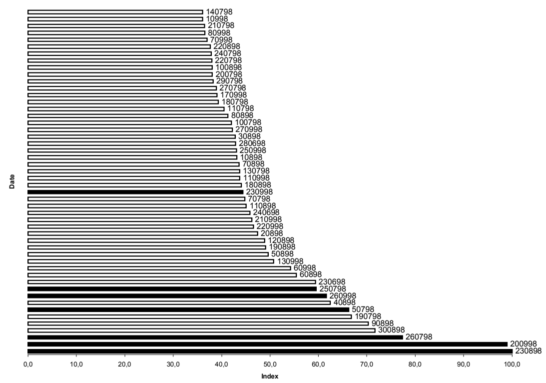

Fig 2.Number of vehicles per day where the busiest day is set at 100.

Results of visual counting

The number of visitors on the 10th busiest day was 2,093. As the size of the area is 1,814 ha this means an average visitor intensity of 1,15 per ha. The amount of facilities for recreation depends on this number. Figure 3 shows the number of visitors present in the area during the day.

Fig 3. Number of visitors present in Ugchelen-Hoenderloo at certain period of time.

Results of interviews

The quality score showed a score lower than 1 for the number of benches and the chance of seeing birds and other animals (Fig. 4). This should be improved by management.

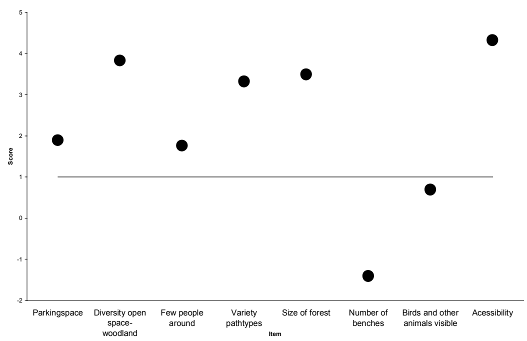

Fig 4. Quality-scores of Ugchelen-Hoenderloo

CONCLUSIONS AND OUTLOOK

The recreation monitoring system proved to be a valuable management tool.

At the moment Alterra is improving its system of: combination of monitoring and smaller onsite surveys through extrapolation of results (Visschedijk 1998b).

Besides Alterra is working on a model which predicts the number of visitors to a site based upon:

Number of different sites in an area
Quality of the site
Quality of the routes leading to a site
Number of inhabitants in an area of approx. 25 km around the site.

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Visitor Management by Visitor Monitoring? Methodological Approach and Empirical Results from the Wadden Sea National Park in Schleswig-Holstein

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Abstract: Even today monitoring in most large nature reserves is mainly concerned with ecological environmental observations. Socio-economical parameters and special parameters concerned with tourism are rarely part of such programmes. This is not the case in the Schleswig-Holstein Wadden Sea National Park (SH-WSNP). During an extensive ecosystem research project the necessary basis for a better understanding of the structure and dynamics of the Wadden Sea was made. The local population and economy of the Wadden Sea region, especially tourism, played an important role in the project right from the start. The knowledge gained by the project was used as a basis for the revision of the national park law and in the concept for an interstate monitoring programme for the Wadden Sea. The three modules of the socio-economic monitoring (SEM): SEM-Regional, SEM-Trend and SEM-Poll document the, for Germany, unique and thus innovative character of this monitoring programme which is orientated towards comprehensive data collection and assessment. Extensive experience with different methods and results of the quantitative and qualitative monitoring of visitors were gathered during a three year test phase. The possible use of the results for an optimisation of the management of visitor flow in and adjacent to the National park and for more targeted information and public relations work are discussed.

INTRODUCTION

Monitoring[2] is a well established tool in protected areas and the field of environmental issues. It can be regarded as an integrated part of national park or nature reserve management and it is vital in order to control i.e. the efficiency of management measures or the ecological situation for endangered species and biotopes. The necessity of monitoring these ecological aspects can not be doubted. However, the dominating concept of monitoring seems to consider man solely as an impact factor and in a more or less negative way. With respect to the Wadden Sea, Kellermann et al. (1994) define monitoring as repeated measurement of „parameters which indicate the status of the Wadden Sea and of each of its compartments (...) or activities or natural and anthropogenic inputs which may affect the quality of the environment or the effects of such activities“.

On the other hand in research models such as Man and Biosphere projects (Kerner et al. 1991) or ecosystem approaches as in the Wadden Sea Region (Leuschner 1988, Stock et al. 1996) social and economic systems are an integrated part. They define the relationship between man and nature with reciprocal action. Thus the consequences and effects on the anthropogenic system deriving from the natural system or its protection are equally regarded.

It is this theoretical and empirical concept of reciprocal action which actually seems to meet practical management needs. To achieve protection of nature against the will of people and visitors has proved futile in many cases, at least it demands a steadily growing effort with extensive measures for controlling and prosecuting prohibited actions and behaviour. To monitor attitudes of visitors and the local population towards nature protection can therefore be very useful. Last but not least it is also a legally and politically fixed goal for nature reserves and National parks to inform their visitors and to enable a special kind of nature experience (IUCN[3] 1994). Visitor management in a broader sense of the word therefore is more than just guiding people and keeping them away from sensitive areas. Besides control and management measures it comprises nature education, information, guidance, even tourist packages. A rising need for non governmental funds and sponsoring puts forward the need to know more about the visitors, their expectations and

[2] A short definition is given by BAYFIELD (1997) „Monitoring is to record change“, whereas HELLAWELL (1991) describes monitoring more detailed as „intermittent (regular or irregular) surveillance carried out in order to ascertain the extent of compliance with a predetermined standard or the degree of deviation from an expected norm“.

[3] International Union for Conservation of Nature

willingness-to-pay. This sums up to a monitoring concept which also supplies information for advanced visitor marketing.

The case of the Schleswig-Holstein Wadden Sea National Park (SH-WSNP) illustrates the long process of putting these experiences into a working socio-economic monitoring system (SEM). Although the original research concept (Leuschner 1988) for the area was already based on a reciprocal approach, it took 6 years of socio-economic basic research within the ecosystem research program and another 6 years from presentation of a monitoring concept (1993) to establish SEM in the National Park office in Tönning (Möller & Feil, 1997). Today it is the most comprehensive socio-economic monitoring system that includes a continuous visitor monitoring in nature reserves and national parks in Germany.

THE SEM – CONCEPT: AN HOLISTIC APPROACH ON MONITORING THE ANTHROPOGENIC SYSTEM RELATED TO THE WADDEN SEA NATIONAL PARK

The SEM – Modules

Socio-economic monitoring performed in the region of the SH-WSNP consists of three modules (figure 1):

- A basic monitoring "SEM Regional" describes the development of the regional population and economic structure;
- A second module "SEM Trend" focusses on quantitative and qualitative data about park visitors, e.g. numbers, visitor structure, publicity and valuation of national park attractions, attitudes and motivations;
- "SEM Poll" provides information on knowledge, profile and acceptance of the national park within the region itself and nationwide.

VISITOR MONITORING – STRUCTURE AND EMPIRICAL INSTRUMENTS OF THE MODULES SEM TREND AND SEM POLL

SEM Trend combines visitor counts, surveys of visitor structure and visitor polls using face-to-face interviews at 16 locations (figure 2 – map of study area) which serve as entrances to the national park. The geographical situation – the landward boarder of the national park stretches along about 450 km of coastline and island shores, principally accessible at any time - required the selection of a few typical sites for the counts and opinion polls. Their number is also limited by financial and work resources. Selection of locations followed two criteria:

- Locations on islands, Halligen and at the coastal mainland along the national park boarder;
- hot spots of tourism, locations with moderate visitor frequency and day trip destinations.

An important precondition was the presence of national park service ranger at the respective coastal section, who simultaneously carried out the counts and interviews at the selected locations. Workers were thoroughly and repeatedly trained to minimise probable bias caused by the interviewers.

SEM Poll uses the instrument of representative (computer-aided) telephone interviews with random sampling. Co-operation with a neighbouring university of applied sciences was established in the case of the opinion polls of local residents. An independent market research institution was charged to carry out the nation wide poll.

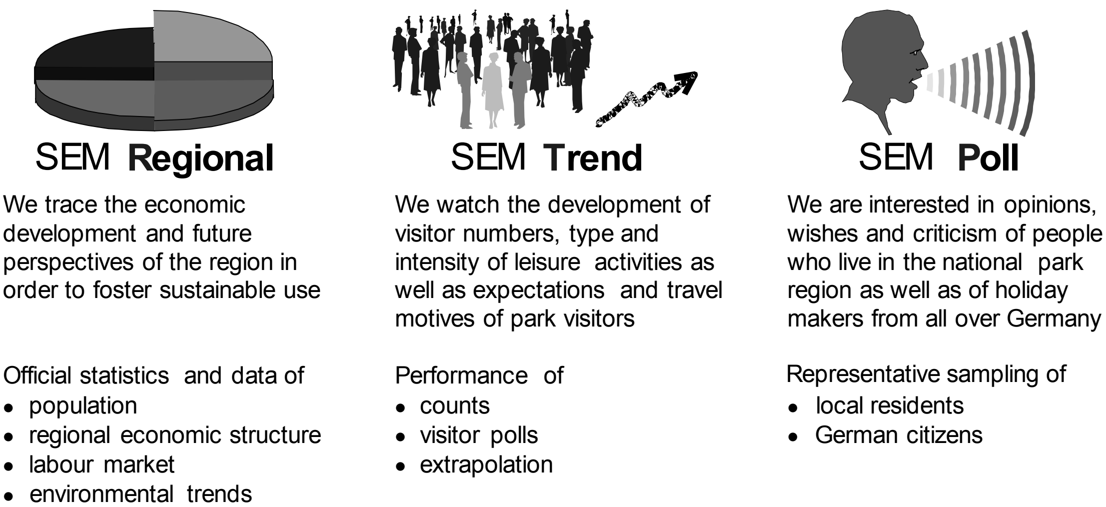

Fig. 1: Modules of socio-economic monitoring

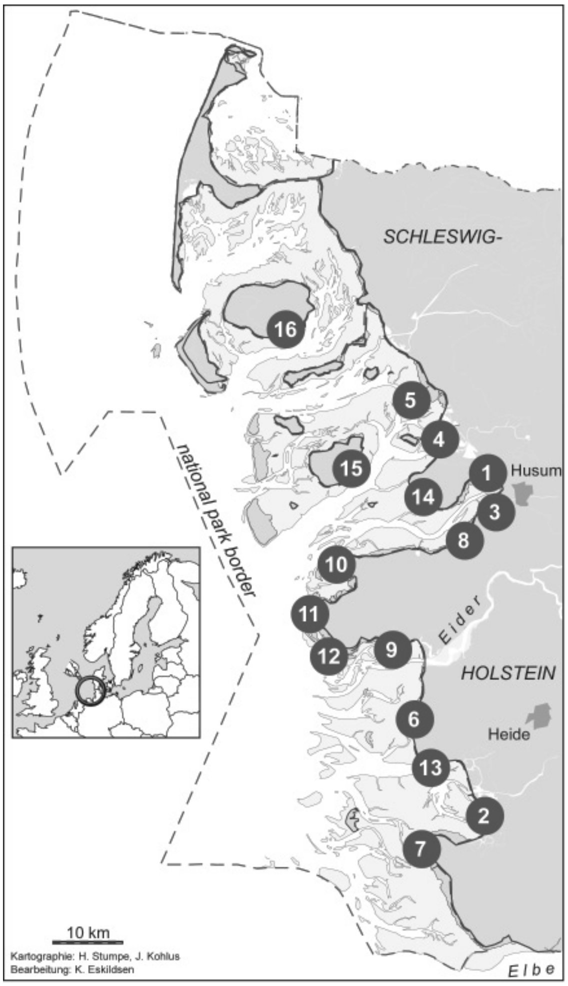

Fig. 2: Map of study area with locations for visitor monitoring. Numbers of locations refer to figure 3.

RESULTS FROM SEM VISITORMONITORING – MEASURING MORE THAN JUST AN IMPACT FACTOR

Who is the visitor? - Identifying target groups

Unlike the situation in world famous national parks like Kruger National Park or Yosemite many, if not most, of the visitors to the SH-WSNP are not primarily visiting the national park. They are mainly tourists, looking for a holiday or day off near the seaside. The SH North Sea coast and Islands already became a recreation and spa region at the end of 19th century. The National park itself was founded much later, in 1985.

From earlier studies (Feige et al. 1993a, 1993b) visitors found along the coastline and island shores can be roughly categorised into:

- The North sea holiday makers, staying in the adjoining tourism sites and recognised as traditionally nature and health oriented guest group;
- Day trippers from outside the coastal region, who spontaneously decide to go for a weekend break or day trip to the beach or seaside;
- The local people, using the National park as their traditional leisure, living and working environment, who often avoid tourist hot-spots and retreat into less popular but ecologically more vulnerable areas;
- Other visitors, such as people visiting friends and relatives, people on business trips, or people with a second home in the region etc.

SEM tries to assess the spatial and seasonal distribution of these visitor groups and to produce additional information on their - site related - behaviour, attitudes and expectations.

As shown in figure 3 i.e. shores on Islands (Föhr, Pellworm, Nordstrand) are dominated by holiday makers whereas smaller, so-called „green beaches" along the coastline (Schobüll, Husum) or specialised sites like wind-surfing resorts (Elpersbüttel) have a higher percentage of local residents and day trippers.

These findings are important for the design of site related information, such as the established visitor information system (VIS) and service offers (i.e. National Park Service).

SEM also asks for additional socio-demographic visitor structures: age, number of persons and children, place of living.

General results on numbers and attitudes

The exact amount of visitors to the park is and will remain unknown, due to the above mentioned geographical situation which lacks a central entrance. Nevertheless SEM aims to collect and assess more information, conducting counts site by site and season after season. Using data from the selected locations a first extrapolation has been made:

The extrapolation for the selected 16 sites sums up to ca. 2,46 Mio visitors for one year, with numbers ranging from 15.000 in the smallest place to 0,5 Mio per year at the beach of Büsum, a traditional tourism site at the mainland coast. 35% of the visits are made during the two summer months July and August and 53 % in spring and autumn (April to June, September, October). Winter counts have been stopped because of a paucity of visitors. However, the winter season is estimated at about 5 to 12 % of the total.

The visitor structure throughout the busy tourist season (April to October) is dominated by North Sea holiday makers (75%), followed by day trippers from outside the region (13%). Locals and other visitors account for another 12%.

Table 1 gives an impression of the effort which has been undertaken by SEM until now.

	1999	2000	2001	Total
Number of visitors counted[1)]	42.803	27.489	49.492	119.784
Registered visitor structure[2)]	4.089	3.264	5.167	12.520
Number of visitors interviewed[3)]	572	670	1.019	2.261
Number of work days[4)]	84	116	112	312

[1)]Counts without interview
[2)]Short questionnaires, only visitor type, age, number of persons and children
[3)]Interviews on attitudes, knowledge and expectations
[4)]Appointed personnel x days of counting/interviewing

Table 1: SEM Trend effort from 1999-2001

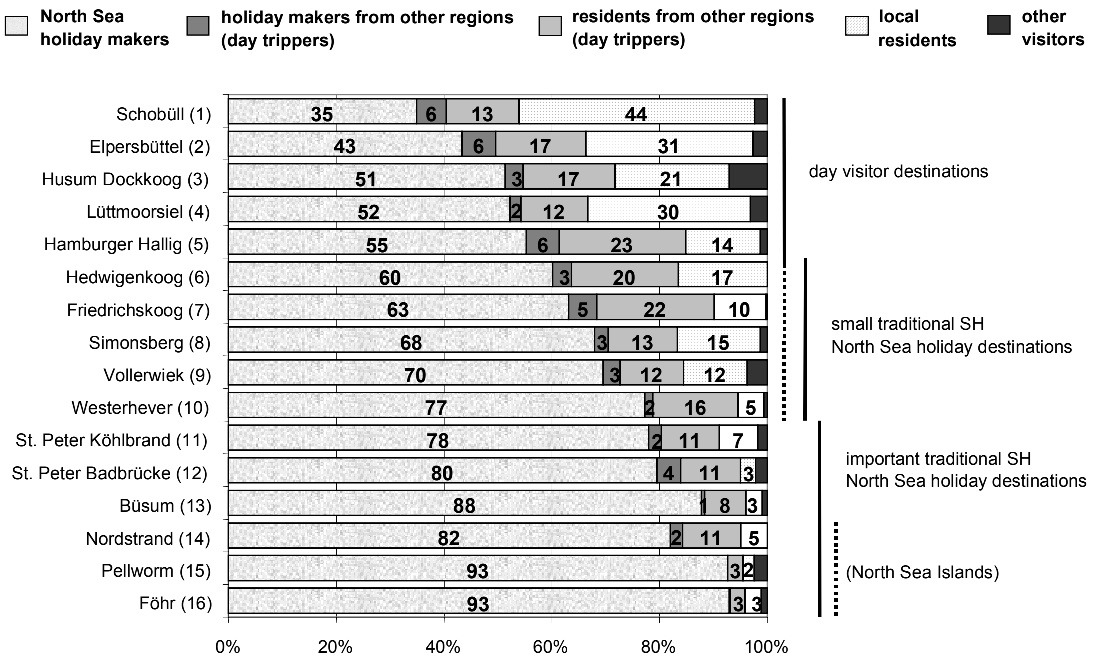

Fig. 3: Visitor structure at 16 locations at the Schleswig-Holstein Wadden Sea National Park in 2000 and 2001. Numbers of locations refer to figure 2

Change in visitor structures by management measures – A-priori and ex-post analysis (Hamburger Hallig)

The Hamburger Hallig is a small island within the national park territory with a causeway to the mainland. It could also easily be reached by car until 1996 when, after intensive negotiations, a toll-bar combined with an entrance fee was established. The national park office, in consensus with the adjoining community, who rejected a strict ban on cars, aimed to cut down car numbers in this way.

Counts of cars and visitors impressively illustrate the effects of this management measure: The number of registered car crossings to the Hallig declined by one third between 1997 and 2000 (see figure 4). Counts which also regarded the modal split show that in 1990 ca. 86% of the visitors came by car. In the year 2000 visitors by car only represent 26% of the total. The bicycle has now become the most important transport vehicle (48% in 2000, 6% in 1990).

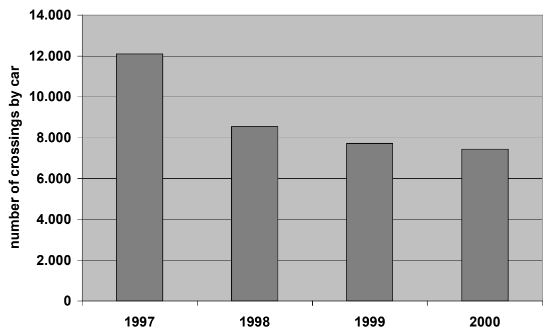

Figure 4: Numbers of registered car crossings at Hamburger Hallig 1997-2000

QUO VADIS? CONCLUSIONS AND PERSPECTIVES

Three years of continuous visitor monitoring have improved the knowledge on visitors to the national park and have built a solid basis of information. Monitoring is not an end in itself, but is designed to provide benefits. Three characteristic steps mark the process of building up a qualified SEM in its way from visitor monitoring to visitor marketing (figure 5):

Step 1: Visitor Monitoring

Step 1 comprises the construction of an empirical and methodological framework with selection of locations for counting and interviewing as well as designing the sample, considering especially seasonal aspects. Because of the variety, number and different attractiveness of beaches, sites, harbours etc. This became quite a challenge in case of the SH-WSNP. This methodological step might prove much easier in other areas with different preconditions.

Developing a standardised procedure for extrapolation of visitor numbers was a second task, which has to be continuously improved upon. Supplementary opinion polls of the regional population as well as representative polls served additional qualitative information on acceptance of the SH-WSNP, interest and behaviour concerning nature protection, the knowledge of its existence and its potential for visitors.

Another future gain may be the multiple use of market research instruments and data by different regional stakeholders. The communities and tourism organisations are equally interested in tourism data as is the national park office. The linking-up and exchange of instruments and information will stimulate co-operation, synergetic effects will result in more effective application of funds.

Step 2: Visitor Management

Step 2 is made up of two parts. First of all processing the collected information into visitor profiles. This aims at identifying specific types of attitudes and behaviour through socio-demographic and other attributes. These are useful for designing customer-oriented products, information and services. SEM will, therefore, be able to provide useful information for the improvement of the already existing visitor information system (VIS).

Secondly we need analysis and a better understanding of interrelations and interdependencies. Up to now, we have only little comprehension of how i.e. weather conditions might influence visitor numbers and structures in certain sites and seasons. Successful visitor marketing requires a deepening of knowledge concerning influencing factors and their reciprocal relationships. Especially interesting are the opinions on information offers and nature experience by different types of visitors at varying sites. Detailed market research has to be conducted. With a special kind of „Hot spot"-monitoring we also learn about conflicts and their implications for visitors.

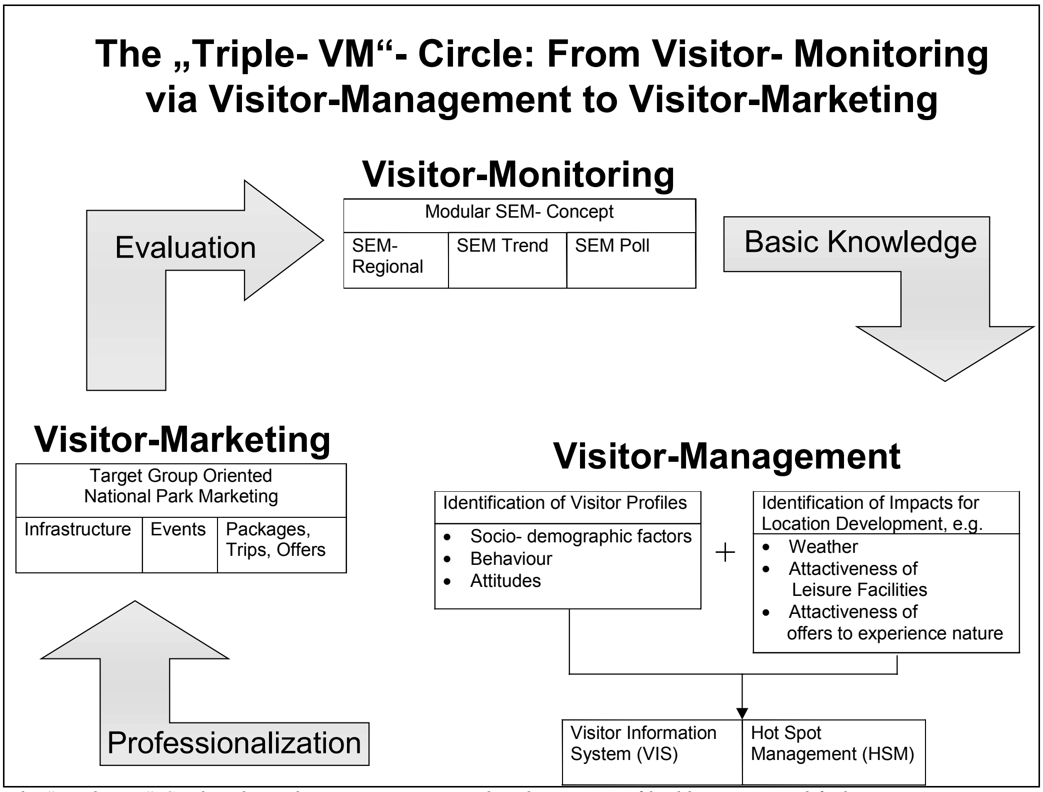

Figure 5: The "Triple-VM"-Circle: Three characteristic steps within the process of building up a qualified socio-economic monitoring (concept: M. Feige)

Step 3: Visitor Marketing

Summing up all information and findings SEM aims at a proactive and integrated visitor marketing. Of course there has always been some sort of visitor marketing. Nevertheless, it needs to become more and more orientated toward the specific needs and attitudes of various types of visitors (sun and beach, bird watchers, families, senior travellers, singles, technical visits etc.). SEM helps to offer them an attractive SH-WSNP experience, simultaneously safeguarding nature protection needs and respecting regulations.

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Tourism Infrastructure Planning in Tusheti National Park of Georgia

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Abstract: This paper provides an example of using biodiversity information for tourism infrastructure and management planning in national parks to avoid conflicts between nature conservation, recreational goals, and other users. Within the area of the proposed Tusheti National Park in Georgia, we used field survey data of seventeen focal species within a GIS analytical environment to assess the consistency of planned management categories zoning and administrative and visitor infrastructure (including tourist trails) with biodiversity conservation requirements. A map, comprised of layers for each focal species, was overlaid onto maps of proposed zoning, infrastructure and tourist trails. Numerous conflicts in planning were detected and recommendations were made to improve zoning and infrastructure planning in the national park, and to minimize negative effects of tourism on biodiversity conservation.

INTRODUCTION

Ecotourism development can have many benefits. It can fund conservation and scientific research, contribute to the protection of the endangered ecosystems and species, benefit rural communities, promote development in poor areas, raise environmental awareness, and satisfy and educate tourists. However, worldwide there are examples of the negative impacts to environment of increased tourism, including ecotourism. These include trail erosion, pollution, wildlife disturbance and population decrease, socio-cultural impacts, etc. (Honey 1999, Knight & Gutzwiller 1995, Fennel 1999, Lindberg & Hawkins 1993, Wright 1996, Barzetti 1993). In light of these negative impacts, it is apparent that the interpretation of "green" travel as a "win-win" situation is not accurate and there is a need for more detailed studies.

Figure 1.: Study area: Tusheti National Park in the north-eastern Georgia

The conflict between conservation and recreational objectives is common in national parks (Wright 1992, 1996, Barzetti 1993, Knight & Gutzwiller 1995). This research was carried out in the Tusheti National Park in Georgia (Figure 1). It provides information that aims to reduce such conflicts by utilizing biodiversity information in the planning of tourism infrastructure, trails and management zones.

METHODS

In August 2000, a baseline survey of 17of the most endangered and sensitive focal species (Figure 2) was conducted in Tusheti National Park. Biodiversity data (species and habitats distribution, habitat quality, current livestock size and distribution, etc.) were transferred to topographic maps (1:50 000). These data yielded distribution maps for each species.

Maps of 17 species were used as layers within the Geographic Information System (GIS) environment to produce a biodiversity map for Tusheti (Figure 3). This Biodiversity map was then overlaid onto proposed infrastructure, zoning, and tourist trails maps (Figures 4, 5, and 6). These maps were used to assess the consistency of the proposed activities in the Tusheti National Park with the biodiversity conservation objectives.

RESULTS

Figures 4, 5, and 6 illustrate the results of analyses. Based on these maps several recommendations were made for improvement of infrastructure, the location of tourist trails, and zoning of management categories.

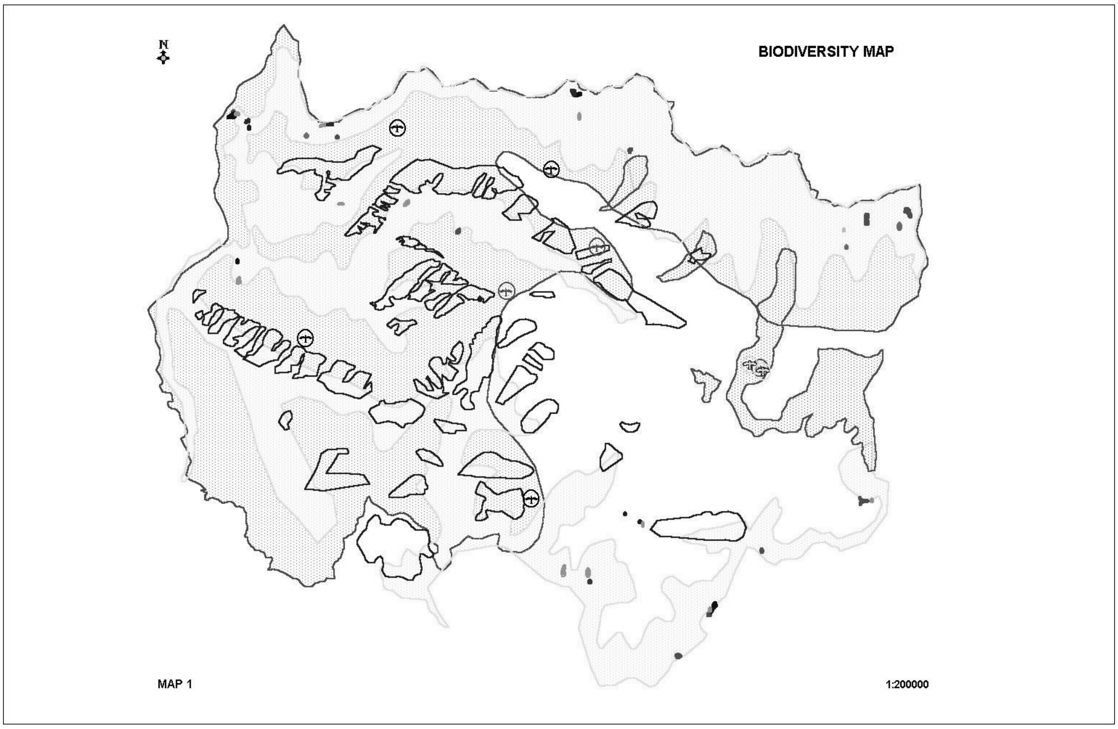

Figure 3.: Biodiversity map of Tusheti National Park produced by overlaying distribution and important areas of 17 focal species.

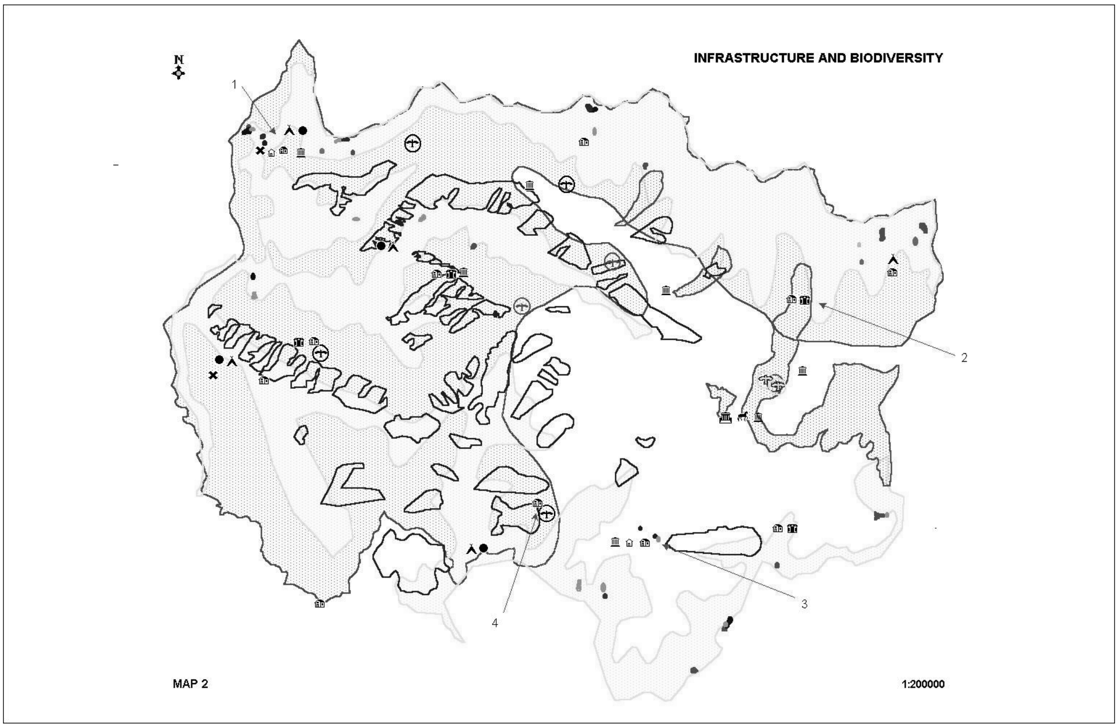

Figure 4.: Planned infrastructure and biodiversity in Tusheti National Park. The arrows show potential conflict areas.

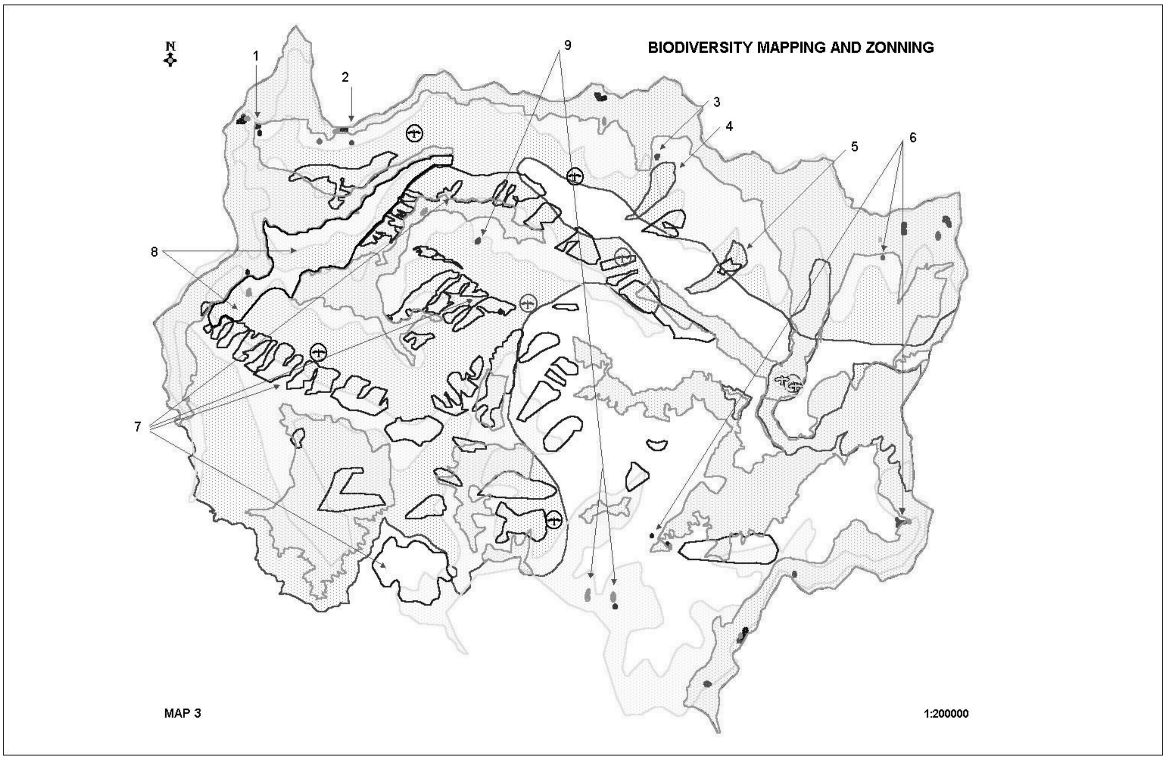

Figure 5.: Planned management categories zoning and biodiversity in Tusheti National Park. The arrows indicate areas recommended for upgrading to strict protection.

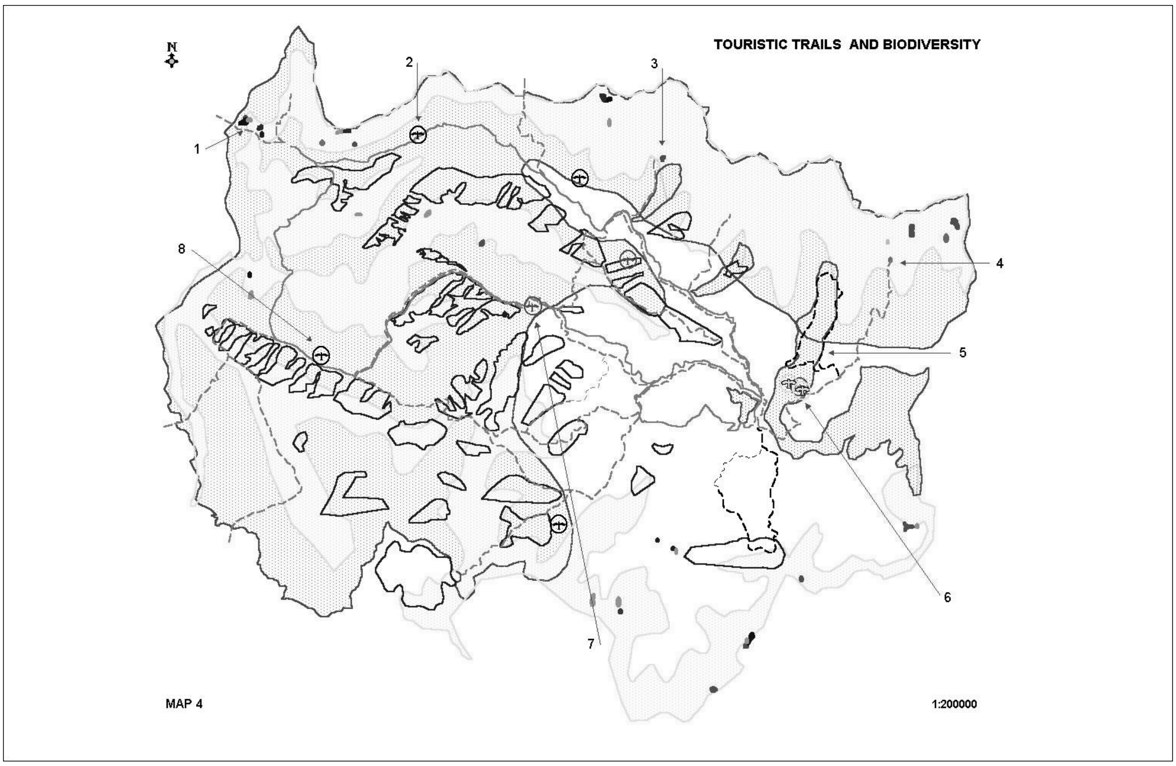

Figure 6.: Tourist trails and biodiversity in Tusheti National Park. The arrows show areas where rails passes through important and sensitive biodiversity sites.

ANIMALS	
Common name	**Scientific name**
Caucasian Snow Cock	*Tetraogallus caucasicus*
Caucasian Black Grouse	*Tetrao mlokosiewiczi*
Golden Eagle	*Aquila chrysaetos*
Griffon Vulture	*Gyps fulvus*
Bearded Vulture	*Gypaetus barbatus*
Bezoar Goat	*Capra aegargus*
Eastern Caucasian Tur	*Capra cylindricornis*
PLANTS	
Species	**Family**
Pseudovesicaria digitata C.A.Mey	BRASICACEAE
Trignocaryum involuctratum Stev.	BORAGINACEAE
Rseudopetckea (Hoeck) Lincz.	VALERIANACEAE
Symphyoloma graveolens C.A.Mey	APIACEAE
Vavilovia Formosa (Stev.) Fed	FABACEAE
Saxifraga ruprechtiana Manden.	SAXIFRAGACEAE
Delphinium caucasicum C.A.Mey.	HELLEBORACEAE
Ranunculus tebulossicus Prima	RANUNCULACEAE
Erysimum subnivale Prima	BRASSICACEAE
Silene humilis C.A.Mey	CARIOPHILACEAE

Figure 2.: Animal and plant species used in the analyses

Infrastructure (Figure 4)

Infrastructure elements (visitor center and administration, visitor and rangers shelters, information center, stable, campsite, sight-seeing platform) should be located as close to settled areas as possible in order to reduce disturbance of the natural ecosystems, and to make it easier to involve the local public in the functioning of the planned national park. In two locations infrastructure elements are next to areas that contain rare, endemic plant species. These elements should be moved or access to the plants must be blocked (e.g. warning signs, fences, etc.). Some infrastructure elements are located inside the narrow range of endangered Bezoar Goat (*Capra aegargus*) and should be moved. Infrastructure elements should not be built close to a Golden Eagle (*Aquila chrysaetos*) nesting site.

Zoning (Figure 5)

Existing strict protection zones do not encompass areas of rare endemic plant species, lands that are critically important to Bezoar Goat (*Capra aegargus*), important breeding areas for Eastern Caucasian Tur (*Capra cylindricornis*), and Rhododendron cover that creates a unique habitat important to many species, including Caucasian Black grouse (*Tetrao mlokosiewiczi*). Our analyses recommend these zones to be enlarged to encompass these areas. In certain areas the connections among fragmented important sites should be ensured.

Tourist Trails (Figure 6)

In several cases planned tourist trails pass through important and sensitive biodiversity sites (rare endemic plant communities, nesting sites of globally endangered bird species, etc). Recommendations vary in each instance, but include the rerouting or shortening of trails, restrictions on the amount of time visitors can linger in an area, and the erection of warning signs.

CONCLUSIONS

Several potential conflicts between conservation and recreational objectives were discovered by connecting biodiversity information to the National Park planning process within a GIS. It is evident, that applying such an approach to protected areas planning process can significantly reduce negative effects of ecotourism development.

Acknowledgments

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The Visitor Flows and the Bird Communities in the Paklenica National Park, Croatia (between 1997-2001)

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Abstract: The paper shows the visitor flow in the Great Paklenica canyon, the most visited part of Paklenica National Park. This area is the greatest climbing center in Croatia. About 500-800 visitors reside on average in this area daily from mid-April to the end of October. The maximum number of visitors, 90.000, was reached in 2001. Up until now we have noted more than 200 bird species the National Park area, and between 1997 and 2001 we have recorded 56 species breed in the Velika Paklenica canyon. This most visited canyon, is known as the breedding area of 18 rocky bird species, such as as Peregrine Falcon, Short–toed Eagle, Kestrel, Rock Partridge, Eagle owl, Rock Dove, Alpine swift, Raven, Rock Nuthach, Blue Rock Thrush, Rock Thrush, Crag Martin, House Martin, Red-rumped Swallow, Black Redstart, Black-eared Wheatear. One pair of Golden Eagles moved to an inaccessible area of the Mala Paklenica canyon. The small colonies of Griffon Vultures have ceased to exist in the National Park. The Egyptian Vulture have disappeared from Croatia at the end of the 1980-ties. This paper discusses the influences of visitor flows, climbing and other recreational activites on the breeding bird communities.

INTRODUCTION

The area of the Paklenica National Park covers 96.000 ha in the southern part of the Velebit mountain (fig. 1). Confined between the sea coast and the central ridge of the mountain chain it comprises two canyons, Velika and Mala Paklenica and the surrounding southern foothills with the native Black Pine (*Pinus nigra*) and Beech woods (*Fagus sylvatica*). Because of its exceptional natural beauties of limestone Karst, its geological formation, large and old virgine forests rare on southerns slopes of Mediterranean mountains, it was proclaimed the second Croatian National Park in 1949. The entire Velebit Mountain was recognized by the United Nations in 1978 as a part of the international network of Biosphere Reserves. Formed mostly of limestone and dolomite, Mountain Velebit emerges 145 km along the Adriatic coast as a 10-30 km wide natural barrier toward the continental interior with the highest peak Vaganski vrh at 1757 m altitude. The southwestern (seaside) rocky slopes are influenced by the Mediterranean climate, while in the interior the subalpine and continental climate prevails on the highest peaks and northeastern (continental) slopes. The ornithofauna of this area was mentioned in a number of published papers (Maštrović, 1942; Rucner, D., 1963; Rucner, R., 1967; Škornik, 1987; Lissak, 1990; Lukač et al. 1992; Lukač & Karadžić, 1993; Lukač & Stipčević, 1997; Lukač, 1999), as well as in numerous popular publications. The paper intends to show the impact of visitors, hikers and climbers on the orinthofauna of breeding birds of the Velika Paklenica canyon. This type of research has never been carried out in Croatia. The measurement for the comparison of the impact of the number of visitors was the abundance of the couples during the research between 1997 and 2001. In this period the number of visitors, hikers and climbers increased constantly. The Shannon-Wiener diversity index was calculated (Krebs 1985,1999,2000) on the basis of the collected data.

METHODS

Investigated area

The Velika and Mala Paklenica canyons penetrate 14 and 12,5 km into the southern slopes of the Velebit Mountain directly from the seacoast to the deep interior in the foothills of the highest mountain ridge. The ridges of both sides are about 700m. Permanent springs from the interior flow through the canyons as temporal streams after snowmelt or heavy rain. Such a specific geographical position of the National Park and the encounter of very different climate types have formed specific ecological conditions. Rich and varied petrophilic wildlife and vegetation with many endemic and relic species characterize both canyons (Lukač & Stipčević, 1997; Lukač, 1999). The geological structure of the area of the national park is unique for its Paleozoic sediments of Permian age in the Dolomite-limestones make up (Božičević, 1995). The climate of southern Velebit is transitional between continental and maritime, and the thermal effect of the Adriatic is limited to a narrow zone on the south-west slopes, up to a Mediterranean influence penetrates deeply into the interior of Mount Velebit through the Mala and the Velika Paklenica canyons. In return, alpine and continental climatic conditions drop down to the very entrances of both the canyons. The relief has a very considerable effect on air, temperature, insolation and precipitation. Thus, the annual precipitation on the Vaganski vrh (1757 m altitude) and the Sveto Brdo peaks (1753 m), comes to about 3500 mm. The whole of the area of southern Velebit features Mediterranean rainfall characteristics, with maximum precipitation in the colder half of the year (Perica, 1994; Perica & Orešić, 1995). Of winds, mention should be made of the north easterly, or *bora*, a cold gusty and dry wind that blows longer and harder in the winter. The origin of the *bora* is to be found in the influx of cold northern air masses that pile up on coming to the relatively high and broad barrier of Velebit in the depression of the Lika polje. Rising, the wind simply overflows towards the sea, most strongly in the southernmost and lowest passes, such as Vratnik, Baške Oštarije, Mali Alan and Prezid. With this overflow of air, in a pseudoadiabatic process, just above the ridge of Velebit, a white mass of clouds is formed. Of the maritime winds, the most important is the *scirocco*, here called the *yugo*, which is formed from the inflow of warm air from the south and its passage across the Mediterranean and the Adriatic. On its way the air becomes saturated, and, as it rises over the Dinaric Alps, its temperature falls, which is accompanied by a rise in relative humidity, cloud cover and rainfall. In summer the *maestral* often blows, a typical westerly or north-westerly. About 55% the National Park area is covered, and 45% is rocky area, without vegetation which has formed karst relief. The covered area consists of largely forests of European Beech *Fagus sylvatica* (52%), Black Pine *Pinus nigra* (20%), mixed forests of European Beech and Black Pine (8 %), Downy oak *Quercus pubescens*, Eastern Hornbeam *Carpinus orientalis*, European Hop Hornbeam *Ostrya carpinifolia* (9 %). The upper tree-limit of mountain is marked by belt of Mountain Pine *Pinus mugho* (4%).Other important habitats are upland meadows and pastures (7 %).

Field investigations

The bird fauna of the Croatian National Park “Paklenica” was investigated in two periods. During the first period of 297 field days 193 birds species were recorded. In the second period of 664 field days other 16 species were recorded in the area of National Park and its surroundings (Lukač & Stipčević, 1997). Field work was concentrated on the inside borders of the National Park (NP), especially in the Velika Paklenica canyon since it represents the main phenomenon on NP. The birds height of about 700 or 800 m, but the were observed in the field in the Velika Paklenica canyon along the main tourist path, and the transect

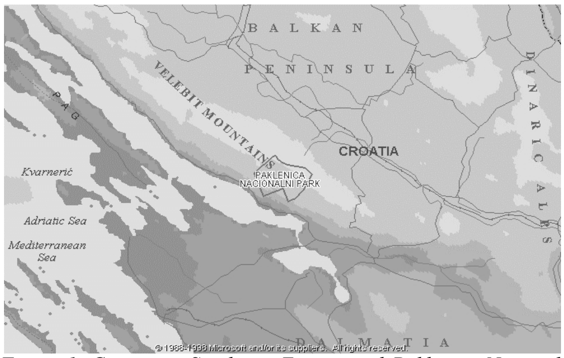

Figure 1. Croatia in Southeast Europe and Paklenica National Park in Dalmatia and in South part of Velebit.

for establishing the bird pairs encompassed 8500m in length and 50 m in width. All petrophile species were recorded outside the said width and at visible rocks on both sides of the canyon. The pairs were counted on the basis of singing males and found nests (Cody, 1985; Bibby at al. 1992; Flade, 1994; Hochrathner, 1995). The abundance of 56 nesting bird species, 18 of which were petrophile species, was analysed. The Shannon-Wiener diversity index was calculated as a measure for defining the abundance and the variety of the bird community (Krebs, 1985, 1999, 2000). The major part of the research was carried out in the nesting season durig 41 field days in the period from the end of April to the first decade of July 1997-2001. The number of visitors was counted at the entrance reception. The most visited area in the Velika Paklenica canyon extends from the reception to the Manita cave, the Foresters’ house and the Mountaineerhouse (altitude from 30-550m). The highest number of visitors per year occurred in the period from mid-April to the end of October. The visitors were recorded in the visitors’ book and on the basis of the reported entrances and the sold tickets. The climbers were counted on the basis of registrations and sold entrance tickets. The visitors in the Manita Peć cave were also counted on the basis of the entrances registered with the guide. All free entrance visitors were also recorded as repeated entrances into the Park. The abundance of visitors was established for the period 1998-2001. Today there are 500 climbing directions in the Velika

Paklenica canyon, while the Mala Paklenica canyon is the no-climbing zone.

RESULTS

The Velika Paklenica canyon bird community

The total of 56 species of nesting birds were recorded. The petrophile ornithofauna consists of 18 species. The abundance of the species and pairs in individual years of the research is best seen on Table 1. Of all petrophilous species the most abundant was the colonial species Apus melba with 15-35 pairs. The same is also true for Columba livia. The Sitta neumayer species has shown constant abundance of 7-10 pairs throughout the researched period. Generally during the research period no significant changes in the abundance of songbirds (Monticola solitarius, M. saxatilis, Oenanthe hispanica, Phoenicurus ochruros, Hirundo rupestris, Delichon urbica) were noticed.

The Extinct Species

The last observation of the *Neophron percnopterus* was recorded in May of 1987. Since then this species was not recorded in the Paklenica NP. Also this type of vulture is disappearing from the entire Croatia. The last time the Eurasian vulture nested in the NP was in 1999. This is due to the campaign of poisoning the wolfs, jackal and stray dogs in the areas close to the NP where the vultures used to feed. At the end of 1997. 12 to 14 specimens of the Eurasian vultures from Paklenica. The campaigns to ban climbing on the rocks where the vultures and peregrine falcon nest proved to be successful in 1997, 1998, and in 1999. In those years the birds succeeded in breeding the hatchlings. Permanent ban on climbing in the Mala Paklenica canyon has secured undisturbed life for the bird community of rocks and cliffs (Tab.2).

Visitors and climbers

The greatest number of visitors was recorded in the Velika Paklenica canyon, and particularly in the part between the entrance reception and the Monuntaineers' house (total length of 8,500 meters). The Manita Peć cave was visited by over 15,000 visitors, the Forester's house and the Mounteneers' house by about 53,000 visitors. The abundance of visitors by years is visible from tables 4. The number of climbers increased every year. The highest abundance was recorded around Easter and during the big –wall climbing competition on 1st May 2000 and 2001. Mountaineering/Rock-climbing has a long tradition in the Velika Paklenica area. Since 1938 over 500 directions have been set up.

Year	Number of species	Number of pairs
1997	38 (16)	272 (108)
1998	33 (14)	202 (106)
1999	40 (16)	300 (128)
2000	34 (13)	234 (100)
2001	40 (13)	303 (135)

Table 1. The number of species and pairs of nesting birds in the Velika Paklenica canyon. Petrophile species in ().

Year	V.Paklenica	M. Paklenica	Total
1996	5	2	7
1997	2	5	7
1998	1	0	1
1999	3	0	3
2000	0	0	0

Table 2. Number of pairs of Eurasian Vultures.

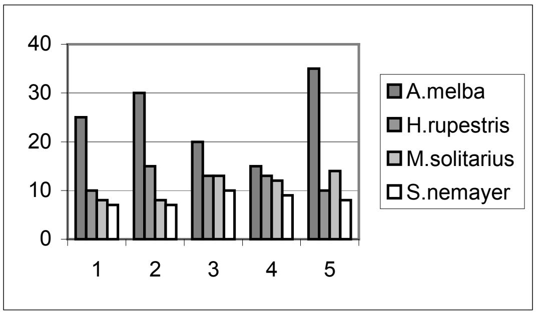

Figure 2. The number of pairs of four petrophilous species between 1997-2001.

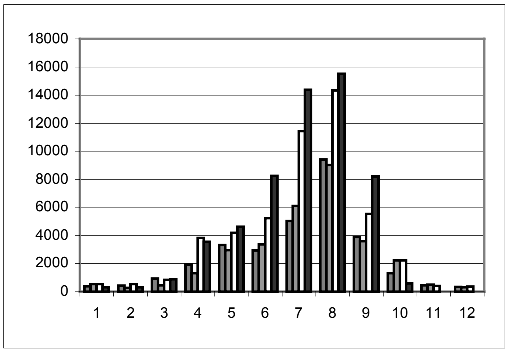

Figure 3. Number of walkers per months from 1998- 2001 in Velika Paklenica canyon.

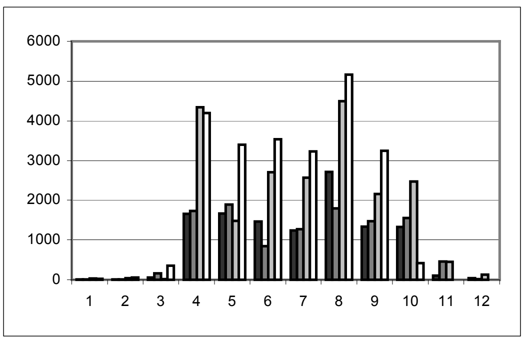

Figure 4. Number of climbers per months from 1998- 2001 in Velika Paklenica canyon.

Bans and regulation of climbing activities

The bans for the climbers and the regulation of climbing is also applied with the Falco peregrinus species as it permanently nests in Velika Paklenica since 1997-2001. The Aquila chrysaetos species, on the other hand, has not nested since 1992 in the Velika Pakelnica canyon, and its single pair moved to the inaccessible original parts of Mala Paklenica., where the visitors' frequence is much lower. During the autumn of 2001 two pairs of the Bubo bubo species were noted to be moving from the areas close to the climbing paths in the Velika Paklenica canyon to the parts of the canyon where there are no such activities nor climbing paths. Only 2-4 pairs have remained here. Only Corvus corax did not nest during the last three years in the parts of the canyon where the rock-climbing activities take place. During the research (1997-2001) the greatest changes occurred in the abundance of the raptores. Thus the Circaetus gallicus, which nests in the canyon occasionally, nested in 2000 and 2001, but not in 1997, 1998, and 1999. The increase in the number of visitors has influenced the withdrawal of the Alectoris graeca species towards the less accessible areas of the Park. The falling abundance of this species, can be explained by other reasons, such as overhunting, the use of pesticides, increased numbers of foxes, etc. The comparison of the Shannon-Winer's diversity index (H) shows a slow decrease of the values since 1997 (Table 3).

Years	H
1997	4,223
1998	4,048
1999	4,218
2000	4,182
2001	4,133

Table 3. Shannon-Wiener indeks diversity.

Years	1998	1999	2000	2001
Months				
I	401	564	575	337
II	453	280	600	372
III	1000	617	863	1251
IV	3595	3058	8158	7746
V	4974	4831	5659	8021
VI	4377	4198	7944	11779
VII	6267	7376	14014	17621
VIII	12126	10812	18833	20671
IX	5219	5063	7688	11456
X	2646	3762	4679	1020
XI	558	962	866	-
XII	383	328	484	-
Total	41999	41581	70363	80274

Table 4. Number of visitors in Velika Paklenica canyon from 1998-2001.

DISCUSSION

The research of the nesting birds in the period 1997-2001 resulted in 56 recorded bird species. Of all those 18 species account for the rock type of ornithofauna (Table 5). The study of the abundance of some species of nesting birds in the Velika Paklenica canyon with the increased number of visitors and particularly the increasing number of climbers has a direct impact on some sensitive species. This is particularly true of *Bubo bubo* (Mebs & Scherzinger, 2000), or *Tetrao urogallus, Lyrurus tetrix* in some part of Europe (Holzhausen, 1995; Klaus, 1995; Klaus & Augst, 1995; Marti, 1995; Schmalzer, 1995; Suchant, 1995). The abundance of this species can be reduced by as much as 50% due to the direct influence of the climbers. Our research has shown that the abundance did not drop, but that 2 pairs moved into the parts of the NP where there are no rock-climbing paths or climbing activities during the spring and summer of 2001. In the autumn the rocks are frequented by 3-4 pairs. The *Corvus corax* is another sensitive species which nests on the rocks and cliffs in the protected parts of the canyons away from the climbing paths. The most recent sighting of the third sensitive species, *Alectoris graeca*, was in 1997, not far from the reception. The increase of the number of visitors influenced its withdrawal towards the unaccessible parts of the Park. It has already been emphasised that the fourth withdrawing species *Aquila chrysaetos* has not nested since 1992 in the nest situated on a rock in Velika Paklenica and outside the climbing paths. It was regularly registered in the unaccessible parts of Mala Paklenica, where the number of visitors is much lower. Only *Falco peregrinus* nested every year between 1997 and 2001 in the middle of the recreational area on the rocks with or without the established climbing paths, which points to the fact that this pair did not mind the increased number of climbers and visitors. Due to all above said we have undertaken steps towards baning climbing on the paths near the nests, and the climbers are regularly advised of this by oral or written information in order to protect the endangered species in the best possible ways. The last time *Neophron percnopterus* was spotted in Croatia in 1987, and this happened in Velika Paklenica. The activities connected with the poisoning, the reducing the number of cattle, and the hunters' shooting the predator birds resulted in the reduced number of abundance and even extinction and disappearance of raptores from Croatia. One of the most endangered species nesting in Croatia with about 80 pairs (Lukač, 1998), Eurasian vulture (*Gyps fulvus*), is disappearing from the NP at the end of 1999 (Lukač & Stipčević, 1997; Lukač, 1999, 2000). Until then 8 to 10 pairs nested in the Park, which accounted for as much as 10% of the total Croatia's population (Lukač & Stipčević, 1997). Following the fall in the abundance in November 1997 when 6-7 pairs disappeared from Mala Paklenica which was preserved from climbing activities. In the course of the following two years griffon nested successfully in Velika Paklenica. In 1998 1 pair nested, while in 1999 3 pairs were recorded nesting (Table 2). All pairs brought up their siblings which left the nests in mid-August. Owing to constant information service for climbers and climbing bans on the paths in close vicinity of the nests in 1997, 1998, 1999 good protection of this species was realized in this period. In 1998 the first feeding site was founded, and permanent information in the media raised the public awareness of the importance of this vulture species. Unfortunately, the poisonings in the Park surroundings sed the disappearance of this species from the Paklenica National Park in 2000 (Lukač, 2000). Since then nesting has stopped in the Park, and the signtings of griffons were sporadic, most often in September and in October while the young birds overflew from the Kvarner area. They usually fly in small flocks of 2-8 birds on their way from Kvarner to southeastern Europe or northern Afrika. Today, quite rightly, the griffon has become one of the most endangered species of raptor birds in Croatia, and the Park's Administration is trying to carry out the projects of resettling of this species. Other rock species (*Columba livia, Apus melba, Hirundo rupestris, Delichon urbica, Monticola saxatilis, M. solitarius, Sitta nemayer, Oenanthe hispanica, Phoenicurus ochruros*) did not significantly change their pairs' abundance, which leads to the conclusion that rock climbing and visits did not prove to be harmful for these species. The comparison of the values by individual years resulting from the Shannon-Wiener index, a slight decline of the value can be noted. Therefore it is proposed to continue the following of the rock ornithofauna with the aim of undertaking the appropriate protection measures for this interesting type of ornithofauna. The education of the climbers and all visitors has resulted in good results, and climbing bans in particular paths are observed, especially with reference to the protection of the rare and endangered bird species.

CONCLUSION

From 1997 to 2001 the number of visitors to the Paklenica National Park increased from 40,000 to almost 90,000. The total of 56 nesting birds, 18 of them petrophile species, were spotted in the Velika Paklenica canyon. The greatest impact of climbers was noticed with the *Bubo bubo, Alectoris graeca, Aquila chrysaetos* and *Corvus corax* species. The *Falco peregrinus* has nested constantly in the Velika Paklenica canyon since 1997. The measures that banned climbing proved to be successful in protecting the griffon, peregrine falcon and short-toad eagle. Due to an increased number of climbers *B. bubo* moved to the less frequented parts of the canyon. The same is true for the *C. corax* species. Only *A. chrysaetos* and *A. graeca* moved to the parts of the Park where the number is significantly lower. We propose that the Mala Paklenica canyon continue to be the climbing ban zone, and that the visits be constrained to small groups and exclusively accompanied by a guide. This part of the Park offers excellent oportunities for birdwatching of the petrophile types of bird communities.

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APPENDIX

Table 5. The 56 recorded nesting birds speciesr in the period 1997-2001 in Velika Paklenica canyon. Of all those 18 species account for the rock type of ornithofauna.

Years of investigations	1997	1998	1999	2000	2001
Species Number of species per year	38	33	40	34	40
1. *Luscinia megarhynchos*	48	30	40	35	47
2. *Sylvia atricapilla*	24	19	45	31	41
3. *Apus melba*	25	30	20	15	35
4. *Columba livia*	27	25	30	18	35
5. *Fringilla coelebs*	11	9	20	14	18
6. *Turdus merula*	19	9	28	22	18
7. *Delichon urbica*	7	6	18	15	16
8. *Monticola solitarius*	8	8	13	12	14
9. *Hirundo rupestris*	10	15	13	13	10
10. *Sitta neumayer*	7	7	10	9	8
11. *Motacilla cinerea*	3	5	5	5	6
12. *Oriolus oriolus*	2	1	6	5	6
13. *Parus palustris*	2	3	1	2	5
14. *Phoenicurus ochruros*	4	2	3	4	4
15. *Phylloscopus collybita*	7	4	3	1	3
16. *Parus major*	2	2	4	3	3
17. *Parus caeruleus*	0	3	4	1	3
18. *Sylvia melanocephala*	1	0	0	0	2
19. *Sylvia cantillans*	4	2	3	1	2
20. *Falco tinnunculus*	2	3	2	2	2
21. *Erithacus rubecula*	0	2	2	1	2
22. *Cinclus cinclus*	1	2	2	2	2
23. *Coccothraustes coccothraustes*	1	1	2	0	2
24. *Corvus corax*	2	1	2	1	2
25. *Lanius collurio*	3	0	1	2	2
26. *Sylvia hortensis*	3	0	1	1	1
27. *Picus canus*	0	1	0	0	1
28. *Sitta europaea*	0	1	2	4	1
29. *Cuculus canorus*	1	0	0	1	1
30. *Streptopelia turtur*	0	0	0	0	1
31. *Garrulus glandarius*	1	0	1	0	1
32. *Troglodytes troglodytes*	0	1	0	0	1
33. *Emberiza cirlus*	0	0	0	0	1
34. *Falco peregrinus*	1	1	1	1	1
35. *Serinus serinus*	0	0	0	0	1
36. *Parus ater*	1	0	0	0	1
37. *Picoides minor*	0	1	0	0	1
38. *Circaetus gallicus*	0	0	0	1	1
39. *Aegithalos caudatus*	3	0	1	2	1
40. *Emberiza cia*	1	1	1	0	1
41. *Oenanthe hispanica*	6	0	4	4	0
42. *Carduelis carduelis*	0	0	0	3	0
43. *Muscicapa striata*	1	1	1	1	0
44. *Sylvia curruca*	1	0	1	1	0
45. *Otus scops*	0	0	0	1	0
46. *Gyps fulvus*	3	1	3	0	0
47. *Bubo bubo*	0	1	2	0	0
48. *Accipiter nisus*	0	0	1	0	0
49. *Monticola saxatilis*	1	0	1	0	0
50. *Picoides major*	0	0	1	0	0
51. *Carduelis chloris*	0	0	1	0	0
52. *Acanthis cannabina*	0	0	1	0	0
53. *Picoides leucotos*	0	1	0	0	0
54. *Columba plaumbus*	1	0	0	0	0
55. *Jynx torquilla*	1	0	0	0	0
56. *Alectoris graeca*	1	0	0	0	0
TOTAL	272	202	300	234	303

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Visitor Management in the Wilderness Area Dürrenstein, Lower Austrian Kalkalpen

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Abstract: With its approx. 2.400 ha, the wilderness area Dürrenstein lies in the south-western part of Lower Austria in the northern Kalkalpen. The primary objective of this protected area, which is aiming at being recognised as Category I of the IUCN guidelines (Eastern part: Ia – strict nature reserve and Western part: Ib – wilderness area), is the sustainable protection of this region. However, as according to the said guidelines, human disturbance in the wilderness area must be minimised, yet educational opportunities (for Ia) and the well-being of visitors (for Ib) are part of the criteria for the mentioned categories, there could be potential conflicts between nature protection objectives and the activities resulting from an educational and recreational obligation (visitor management and guidance). As part of the LIFE project carried out for the establishment of the wilderness area, visitor surveys were made. They showed that the area around the Dürrenstein was mostly a regional recreation area. The number of visitors has remained widely the same in the last 50 years despite slight fluctuations. An increase in the level of popularity of the protected area, following the Category I recognition, could alter the situation. A possible consequence of a larger number of visitors would be the effect on habitats i.e. a disturbance of the wild animals living in the wilderness area. In particular hoofed game, red deer, deer and chamois but also rare birds such as capercaillie or black grouse could be affected. The result of increased disturbance is species extinction or in the case of hoofed game (forest)ecological damage, which cannot be tolerated in such a small wilderness area. In order to counteract the negative effects of a positive visitor development in the wilderness area, appropriate standards must be set for visitor management. For this, measures for visitor guidance should not only be applied inside the wilderness area, but also partly in its forefield. Only thus may the demands of nature protection on an effective visitor management be met.
Therefore, basic – from the point of view of the protected area management, very moderate – principles were fixed for the wilderness area itself:

- Visitor information on the protection objective
- Monitoring of the development of the recreational use
- Gentle guidance instead of orders (marked trails)
- Discussion of arising utilisation conflicts with all parties concerned.

INTRODUCTION

The "Wilderness Area Dürrenstein" with its 2.400 ha ensures the sustainable protection of a probably unique area in Central Europe, considering its "naturalness". This special natural area lies in the south-western part of Lower Austria, on the southern slopes of the Dürrenstein massif and near the Lower Austrian-Styrian border.

Its situation off larger housing development areas, the relatively low level of development and the decision taken already by Albrecht Rothschild in the 19th century to remove parts of the present protected area from use and thus keep it for the descendants, provide favourable conditions for the creation of a category I protected area following the IUCN criteria.

The realisation of a project as part of the EU-LIFE Nature Development Programme was the onset for the creation of this for Austria unique protected area. The objectives of this nature protection project were in particular (see Gossow, 2001):

- Securing areas by declaring it protected nature area;
- Establishing the first wilderness area of this kind following the IUCN criteria in Austria and setting up an efficient protected area management;
- Undisturbed development of primeval forests with at the same time improvement of the state of conservation;
- Taking stock of all habitats and species listed in the appendices of the Fauna-Flora-Habitat Directive or the Birds Directive, and as a result, drawing up a management plan. As an additional basis for the management plan, studies of the recreational use and the visitor

flow were made (see Gossow, 2001 and Muhar et al., 2001).

Because of the natural conditions and the way the property is distributed, the area will be divided into two sub-areas according to the IUCN criteria. The eastern area owned by the Rothschild family would be recorded as category Ia – "strict nature reserve", whereas the western part belonging to the Österreichische Bundesforste AG would be declared protected area category Ib – "wilderness area". Both categories have in common the aim of sustainable protection of an area, i.e. the development of natural processes based on the principle of non-intervention, respectively reduced intervention. Therefore any measure that does not serve the purpose of stabilising a nature-orientated balanced situation is forbidden. Thus because of the relative smallness of the "Wilderness Area Dürrenstein" a hoofed game management still needs to be carried out. However, because of the nature-orientated objectives, this game regulation cannot be assimilated to common hunting.

The main difference in both categories lies in the fact that in a wilderness area (Ib) the recreational use is of great importance, whereas in the strict nature reserve, access is only foreseen for scientific or educational purposes (IUCN & EUROPARC Federation, 2000). Management inside the individual areas has to be differentiated accordingly. The actual paragraphs in the IUCN guidelines (IUCN & EUROPARC Federation, 2000) state the following:

Ia – Strict nature reserve:

"To secure examples of the natural environment for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded."

Ib – Wilderness area:

"To provide for public access at levels and of a type which will serve best the physical and spiritual well-being of visitors and maintain the wilderness qualities of the area for present and future generations".

METHODS

Various scientific research activities were undertaken as part of the LIFE project "Wilderness Area Dürrenstein". Game ecological and ornithological studies were particularly relevant for visitor management. But an assignment on "Recreational use and visitor management in and around the wilderness area Dürrenstein" was also given to the Institute for Landscape Conservation and Spatial Planning at the University of Agriculture in Vienna. Simple but effective methods were applied to record visitors. With the help of the staff of the protected area administration and the forestry administrations, the following tasks were undertaken to record the number of visitors:

- Counting of visitors in the project area,
- Counting cars on the car parks and
- Examination of the summit- and mountain refuge logbooks.

Besides these systematic data recordings, surveys were also made on site. For this, interviews were carried out both with tourists and local actors. Based on these findings and on the conclusions resulting from them, some basic principles for visitor management were developed (Muhar et al., 2001).

EXAMINED AREA AND CURRENT VISITOR FLOW

Area of unspoilt nature

As already mentioned, the wilderness area Dürrenstein lies in the south-western part of Lower Austria, near the Styrian border, embedded in the Natura 2000 area of "Ötscher - Dürrenstein". The actual primeval forest Rothwald with its approx. 460 ha of primeval virgin forest lies on the south-east drop of the 1.878 m high Dürrenstein. Dachstein chalk and dolomite are geologically dominant. Climatically, with an average temperature of 3.9° C a year and a yearly precipitation of over 2.000 mm, it is a cool, sub-Atlantic climate. The dominant forest population of the protected area consists of a spruce-fir-beech forest with various combinations of tree types. Depending on the exposure, the tree limit is made of sub-alpine spruce forests, beech forests or a mountain pine belt, the Latschen.

Regarding the fauna, almost all Alpine species are represented, besides the brown bear, a very important species (Aste & Gossow 1996) and the lynx typical species like deer, chamois, snow hare, all Austrian types of grouse, golden eagle, peregrine falcon, white backed woodpecker but also common viper and Alpine newt, as well as rare xylobiontes such as the "Alpenbock" should be pointed out (Amt der Niederösterreichischen Landesregierung 2001).

The species, which due to their way of life could be under pressure without an adequate management, particularly with a change in the number of visitors, and for which the population, respectively the forest-game structure, could be at risk will be briefly characterised below.

<u>Hoofed game (deer, roe deer and chamois) (Völk & Wöss, 2001)</u>

The three above-mentioned hoofed game species have at least parts of their habitats inside the wilderness area Dürrenstein and have so far been hunted there. The management of hoofed game in the vicinity of the protected area influences of course the number and the retention period inside the borders of the protected area. Retention period, size and disturbance of hoofed game populations from hunting and in particular from visitors are, besides habitat quality, the factors that determine the use and habitat structure of hoofed game (e.g. damage caused by browsing animals) in an area.

Grouse (capercaillie, black grouse, hazel grouse and rock ptarmigan) (Wöss, 2001)

Within the borders of the wilderness area there are appropriate habitat structures for all four Austrian grouse types (see also Klaus 1991). This means that the wilderness area provides habitats for capercaillie, black grouse, hazel grouse and rock ptarmigan. Whereas the capercaillie population is dependent on the hinterland because of the size and the structure of the protected area, this natural jewel is of great importance for the rock ptarmigan and in particular for the black grouse.

Large birds (black stork, golden eagle, peregrine falcon and eagle owl) (Leditznig & Leditznig, 2001)

The wilderness area together with the surrounding Natura 2000 area of "Ötscher-Dürrenstein" is of over regional importance particularly for the black stork but also for the peregrine falcon (Hagemeijer & Blair 1997). Golden eagle and eagle owl populate the area in varying density. These rare birds were hunted over decades, centuries even, and were brought close to extinction. This is why especially these animals are very sensitive to any kind of disturbance.

Visitors

As part of the LIFE project, visitor surveys were carried out in the whole of the Dürrenstein massif under the authority of Prof. Dipl. Ing. Dr. Andreas Muhar. The results show that the Dürrenstein is a local excursion mountain with a relatively small trading area regarding visitors (see figure 1.). Naturally, there have been variations in the number of visitors during this time, but no significant changes over the whole period. This means that, contrary to the spectacular mountain destinations in the Central Alps, there has been no increase in the touristic use (Muhar et al., 2001).

One of the reasons for this "extensive" use could be that there is no public path, no road leading to this mountain and no lift or skiing slope fragmenting nature. For the individual sportsman, the "touring" one, there are no attractive runs on offer either. So far the actual protected area has only been marginally used by holiday-makers. This is partly due to the relatively bad accessibility following the realities of the natural environment, and also to the sometimes restrictive measures of the landowners. The lack of tourist infrastructure also contributes to it.

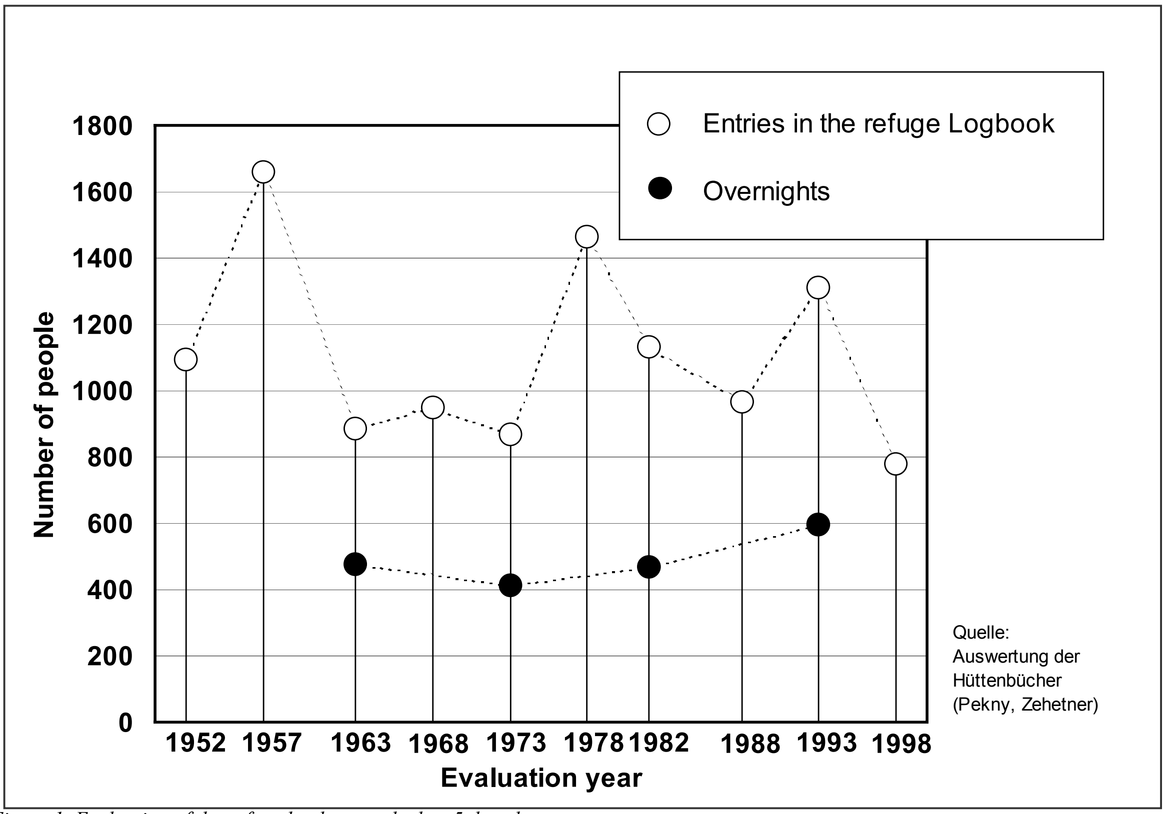

Figure 1. Evaluation of the refuge books over the last 5 decades

VISITOR MANAGEMENT IN THE WILDERNESS AREA

A certain amount of demands are being made of visitor management. These result from the IUCN guidelines (see introduction), the requirements of nature and species protection, the basic legal framework (forestry, hunting and nature protection law etc.) and finally from the regional resp. local realities or claims. Thus, the task of the future protected area management should be to develop a concept from all the submitted requests and documents, which would firstly meet the requirements of nature protection and secondly also offer visitors the opportunity to use the wilderness area in the most environmentally friendly way. All protected area managements, such as e.g. those of the Austrian or international national parks (see e.g. Donau-Auen, 1999 or Parks Victoria, 1998), are confronted to this "Gordian knot".

Consequently, the demands made of visitor management for the wilderness area Dürrenstein are listed below. At the end of this chapter, some basic principles for visitor guidance in the wilderness area are given, which will however have to be developed and compiled more in detail.

General expectations of the protected area administration from visitor management

Due to the increased popularity of the wilderness area following the LIFE project and a possible international recognition, an increase in the number of visitors is to be expected.

Nevertheless, the primary objective of visitor management should not be a quantitative increase of the number of visitors, which need not automatically be considered as negative, but rather a qualitative improvement of the offers and as a result also a guidance of the expected visitors. A high quality offer for tourists that is characterised by appropriate guidance measures also allows for an increase in the number of visitors and with it for a better acceptance of such an ambitious nature protection project. The management concept should ensure understanding for nature and for the measures taken to protect it not only from the local population but also from foreign visitors.

Thanks to visitor management the core zones of the wilderness area should become increasingly unburdened. At the same time those looking for recreation should be orientated towards the less sensitive border zones of the protected area, or even towards the areas surrounding the wilderness area. One particular measure would be the realisation of a "show" or "diversion primeval forest" not foreseen in the LIFE project. Such a forest, which would be comparatively easy to access and, from a natural environment point of view, less delicate, could contribute significantly to relieve the actual protected area without withholding anything from visitors. At the same time, the request for recreation and education would also be met. This means that an essential task of an efficient and integrated visitor management should be to provide sufficient information and thus visitor guidance in the forefield of the protected area.

To achieve this, the already available infrastructure should be used accordingly. For example, the so-called "Ybbstalerhütte" (refuge) on the border outside the wilderness area could be taken into account as an already existing excursion destination. A large part of the trails leading up to the Dürrenstein summit go past this station. Because of its central location this refuge would be very well suited as a starting point for excursions or for holding information events. The integration of this touristic "fixed point" into an integrated visitor management would not only relieve the wilderness area but also meet the expectations of the tourist boards and the municipalities.

Special requests from the specialist groups

<u>Demands made to visitor management by game biologists</u>

In order not to drive hoofed game away from the open areas outside the forest, a controlled recreational use should be carried out. This measure also allows reducing the shooting of hoofed game in the wilderness area. Visitor guidance should at least not lead to an increase in the vegetation use in the forest area due to the disturbance of wildlife.

<u>Demands made to visitor management by ornithologists</u>

The biggest danger for grouse and rock ptarmigan could come from an increasing and uncontrolled use following tourist interests. "Modern" recreational activities such as hiking or snowshoeing in particular can be considered as potentially important disturbances. Golden eagle, eagle owl and black stork use very large territories, resp. roaming fields and therefore the wilderness area with its 24 sqkm is too small to ensure the protection of these birds. The wilderness area should thus be the starting point for an extensive visitor management, which should result in a widespread quietening of the breeding areas and partly of the feeding areas.

<u>Demands made to visitor management by the region and tourism</u>

The very high nature protection value of the area is indisputable. However there is a demand for at least a qualitative plus of visitors through a wider choice of (marked) trails and a specific visitor programme such as excursions. From a tourist point of view, the wilderness area should therefore become part of a widespread tourism concept and with this, participate in adding to its value.

<u>Legal requirements</u>

Two issues must be considered in particular. For the area in category Ia – Rothwald, access is generally prohibited according to the regulation for nature protection areas. Thus, every access requires an approval from the competent authorities. Also according to the regulations of the ABGB (civil code) (par. 1319 and 1319a) the question of liability must be cleared. Any damage that could be caused to participants in an excursion on official paths by e.g. falling branches or suchlike will have legal repercussions. For this reason, one of the requirements of visitor guidance must be that any risk should be reduced to a minimum.

Concepts

As it appears from these rather diverse demands the future protected area administration will be confronted with some conflicts. Nature, as already mentioned several times, is the highest priority. All other measures must be taken under this assumption and subordinate to this objective.

The Dürrenstein area is touristically not so developed yet that visitors could represent major threats for the wilderness area. However, in order to be able to react in time to any changes, the project leaders set up the following very moderate basic principles for visitor guidance:

- Informing visitors about the need for protection through information boards or leaflets. The organisation of excursions also contributes to increase visitor information and acceptance. Acceptance is thus encouraged both with visitors and the local representative bodies.
- Monitoring the development of recreational use and reacting to any changes.
- Gentle guidance instead of prohibition (marked trails). This gentle guidance already exists due to the difficult spatial realities and partly because of the general legal conditions.
- Discussing any arising utilisation conflicts with all people concerned.

This strategy could only be developed because of the very positive initial situation of the touristic aspect only playing a minor role in this area. Nevertheless, depending on the different categories, the areas are being treated in a different way. The main flow of visitors and thus visitor management are found in the periphery of the protected area and in the category Ib protected area. In the category Ia area (Rothwald) there will be no access for recreational purposes. Only visits in the form of small, yearly-organised excursion groups could be envisaged.

The question of liability is a problem. In order to keep the risk as low as possible, the marked and authorised network of trails will only be displayed very sparingly, provided this measure is in accordance with the protection objectives.

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Actual Numbers and Effects of Recreational Disturbance on the Distribution and Behaviour of Greylag Geese (Anser Anser) in the "Neusiedler See – Seewinkel" Nationalpark Area

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Abstract: The Neusiedler See – Seewinkel National Park area is confronted with a remarkable increase in tourism and recreational activities during the last years. The „Koppel" area, situated on the eastern shore of the lake, is one of the most important breeding sites for Greylag Geese. Behaviour and distribution of the geese on the breeding site as well as touristic activities on the adjacent road leading along the „Koppel" were examined to investigate relations and interactions between the Greylag Goose population and tourism. Taking into account the excellent weather and breeding conditions in the year 2000 the results of the survey indicate a stable or even rising Greylag population, increasing numbers of visitors and high disturbance frequencies in the vicinity of the study area. The number of disturbances on the adjacent road seems to affect the suitability of the site in general, leading to a specific temporal and spatial distribution of the birds, whereas different disturbance qualities result in changes of the birds behaviour.

INTRODUCTION

According to the World Conservation Congress in Montreal in 1996 protected marine and terrestrial habitats with high biodiversity value are becoming popular tourism destinations throughout the world. Tourism is expected to double in the next twenty years and a growing share of that travel will affect national parks, protected areas and other nature conservation refuges. Many studies reveal that in the absence of appropriate policies and management plans, tourism to natural areas can be a handicap for nature conservation. Planning and supervision of tourism in areas with high ecological value is an important tool to avoid conversion to other forms of land use. Tourism represents a chance but yet a challenge for the national park management to raise the peoples interest for nature and to gain additional money for the targets of nature conservation.

The Neusiedler See – Seewinkel national park area supports a number of nationally and internationally important waterfowl species. The park is a border crossing nature reserve being situated partly on Austrian and on Hungarian territory. Beeing part of regional, national and international efforts for wildlife conservation, the Neusiedler See – Seewinkel national park plays a major role in promoting species preservation as well as habitat restoration. Due to overall increasing numbers of tourists in the recent time the aims of wildlife preservation in this area may interfere with the development of recreational opportunities. The geographic area under investigation, the region Neusiedler See – Seewinkel (Fig. 1), covers about 760 km^2 and is part of the peripheral region of the Western Hungarian Plain.

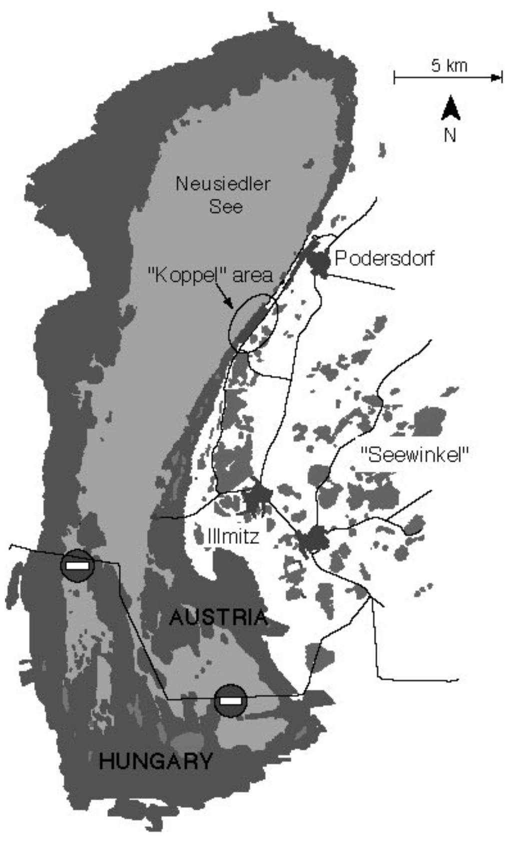

Figure 1.: Study area: Region Neusiedler See – Seewinkel and „Koppel" area.

A mosaic of agricultural land, vineyards, pastures with grazing management and shallow, mostly alkaline ponds with abundant rushes and salt marshes characterizes the landscape.

The size and the geographical position of the lake and the climate offer special conditions for watersport and other outside recreational activities. The close proximity to major cities like Vienna, Sopron and Bratislava as well as an excellent road network provide a sizeable catchment area. The lake's extent is 36 km in lengh and 7 – 15 km in width. It is the largest European pannonic steppe lake representing the western border of the Hungarian Plain. The national border between Austria and Hungary cuts through the southern part of the lake. Regardless of todays existing political borders the region constitutes an ecological entity and an interdependent habitat for the related fauna and flora.

About forty little inland ponds are forming the „Seewinkel" (Fig. 1), offering a great variety of different habitats for various species of the pannonic flora and fauna.

The national park Neusiedler See – Seewinkel was established in 1994 with an area of approximately 8.000 hectar on Austrian and almost 7.000 hectar on Hungarian territory (1 hectar = 100m x 100m). The Austrian part of the national park consists of several spatial connected and unconnected subareas, which have been implemented into the existing cultural landscape. Following the IUCN guidelines these areas are designated for different objectives of management and nature protection. A growing and improved network of roads for common traffic, farm workers and tourists (including biking routes) was established during the past years with various impacts on adjacent habitats of wildlife species.

The whole national park area represents a worldwide known bird sanctuary of international importance for migrating, wintering and breeding waterbird species. Greylags are endemic breeding birds and use different locations as breeding and resting sites in numerous amounts. The Central European Greylag Goose population belongs almost completely to the subspecies *Anser anser rubirostris* (Madsen et al., 1999). The main breeding and rearing areas are situated in the Hungarian Plain and the Northern Viennese Basin. In Austria the distribution of breeding Greylags is concentrated in the reed-belt of the Neusiedler See as well as among many inland ponds in the central part of the Seewinkel.

The road leading along the eastern shore of the lake connecting the villages Podersdorf and Illmitz was originally built for agricultural purposes. But the increase in tourism and outdoor recreational activities also result in rising numbers of seasonal visitors and therefore users of the road network in the national park area. Roads are representing guidelines in the landscape, concentrating and canalizing high numbers of potential disturbance factors which may affect adversely the adjacent wildlife refuges.

The study area, the „Koppel" (= paddock; ref. Fig. 2), is the most important breeding site of Greylags on the Austrian side of the nature reserve and is harbouring a variety of other waterbird species too (i.e. herons, ducks, waders). The site covers about 27 hectar and is a narrow strip of land laying between the road under investigation and the lake itself. The distribution and the structure of the vegetation on the „Koppel" is strongly influenced and modified by grazing horses. Short vegetation seems to suit the needs of Greylags as a good breeding habitat. It is well known that the quality and the quantity of an areas ressources including the density and growth of vegetation have an important influence on habitat selection (Bauernfeind, 1979).

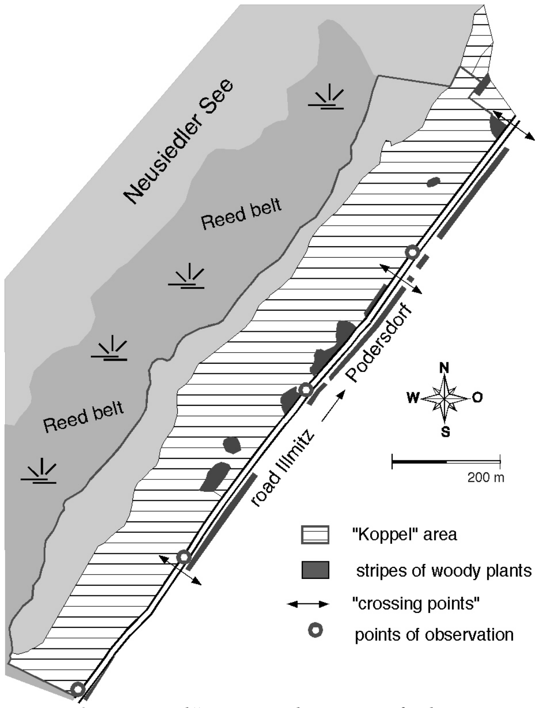

Figure 2.: „Koppel" area with points of observation and „crossing points" (for details see text).

The aim of the study was to investigate the impact of recreational disturbances on Greylags and their habitats in the national park Neusiedler See – Seewinkel. It is obvious that human induced disturbances can release changes in behaviour as well as in the spatial and temporal distribution of migrating, wintering and breeding waterbirds (Eichelmann, 1993; Madsen, 1985, 1995). Different species react in varying ways and have differing sensitivities towards disturbances depending on time, habitat and physiological constitution (Gold et al., 1993). Geese and especially Greylags are well known for their adaptability and learning ability (Kühl, 1979, Lorenz, 1979). In areas like the „Koppel" effects of habituation can even be stronger because the geese are familiar with the location and show a strong site fidelity. So if human disturbances result in a negative impact on geese in such areas, an even higher effect on other more sensitive bird species using the same or adjacent habitats can be assumed.

METHODS

The results of the study are based on field observations using binoculars (7x50) and a dictaphone for data recording. Field work was carried out between March to September 2000.

Climatic conditions (temperature, wind, rainfall), during the year 2000 were recorded using a weather station situated at the Biological Station in Illmitz. Information and data about the development of overnight lodgings and tourism were made available by the tourism information bureau of the village of Illmitz.

Number and type of touristic activities were recorded along the road touching the „Koppel" area. During days of observation counts were taken every 15 minutes. The following types of disturbances were distinguished: cyclists, cars, pedestrians, tractors, agricultural machinery, motorcycles, carriages, riders and dogs. Additionally movements on the lake (i.e. boats, surfers etc.) were observed.

Altogether 82 surveys were made to assess the spatial and temporal distribution of Greylag Geese on the „Koppel" area. Between 6 o' clock a.m. and 7 o' clock p.m. the positions of Greylag breeding pairs and non–breeders on the „Koppel" area were registered. For a better orientation and to define the position of the Greylag individuals on the site, characteristic landmarks and a 10 x 10 meter grid were used to provide distribution maps.

The behaviour of Greylag flocks on the „Koppel" area was also monitored. Four observation points were chosen and scans to take records of the activity pattern of all Greylag Geese visible were made every 15 minutes (Altmann, 1974). The following activities were distinguished: lying, sleeping (head on the back or under wings), grazing, alertness, agressive behaviour, running, flight (flying), flight (running) and comfort behaviour (e.g. preening). Activities that did not fit into the above-mentioned scheme were classified as „normal behaviour" (e.g. standing, inactivity).

RESULTS AND DISCUSSION

Due to the seasonal varying water level of the lake the mosaic of terrestric habitats on the „Koppel" is frequently changing. In general these facts are influencing and modifying the lenght of stay of the geese as well as the spatial distribution and the usage of the site.

Climate

Many of already published data proof the impact of climatic conditions on wildlife species in various ways (Frenzel & Schneider 1987, Gerdes 1994, Parz-Gollner 1991, Parz-Gollner & Farago 2000,). In the year 2000 the first goslings on the „Koppel" were noticed on 31. March. Taking into account 28 days of incubation, breeding must have started around 3rd of March in this year. A comparison with already published data (Bauernfeind 1979) indicates a good correlation between temperature and the start of the breeding period in the Seewinkel area. Low temperatures in February and March seems to delay the start of incubation by one or two weeks.

Greylag Goose population size

To estimate the size of the total Greylag population in the central part of the Seewinkel, 14 breeding and rearing localities have been controlled on 23 days during spring time. Breeding pairs and their goslings, as well as non-breeders were counted driving along on specific routes by car. A sum of 300 breeding pairs was recorded. This count does not include the birds on the western shore of the lake and comprises only a rough estimate of the population in the southern part of the lake. This zone is almost completely covered with a dense reed-belt and represents the core area of the park with the highest degree of protection. Additional observations in well-known grazing areas resulted in an estimated number of 700 – 800 non-breeding Greylags.

The various breeding locations in the national park differ in quality and size. Most of the localities hold an average of 20 breeding pairs, proving the „Koppel" site to be an extraordinary breeding place where a maximum of 60 families could be observed.

A detailed survey regarding the structure of the Greylag population was concentrated on the „Koppel" site. Table 1 shows the total number of Greylag families observed and the number of goslings per pair. Families with four goslings represent the most common family size.

Pair + goslings	N	%
P + 1	174	6,85
P + 2	651	25,6
P + 3	610	23,99
P + 4	672	26,44
P + 5	318	12,51
P + 6	113	4,45
P + 10	4	0,16
	2.542	**100**

Tab. 1: Family size with different numbers of goslings per pair on the „Koppel" area.

From March to May an average of 3,6 goslings per pair was counted. In June, two months after the appearance of the first goslings, the mean number dropped to 2,65 goslings per pair. According to literature, this result indicates a low gosling mortality rate of only 25% among the breeding population on the „Koppel" site (Litzbarski, 1982).

It has to be pointed out, that the warm temperatures and few rain during spring caused ideal breeding and rearing conditions in the year 2000. Considering these facts results indicate a positive trend of the Greylag population at the „Koppel" at least in the year 2000.

Assessing 300 breeding pairs counted with an average of 3,6 goslings per pair the breeding population is reaching a total sum of 1.680 family members. Adding the number of non-breeders the actual overall population size of Greylags Geese in the area surveyed can be estimated as approximately 2.400 individuals at the time of fledging.

The breeding success and the start of incubation mainly is dominated and influenced by climatic conditions and food availability. To assess the impact of tourism and recreational activities on the spatial and temporal distribution as well as on the behaviour of Greylags during their breeding time on the „Koppel", visitor counts were made and data about touristic activities were collected.

TOURISM

Tourism plays an important role and is of high economical value for the residents in the Neusiedler See – Seewinkel area. The administration of the national park therefore has to realize two partly contradictionary management goals. According to the IUCN criteria for national parks (IUCN/WCPA & WCM, 1994) the management on one hand should provide a refuge for spiritual, scientific, educational and recreational opportunities. On the other hand the adherence to stringent regulation of nature protection is obligatory.

An adequate visitor management in national parks needs to get sufficient information about the demographic data of the public. A well informed administration is able to react to visitor streams and trends in time and therefore is able to enhance the recreation value of an area within the scope of the nature protection regulations. The analysis of the touristic data results in four main conclusions:

1. The number of overnight stays is showing a clear rising tendency in the Neusiedler See – Seewinkel area.
2. Visitors prefere higher standards in accomodation but also a trend to more independence (e.g. appartments for families with children) can be noticed.
3. The number of visitors from Germany, the most numerous visitor group in former times, is constantly decreasing during the last 20 years. In return for this evaluation, more Austrian tourists spent their holidays in the Seewinkel lately.
4. An essential part of tourism, the one-day trips, has been neglected for a long time. Because of its spontaneity and mobility, this type of tourism is especially difficult to calculate.

The positiv touristic trends may interfere with the aims of wildlife preservation. High numbers of visitors should not only result in an uncontrolled extension of infrastructure. The national park administration has to develop solutions to enable a temporal and spatial organized visitor management - at least in highly sensitive areas of the national park.

Human induced disturbance factors

83 % of potential disturbances observed on the „Koppel" road were represented by cyclists, the share of cars is 8 %, the share of pedestrians is 6 %, tractors, motorcycles and other disturbance factors amount to 1 % each. The goose population on the „Koppel" is almost permanently confronted with high human induced activities along the „Koppel" road during daytime. In the morning hours and about noon peak numbers of more than 3 disturbances per minute and in the afternoon still about 2,5 disturbances per minute have been recorded. The maximum value was registered on 10.6.2000 around 10 a.m., when more than 10 people per minute were driving or walking along the road.

Reaction of the geese

Spatial and temporal distribution

In the morning hours some of the families with goslings were leaving the site by walking south and eastwards to neighbouring feeding grounds. This displacement of a varying number of families was taking place by using specific „crossing points" leading over the by humans frequently used road (ref. Fig. 2).

The crossing of the „Koppel" road by Greylag families was documented for the first time during this study in detail. This behaviour may be a result of possible increased intraspecific competition for food resources among the breeding pairs. Another reason for the regular displacement observed might be the avoidance of human induced disturbances taking place along the „Koppel" road, while the geese preferred to graze in more quiet areas with more or better food quality. Morning hours were preferred to cross the road to visit the adjacent grassland areas, where the geese spent time for grazing. The same distinct „crossing points" were also used by geese to return to the „Koppel", where the families stayed overnight.

In general, the geese kept a distance of approximately 60 m to the road in response to human induced high disturbance frequencies. The distribution of geese on the „Koppel" site however was not constant and depended also on the actual habitat quality and water level. In particular, the poorly structured dry grass area in the northern part and center of the „Koppel" site was normally avoided by geese families. Places behind stripes of woody plants featured the highest densities of Greylag breeding pairs. These wood-lots offered effective covering and also enabled the geese to graze in closer distance to the road than on the rest of the open „Koppel" area.

The distribution of various flocks of non – breeding Greylags on the „Koppel“ indicates a quite different usage of the site by these groups of birds. Non – breeders mainly used this location for assembling or as a roosting place during daytime. Only a few amount of the non-breeding birds used the „Koppel“ as a feeding ground.

Activity pattern

A remarkable detail in the dataset was the small amount of alertness (9,8%) and agressive behaviour (0,1%) among the group of breeding birds observed. The low level of aggression in the Greylag population seems to be a result of the local displacement to adjacent localities. Competition for ressources and space is the most common reason for intraspecific agression.

Breeding pairs in close proximity to the road tend to show alertness behaviour more often or even continously. These birds seem to achieve a „guard function“ for the benefit of the other family groups. Furthermore the knowledge of the „trained“ borderline formed by a fence, which very rarely is overstepped by visitors, as well as the possibility to retreat in the close reed-belt in case of danger, seem to be effective strategies by Greylags to ensure an adequate use of the Koppel site as a breeding area, - despite to the outstanding numbers of tourists observed. For further discussion normal behaviour, comfort behaviour, lying and sleeping are combined to the term „resting behaviour“.

The results of the „behavioural scans“ confirm again the different utilisation of the „Koppel“by Greylag breeding pairs and non-breeders. Figure 3 and 4 show the activity patterns between April and August. The non-breeders (Fig. 3) are resting most of the time on the „Koppel“ site whereas the breeding pairs (Fig. 4) spend most of the time grazing. The highest amount of alertness was registered in June and July, being the months with the maximum disturbance frequencies.

The most distinctive factor that emphasizes the special position of the „Koppel“ in comparison to all other breeding sites investigated, is the vast number of potential disturbances. No other area in the Neusiedler See – Seewinkel national park faces such high numbers of tourists in such short periods of time and on such a spatial resticted location. The fence which is separating the „Koppel“ site from the road forms a natural borderline. The crossing of this borderline by humans causes the families with goslings to react with a panic flight into the reed-belt and the non-breeders to leave the „Koppel“ by flying away. Despite to the Greylags distinct adaptability and well known learning behaviour some conclusions can be drawn. Assuming that the percentage of geese showing alertness is an adequate tool or indicator to describe the impacts of disturbances, the following „classification“ can be made:

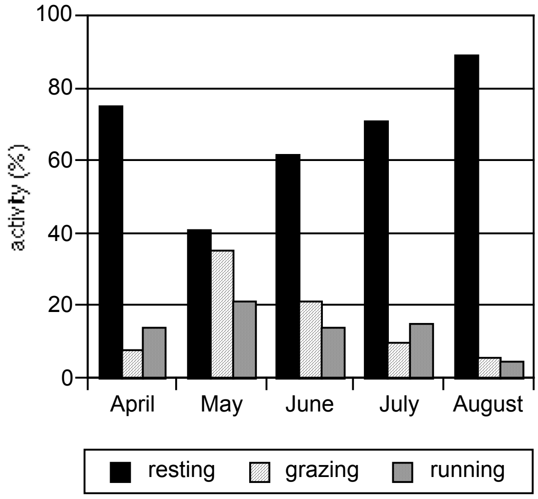

Figure 3.: Activity pattern (%) of non-breeders per month; observation period: April – August 2000.

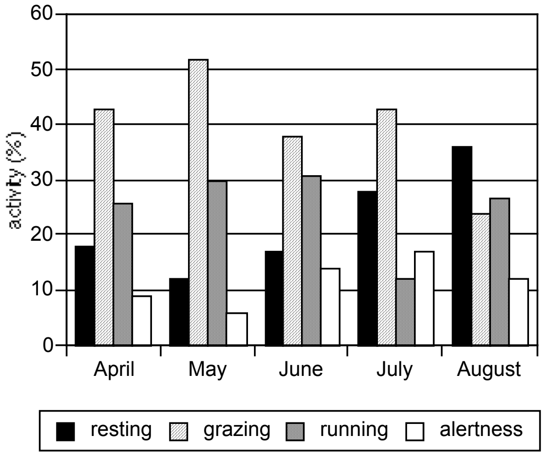

Figure 4.: Activity pattern (%) of breeding pairs per month; observation period: April – August 2000.

1. Boat traffic, water sport activities: The assumption that human activities on the lake entail stronger reactions by the geese than disturbance factors taking place on the land side, can neither be certified nor rejected. The fact is, that the man high reed-belt and the sloping area form a secure barrier where the geese can hide effectively.
2. Cyclists, cars, pedestrians: These three types of impacts constitute 97 % of overall recorded disturbances on the „Koppel“ road. In general the reaction of geese to very high numbers of tourists on the road resulted in the avoidance of the „crossing points“ and the geese stayed in a greater security distance to the road (spatial zonation). The decisive factor for Greylag families to walk over the street seems to be the period of time needed for crossing the road safely. A constant flow of tourist on the road inhibits the displacement behaviour observed. An exception to the habituation (adaptive behaviour) is the limiting value of 100 or more cyclists per 15 minutes. This high disturbance frequence triggers the geese to show alertness more often. In the past years such high numbers of visitors were an exception, but with

seasonal rising numbers of tourists this stress-situation for the geese will increase.

3. Tractors and motorcycles: These two categories cover only 2 % of all disturbance factors but caused the second largest change in the activity pattern. It can be assumed that the increased alertness of the geese is a reaction to the loud noise of motor engines and the rareness of this type of influence.
4. Carriages, riders and dogs: Only 1 % in each case of overall noted disturbances are covered by these categories. Animals like dogs and riding horses caused the most intense flight reaction by geese. In some way the reaction to horses is surprising because the area is frequently used as a paddock.

CONCLUSIONS

Human induced disturbance can cause birds to abandon a breeding, grazing or resting area. If an area of high ecological value is avoided because of „disturbance", these human caused impacts are equal to habitat loss. The „Koppel" area represents on one hand an optimal breeding and rearing area for Greylag Geese. On the other hand the area is strongly influenced by touristic activities on a road leading along the site.

Results of data analysis give evidence that the number of disturbances on the „Koppel" road seem to affect the temporal and spatial distribution of the birds and the general usage of the site, whereas specific disturbance types induce behavioral changes.

Compared to existing literature data the surveyed tourism frequencies with an average of three human induced disturbances per minute are high.

Greylags prefer the type of habitat as actuallly can be found on the „Koppel". Stripes of woody plants and reed are important habitat structures. The combination of low temperatures and severe wind conditions forces the geese to feed in these wind-sheltered zones which are also used as a shelter against human induced disturbances. Open areas where no habitat structures or vegetation can be found are in general avoided by geese.

The „Koppel" site seems to be a perfect breeding and rearing area for Greylag Geese. Despite to the high number of human induced disturbances the geese are able to compensate these impacts in various ways. Effects like habituation, changes in activity pattern, learning behaviour and adaptions in spatial and temporal distribution on the site have been observed.

Ways to define the numbers and expectations of „one-day visitors" must be found. As a solution random sample interviews of people in the national park area should be taken. Visitors who stay over night or longer, visitors on a one day trip and the local people visiting the national park area can be counted and interviewed. People involved will be informed and can improve their knowledge about the park and wildlife protection.

The overall breeding conditions for Greylag Geese in the Neusiedler See – Seewinkel national park suggests a positive trend of the breeding population. It can be expected that especially during the rearing time the geese will continue to expand the habitat use in adjacent feeding areas. Breeding and feeding grounds are often divided by roads with high traffic frequencies. Mechanisms have to be found so that breeding pairs and goslings are able to cross streets safely and without disturbances. At least in ecological highly sensitive areas a temporal and spatial organized visitor management has to be implemented.

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Integrating Tourism and Grouse Habitat Protection in the Black Forest

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Abstract: This project illustrates methods for combining tourism and conservation. The project area of 8.000 hectares is a popular central European tourist attraction. It is also NATURA 2000 area and habitat of the hazel grouse (Bonasa bonasia L.) and capercaille (Tetrao urogallus L.). Grouse species are used as indicators for environmental features such as diversity, natural character and beauty of the landscape. A catalogue of integrated actions was coordinated in a two-phase method based on detailed inventories of the landscape ecology, tourist use, the habitat and distribution of grouse species:
The first step was to tune the measures for habitat improvement within a spatial concept with rest zones for wildlife in which silvicultural measures should improve habitat structures.
The second step was coordination with local authorities and NGO's to concentrate and improve the tourist infrastructure outside these rest zones.
The result of the project (begun in 1998) has been a win-win-situation: improvement of habitat structures as well as improved offer for tourism. Conservation and the utilization of nature are no longer regarded as contradictory. The dynamic of a spatial concept based on scientific results allows all the various interest parties to work together. The project is supported by EU's "LIFE-Nature" programme.

INTRODUCTION

The Feldberg area is a popular tourist attraction in central Europe. Tourism is the primary source of income for local communities. Besides agriculture and forestry, summer and winter sports and other recreational activities lead to a variety of environmental impacts. In addition, the Feldberg area in the southern Black Forest must be seen within the context of nature conservation of special significance. In this area, rare subalpine flora and fauna have found unique sanctuaries outside the Alps. Hazel grouse and capercaille, endangered species in central Europe, also still live here. A large refuge and an EU bird preserve (SPA) have been established to protect this valuable landscape. It has also been suggested that the whole region be granted NATURA 2000 status.

User conflicts develop between species and habitat protection on the one hand and tourism on the other. The central aim of the project was not to simply to leave tourism and conservation as contradictory viewpoints but to harmonise them. In the Black Forest, hazel grouse and capercaille are used as indicator species for such environmental factors, and thus for the extent that nature has remained intact. If abundant numbers of these species can be maintained on a long-term basis, a successful harmonisation between natural environmental and cultural touristic use would be implied. Such a combination could be considered as a fundamental requirement for tourism and sports in the countryside.

A project programme was designed to realise these objectives. Supported by the EU's LIFE programme, the "Integrated Habitat Protection for Grouse in the Black Forest" project was established. It is co-ordinated and conducted by the Forest Research Institute (FVA). It was approved by the European Commission in 1998 and was set up to last for four years. Actual implementation is to be exclusively supported with various grants. Support from forest owners and the representative organisations of interest groups is needed for long-term activities extending far beyond the immediate project goals. The current grant consists of financing from the EU's LIFE Nature programme (50%), the State Forest Service via FVA (40%), and the Conservation Service in Freiburg (10%).

THE PROJECT REGION

The project region is in the southern Black Forest around Feldberg. The total area of 8,500 hectares is about 80% forest. All types of forest owners are represented: 50% is state-owned forest, 38% council forests, and 12% is privately owned. The lowest areas have a height of 630 m above sea level, while the 1,493-metre-high Feldberg itself is the highest point.

The forests mainly consist of spruce and beech, characterising the landscape in the most varied of combinations. These mixtures are mainly enriched by fir trees and, in younger forest stands, through a variety of deciduous trees. Pine and other conifers are less commonly present.

The Feldberg massif is also one of central Europe's most intensively used regions for tourism and sport tourism. In summer, the region is extremely popular among hikers, mountain-bikers, and others seeking recreation and relaxation. An all-season ski-roller facility with a biathlon shooting range is available for competitive sports. In winter there are numerous ski-runs and lifts for the alpine skiers. The region also has a dense network of cross-country ski-runs on which numerous national and international Nordic ski competitions, including biathlons, are organised. Winter hiking and snowshoe hiking are forms of recreation carried out in some parts of the region.

METHODS

In order to achieve the project objectives, a broad interdisciplinary approach was chosen, consisting of the following elements.

1. Inventories of the habitat structure, the occurrence of grouse, the touristic infrastructure.
2. Mapping, data management and evaluation using geographical information systems (GIS).
3. Development of a catalogue of integrated measures co-ordinated with the Forest Service , local authorities and NGO's.
4. Implementation of integrated measures involving concepts of silviculture and visitor steering, in particular.
5. Control verification of results and monitoring.

GIS application

The numerous questions posed by analyses of ecological systems required rapid access to large amounts of data, the automation of problem-oriented evaluation levels, and the display of results in thematic maps and tables. Geographical Information Systems (GIS) fulfilled the demands for evaluation and the display of results. The digital collection and evaluation or display of space-related data was carried out by means of ARC-INFO by ESRI, and IDRISI. The data obtained was laid down in an Access database that converted information from cards into digital form and integrated the appropriate subject data in the database. The type and intensity of land use was derived from Landsat-5 data and from the state surveying department's topographical cartographic information system (ATKIS).

Habitat analysis

Mapping of the habitat structure involves collecting habitat-determining structural parameters. These were derived from both the characteristic forest structures and the specific habitat requirements of the hazel grouse and capercaille regarding food and cover.

A two-stage process was developed:

- First, the selected habitat parameters were collected without influencing their evaluation.
- In the second step, the habitat parameters were linked to one another depending on the particular question involved and submitted to an evaluation matrix.

Thus this method differs from other evaluation processes that directly carry out evaluation-oriented mapping of forest areas as suitable or unsuitable. The procedure developed consists of the following steps:

The area under investigation was divided up into "habitat patches", as far as possible not <1 ha or >50 ha. That part of the habitat of a species that was homogeneous with regard to the habitat factors to be evaluated was defined as a habitat patch. When possible, delineation of these patches was oriented upon the official borders of the forest stands.

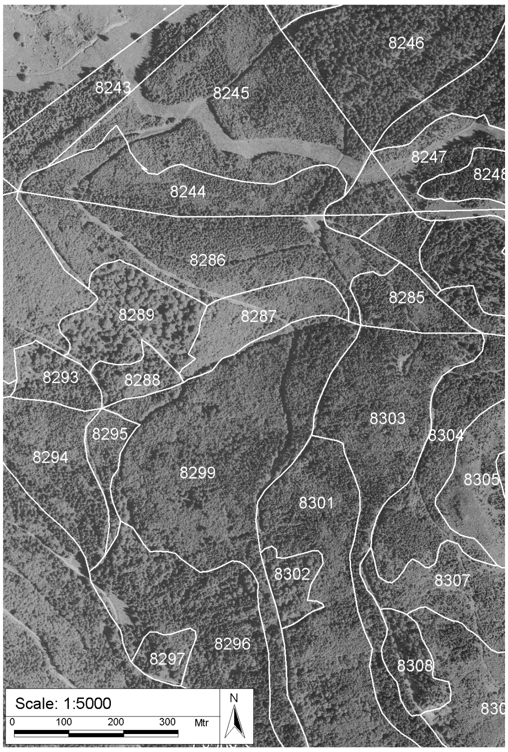

Figure 1.: Habitat analysis by habitat patches (Suchant, 2001)

The method used can be described as follows:

- The habitat parameters of each habitat patch were collected terrestrially.
- The geometrical data were obtained in the GIS. Each habitat patch was assigned a number, allowing both linkage to the parameter data of the habitat structure mapping and to other project data.
- The parameter data was brought together in the form of an ACCESS file.
- Coverages could be created for each habitat parameter by linking the geometrical data with the parameter data.

- The calculations were carried out using STATISTICA statistical software.

Habitat evaluation

First, indicators were evaluated for suitability as a food-base and for providing protective cover. The defined indicators were then linked to one another and aggregated in a second stage.

Varying habitat requirements, related to gender and season, were taken into account during the first evaluation by differentiating between 3 variants ("capercaille winter", "cock summer" and "hen summer"). Differentiation between cock and hen in summer is necessary as hens need more food and protective cover during the incubation and rearing periods. The indicators were not weighted but classified as suitable or unsuitable. Patches that were neither suitable nor unsuitable were labelled as neutral habitat patches.

Surveying grouse distribution

In the project area, regularly collected recording forms are used for the information obtained directly and indirectly by the various forest managers and other observers. The recording process involves the forest managers passing on the observations on the recording forms every six months in June (for the winter period from 01.12. to 31.5.) and December (for the summer period from 01.6. to 30.11.). This type of systematic recording has been in action since summer 1996.

In addition to the direct observation of an animal, indirect proofs can be obtained. These methods include dusting places, feathers, tracks and droppings. Provision of the location allows an unambiguous and thus also cartographic representation of the recorded event, so that it can be allocated to the habitat patches of the habitat mapping. This also permits the success of measures for habitat design to be assessed with a locational reference.

The touristic infrastructure and its use

Surveying, representation and analysis of the existing touristic infrastructure, and its use in terms of time and space was also carried out with the help of a GIS. To this end all point, line and elements of tourism infrastructure within the project area were first identified and digitalised. In the process, a distinction was made between summer and winter use. A further differentiation was carried out regarding the type of touristic use: cycling, hiking, winter hiking, cross-country skiing, alpine skiing and cross-country skiing tours. Furthermore, all hotels, cabins and lodges, etc. and all car parks were registered. Topographical and thematic maps were involved in addition to our own mapping.

As mentioned above, the intensity of use was determined in addition to surveying the use of space. Photoelectric switches were used to gain 24-hour, year-round values for use intensity at frequently visited recreational nodes. The distribution of visitors in the project area was determined using the multi-moment recording method developed by KARAMERIS (1982). Moreover, a visitor questionnaire styled on ATTESLANDER (1995) proved effective in determining the times of recreation, motivation and aims. Surveys and observations made by the locally responsible regional managers were validated using the results of POLENZ (2000), who in Autumn 1999 carried out a visitor questionnaire and moment recording in the project area. In addition, a study by the Workgroup for Landscape and Environmental Planning (AGL) (1995) on the temporal and spatial use of the Feldberg peak within the project area was evaluated. Its results confirm the trends observed in our own surveys and by POLENZ (2000).

Grouse Species as Indicators

An important aim of the project is to continue using the incidence of the grouse species as indicator species for a high level of biodiversity and as characteristic species for the individuality and beauty of the natural landscape in the Black Forest. The significance of the capercaille as an indicator for a high level of **biodiversity** was demonstrated by SUCHANT (2001), who treated the varied structure of its habitat as an indicator for diversity and not the incidence of the species itself.

The importance of grouse as an indicator for the **individuality of the natural landscape** is a reference to the characteristic forest habitats of the capercaille and hazel grouse. When one considers the entire European distribution of the two species it is clear that they are mainly present in the large closed forest areas of boreal climatic zones. In central Europe their distribution pattern correlates with areas of highly forested mountain ranges. According to SUCHANT (2001) there is a strong horizontal differentiation of incidence in mountain ranges. Capercaille in particular are most heavily concentrated in montane and high montane locations. The project area includes such highly forested montane and high montane sites of a central European mountain range. Thus the incidence of the grouse can be taken as an indicator for this area of forest that, as a result of local climatic conditions, exhibits specific forest structures.

The **beauty** of the natural landscape is judged according to anthropogenic standards of evaluation. The capercaille and hazel grouse are considered to be the "remnants" of an original and thus "more beautiful" nature. The symbol of the so called "majestic cock" symbolises, as almost no other animal could, a natural forest landscape, not destroyed by mankind. These associations were made clear during a meeting of experts that took place within the framework of the project. On the question of why capercaille, in particular, should be protected there was unanimous agreement among all the experts present: "We protect capercaille because we like them"!

Not least is the consideration that given all the anthropogenic utilisation of forests (wind power generation, tourism in all its forms, buildings, etc.) grouse in their areas of incidence can be used as indicators for the destructive potential of human intervention in nature.

Co-ordination process

A two-stage approach was developed for project implementation: First, as a result of its prime importance, the relationship between grouse population development and the existence of sufficient suitable habitat structures was demonstrated. Building upon this, the problem of superimposing the spatial and temporal use of forests by wild animals and, simultaneously, by humans seeking recreation, relaxation and sport. It was, however, assumed that a certain level of disturbance represented no threat to populations of grouse species in the presence of sufficient suitable undisturbed habitats.

A two-stage process for solving conflicts was developed based on these considerations (Fig. 2):

- During the first phase, the Forest Service was won over as a partner for implementing habitat improvement over a large area. Private and community forest owners were convinced of the need for implementing habitat-improving measures by means of a trust-building information campaign and visits to demonstration tended areas. As a result, the implementation of measures could be started on straight away.
- A visitor steering concept was worked out jointly by all the project partners, i.e. with representatives from the areas of sport, tourism, local institutions, conservation and the Forest Service. The agreed aim of this concept is the creation of ideally suited quiet zones for wild animals and the simultaneous steering and concentration of touristic use of space in particular areas, within which the particular touristic infrastructure is to be improved. Visitor steering is thus qualitative and not restrictive.

As a result of the collaboration with the Forest Service, and the agreement on all the measures for steering visitors with the above-mentioned project partners, the interests of all those organisations concerned with protecting and using the area could be integrated.

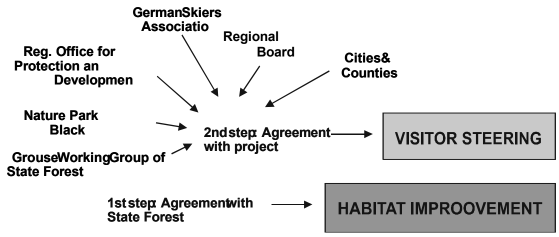

Figure 2. Two-stage Co-ordination

SELECTED RESULTS

Habitat Analysis

A first overview of the existing habitat structures was provided by assessing the types of tree species present in the area (Fig. 3).

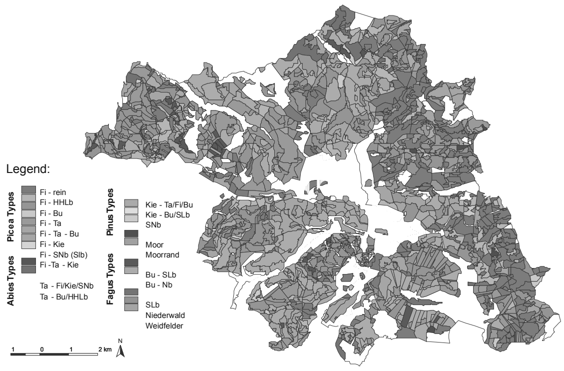

Fig. 3: Tree species distribution

The illustration provides information on the following properties:

- The variety of stand types with widely differing mixtures of tree types.
- The mosaic structure with highly varied individual patch sizes.
- The heterogeneous distribution of the stand types: there are concentrations of similar stand types in certain areas, e.g. beech-dominated stands in the west and the spruce-dominated in the east.
- No dominance of one stand type over larger areas.

The evaluated habitat parameters could all be displayed in a similar way. A habitat evaluation differentiating between summer and winter was carried out in order to gain an overview of the suitability of habitats for the capercaille and hazel grouse.

The results are: 10 % of the patches offering neither food nor cover. On the other hand, the proportion of habitat patches offering both food and cover in winter is very low (10%) while in summer, with more than 1/3 of the patches, it is clearly higher. Correspondingly, the amount of neutrally evaluated habitat area is very high (winter 82%, summer 58%). This indicates a very high improvement potential for improving food-bases and / or protective cover.

Grouse distribution

A total of 875 cases of capercaille evidence were found during the 8 survey periods: 460 for cock capercaille (52% of all sightings), 200 for hen capercaille (23%) and 215 proofs of indirect evidence (25%). In addition 14 chick groups were observed.

The distribution of direct sightings can be characterised as follows. There were always more observations of cocks than hens. There were strong fluctuations in the number of observations made during the different periods. Thus 98 capercaille observations were recorded in summer 1996, but only 12 in winter 1999.

There were between three and four evidences of chick groups during each of the survey periods. The relationship between hen : chick groups observations, however, varies: summer '96: 12:1, summer '97: 6:1, summer '98: 9:1 and summer '99: 10:1.

If one relates the sightings to the observation location it becomes clear that in the majority of habitat patches there were only one or two capercaille sightings in the 8 survey periods (cock, hen or indirect evidence). Only in 16 habitat patches were there more than 10 sightings in the 8 survey periods. The maximum number of sightings in one habitat patch during one survey period is 25.

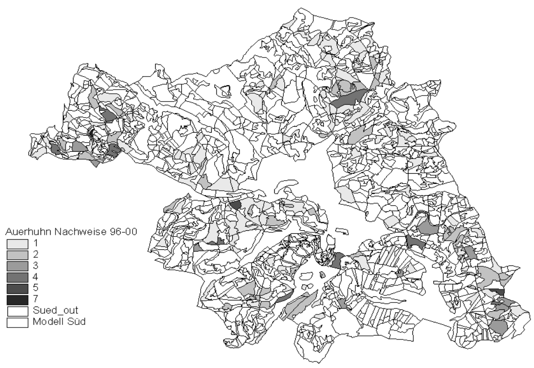

Fig. 4: Spatial distribution of grouse proofs

Fig. 4 shows how the capercaille sightings are distributed. There is also a correlation between sightings and altitude in the model region. Thus, for example, 31% of sightings were made between 1200 and 1250 m above sea level. In comparison only 16% of the habitat patches of the entire model region are found at this height level. The vast majority of sightings (approx. 95%) took place at above 1050 m, i.e. roughly in the model region's high montane areas. Below 1050 m there were very few and below 950 m only single sightings. Spatial relationships to touristic use can also be seen in this distribution dependent on high altitudes. Touristic use too is almost exclusively to be found in the highest locations.

The touristic infrastructure and its use

As a result of the opportunities presented by GIS evaluation it was possible to show seasonal and annual spatial and temporal touristic utilisation in the project region separately according to the various types of use and, in a further step, to superimpose upon it the results of the habitat structure mapping and the stand monitoring for the grouse species. This allowed overlapping use, and the resulting conflict potentials and improvement potentials for conservation and tourism, to be clearly shown.

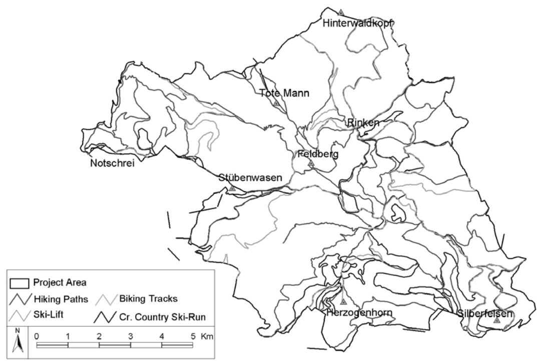

Fig. 5: Touristic infrastructure

With regard to the spatial distribution of touristic infrastructure shown in Fig. 5 it is worth noting that

- there is a closely meshed network of paths (182 km long = 21 m / ha),
- numerous additional mountain-bike routes run through the region (71 km = 8 m / ha),
- the cross-country ski-runs totalling (92 km = 11 m / ha) are, to some extent, already very well concentrated,
- the centre, and thus the highest point, of the region is characterised by alpine ski sports.

As a whole, the intensive and widespread touristic or sport-touristic utilisation of the project region can be seen very well as a result of this evaluation.

The intensity of utilisation is shown in Fig. 6 using an example.

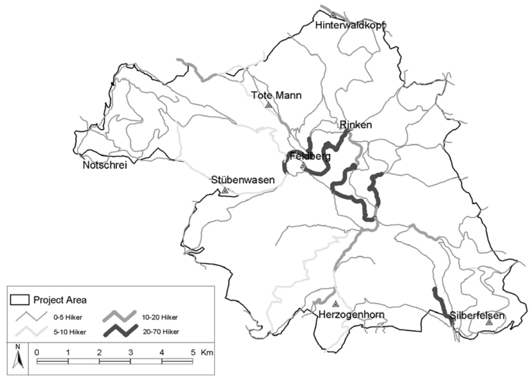

Fig. 6: Intensity of Utilisation in summer 1999 (POLENZ 2000)

The 1272 hikers counted use the region very differently. Thus there is a clear concentration on paths both leading to and on the Feldberg peak. In the Feldberg region it is the higher areas that are particularly popular amongst hikers. This statement is also supported by the results of the questionnaire. Hikers obviously appreciate the treeless peak of the Feldberg for the views they provide.

When considered as a whole, evaluation of the touristic utilisation of the project area reveals, among other things, the preferred use of the highest areas. Thus the higher locations are preferred by the grouse and by the recreation-seeking and sport-oriented humans. This is what results in the need for an integrative spatially planned solution of possible conflicts. This was implemented in the project by means of a number of interconnected measures.

Planning the measures

The measures were planned on the basis of the answers provided to the following questions:

- Where are the grouse species capercaille and hazel grouse found?
- Where are the suitable season-dependent habitat structures for the grouse species?
- Where is there overlapping between spatial and temporal use by the grouse species and the touristic infrastructure, and it's spatial and temporal use by humans?
- Where are there well-founded conflicts of use between the habitat needs and spatial and temporal use by the grouse species on the one hand, and legitimate forestry use on the other?

In an initial move, using the knowledge gained by answering the above-mentioned questions, zones within the project region where grouse were mainly found were defined (Fig. 7).

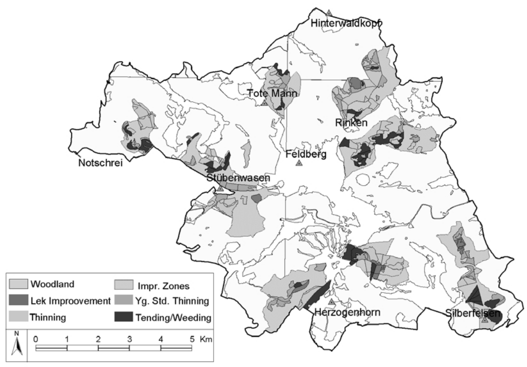

Fig. 7: GIS-based management of silvicultural measurements

On the basis of the results of the habitat structure mapping forest stands were selected in these zones that had only partly suitable or unsuitable habitat structures. For these forest stands concrete silvicultural measures for habitat improvement were derived for the grouse species and translated into work contracts based on the results of the habitat structure mapping. In a second step, conflict potentials were determined by overlaying the digital time- and space-related data on the distribution of the grouse in the project region over the touristic infrastructure and its use. In a further step, GIS-supported scenarios for an optimum exploitation of landscape-related ecological and touristic improvement potentials were developed. These are intended to create ideally suited and undisturbed quiet zones, as well as zones of steered and concentrated touristic activity in areas with qualitatively improved infrastructures, and have led to the creation of concrete planning variants for steering visitors (Fig. 8).

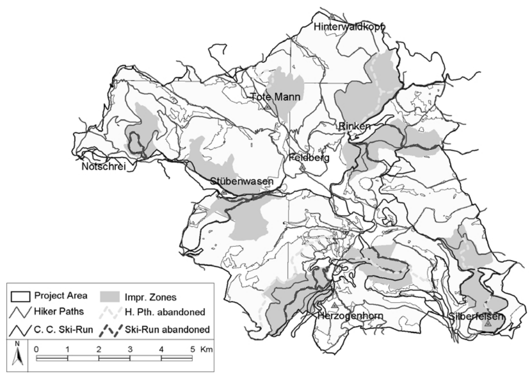

Fig. 8: Planning map of concentration of touristic infrastructure thus improving the situation both for wildlife and tourists

Practical implementation

On the basis of the planning of measures at the forest stand level regarding the main areas of grouse distribution, targeted habitat design measures were undertaken outside the mating season and incubation and rearing periods and before the onset of winter. Each of the forestry measures were modified to meet the special habitat needs of the two grouse species depending on the original state of the forest, and agreed to by the local forest manager responsible. Specialists also gave training courses for the forest managers. The practical implementation of the planned measures was carried out by either the forestry workers of the state's forestry administration, by specially qualified companies, or by voluntary groups. All the measures implemented were, like all the digitalised and other data collected in connection with the project, documented in analogue and digital form at the stand level. This provides the basic foundation for checking the success of these measures later at the stand level.

The following measures have been implemented or initiated during the last three years:

- 300 ha Habitat-Improvement
- 33 km Displacement of hiking / cross country paths
- 15 km Improvement of hiking / cross country paths

CONCLUSIONS AND OUTLOOK

In consequence of the convention of biodiversity in Rio 1992 and the resolutions of the "Conference for the Protection of Forests in Europe" in Helsinki 1993, all signing states have to give proof of the sustainability of their forest sectors. As a monitoring instrument, 6 criteria and 27 indicators were agreed upon and formally accepted at the “first expert level follow-up meeting” in Genf in 1994. Biological diversity is one of the 6 criteria that should be improved in managed forests, at least kept at the current status quo. Despite the definition of five indicators for the assessment of biodiversity, it is not successfully integrated yet into the monitoring of sustainability in the management of forest ecosystems (ELLENBERG 1997).

This deficit is fairly well-known by silviculturists and is assumed to be compensated by the use of “red data books”. Because the use of such lists of endangered species is still lacking applicable temporal and spatial species-related information, the selection of target species and indicator species has gained importance (ELLENBERG 1997, ALTMOOS 1997, FLADE 1994).Capercaille (Tetrao urogallus) is widely accepted as an indicator for high structural diversity and species richness in montane and upper montane mountain ranges in central Europe (ADAMIC 1987; VALKEAJÄRVI and IJÄS 1986; MOSS et al. 1991; BAINES et al. 1995; BESHKAREV 1995; STORCH 1995).

Suchant (2001) shows that the use of habitat parameters of indicator species, e.g. capercaille, offers an operational silvicultural tool to improve and monitor biodiversity in intensively managed forests. At the same time it is not necessary that 100% of a region has to fulfil optimal habitat structures. Depending on the surface area of habitat potential and the targeted number of a minimum viable population a percentage of 30 to 50% of suitable habitat is enough for a viable population.

Therefore it is not necessary, that tourism has to be restricted totally in NATURA 2000 areas, but only in certain zones. Where these zones should be situated depends on the actual situation (habitat structure, distribution of indicator species, landscape ecology, touristic infrastructure, aims of conservation, aims of tourism). At the same time tourism can be concentrated and improved outside these zones.

The presented project shows an example, how the targets of nature conservation, especially biodiversity, and the targets of tourism can be fulfilled in a win-win-situation. Therefore every interest group can agree with the concept. The practical implementation shows the success of such an integrated project. It is an example for the integration of nature conservation and nature use by tourism. Especially within the NATURA 2000 network in Europe such integration is necessary both for conservationists and tourism managers.

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Perception and Reality of Conflict: Walkers and Mountain Bikes on the Queen Charlotte Track in New Zealand

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Abstract: A variety of social and physical impacts are attributed to mountain biking. In many cases, the perception of these impacts differs from the reality of on-site experiences. This distinction is explored in two ways. First, a brief review of impact issues associated with mountain bikes is carried out. Second, results are presented from a survey of 370 walkers on a multi-day natural track where biking has been allowed on a trial basis. Walker opinions are surprisingly positive toward bikes. These opinions are found to be more positive among those walkers who had actual encounters with bikes. By contrast, more negative opinions were found among those who had no such encounters. Such distinctions between perception of a conflict and the actual outcome from an experience have important implications for park managers responsible for providing a range of different recreation opportunities.

INTRODUCTION

Like most other government departments managing conservation areas, the Department of Conservation (DOC) in New Zealand has dual responsibility for protecting environmental values and allowing appropriate recreational uses. With this responsibility, the DOC manages almost 30% of New Zealand's land area, most of which is, by international standards, highly protected natural environment of high wilderness quality. Development of roads is not normally allowed, and as a consequence, recreation use has traditionally been limited to foot access through an extensive network of backcountry walking tracks and unmarked wilderness routes.

While rough surfaces and challenging terrain prevent bike access to most of these tracks, there are many that could be ridden by very fit and technically experienced riders. A smaller proportion would be relatively easy to ride by less experienced riders. These are the types of tracks providing the range of natural environment and challenging single-track riding experiences most sought by off-road riders (Cessford, 1995b; Hollenhorst et al., 1995; Hopkin and Moore, 1995; Goeft & Alder, 2000; Symmonds et al, 2000). The range of riding opportunities is one of the main reasons that such natural settings have experienced such biking growth (Hollenhorst et al., 1995). Such spread into a wider range of previously walking-only tracks is a world-wide trend, and the issues arising provide similar challenges to park managers everywhere. One of the main options available to managers has been to incorporate bike use through allowing shared use tracks. This option is often attractive to managers as it makes more effective use of existing resources, limits costly replication of facilities, avoids additional environmental effects from new track development, and in the case of areas with limited new-development capacity, may be the only feasible course available. Woehrstein (1998) notes this latter point is often the case in Europe for example.

While national legislation in New Zealand restricts bikes to formed roads in the national parks, biking is otherwise recognised as a legitimate activity in most other protected lands. Here the DOC does designate some shared tracks for walking and biking, where such use does not exceed acceptable levels of social, physical or ecological impact. A key New Zealand example is the popular Queen Charlotte Track (refer www.qctrack.co.nz for description). It is open for walking and biking all year, apart from partial closure to bikes during the peak-use summer season. Provision for shared use here has been opposed by some walker advocacy groups, and is characteristic of recreation conflict situations. This paper explores some of the impact issues managers face in providing such shared biking/walking tracks, and reports on a recent survey of walker perceptions of biking on this track.

MOUNTAIN BIKING IMPACTS

The variety of reasons people give for disapproving of biking can be summarised in three types of impact issues. First; from perceptions of physical impacts on the environment. Second; from social impact perceptions of safety hazards. And third; from social impact perceptions that biking is inappropriate in many natural settings (Moore, 1994; Cessford, 1995a; Woehrstein, 1998; Weir, 2000). Perceptions of these types of impacts lead to conflict between riders, other track users, and track managers. Based on current knowledge, the perceptions and realities of these impacts are discussed briefly below, followed by exploration of a conflict perception example from the Queen Charlotte Track.

Environmental Impacts

Environmental concerns often feature when people discuss problems associated with biking in natural areas. In a sample of walkers, Horn (1994a) found that 75% considered that environmental damage from biking was a problem. A similar focus for concern has been found among park managers, including 35% of those surveyed in Chavez et al. (1993), and 42% in Chavez (1996a). However, it is important to note that these impacts have almost always been related directly to the tracks on which bikes are ridden, rather than on the environments though which the tracks pass. Like any outdoor recreationists, riders will have impacts on the environment, including the soils, vegetation, water, and wildlife. But because most walkers and riders stay on the tracks, wider environmental consequences are minimal because the direct physical effects are generally confined to the track surface.

Only in particular cases may the passage of bikes or walkers result in significant impact on important environmental features, as opposed to normal wear-and-tear on tracks. For example, Goeft & Alder (2000) described a case where bikes were included along with walkers, forestry vehicles and wildlife as potential vectors by which a particular plant disease could be spread. Woehrstein (1998) noted that numerous European studies had found little difference in effects of walkers and bikers on wildlife. And Papouchis et al (2001) found that bikers had far less disturbance effects on Bighorn Sheep than walkers, mainly due to walkers more often moving off tracks and surprising or approaching the animals. To date there appears to be no evidence of bikes having any more significant impact on important environmental features than other recreation uses (Cessford, 1995a; Woehrstein, 1998; Weir, 2000).

Biking does have an effect on the condition of tracks. These effects are often highly visually distinctive from those of walking due to the basic differences between tyre tracks and footprints. Related to this visual perception, the main concern expressed is that bike tyres create linear channels that may promote runoff and erosion, as opposed to the puddling caused by footprints (Keller, 1990). Bjorkman (1996) and others have made extensive investigations that clearly demonstrated impacts on tracks from bikes, although these were not compared with those of walkers. What is not clear is the relative significance of bike and boot impacts on tracks. For park managers, this distinction is particularly important when they are considering the costs of track maintenance. The usual perception is that biking has disproportionately higher impact on tracks than does walking. However, when the comparative effects of different recreation activities have been investigated, the real differences identified do not conform to these perceptions.

Comparative research on track impacts by Weaver & Dale (1978) found that motorbikes had the greatest effects while going uphill, but that when going downhill, the effects of horses and walkers were greater. Including bikes, Wilson and Seney (1994) identified a similar pattern, and noted that lighter and low-powered bikes had much less track impact potential than motorbikes. And European research has found that while bikes had greater uphill effects, walkers had greater downhill effects (Woehrstein 1998). This draws attention to the basic distinction between the mechanical effects of rolling wheels and stepping feet (Cessford 1995a; Weir, 2000), which both have impacts in different ways.

Despite the general perception otherwise, most available comparative reviews and studies have concluded that while visibly very different, the physical impacts of bikes on tracks were not any worse than those of walkers overall (Keller, 1990; Wilson & Seney, 1994; Chavez et al. 1993; Ruff & Mellors; 1993, Cessford, 1995a; Woehrstein, 1998; Weir, 2000; Thurston & Reader, 2001;). This appears to be the case whether considering important biological features or the physical state of the tracks. On this basis, selective restrictions to biking based on physical impact concerns may be inappropriate. Any physical impact problems that arise are more likely to be the effects of greater use-levels overall, or from tracks passing through physically sensitive environments, particularly related to bad drainage characteristics. Here it seems that the problem relates more to how biking is generally perceived rather than the actual effects it may have.

Perceptions of Safety Hazards

Bikes are perceived as a hazard when they are considered to be riding too fast for the conditions (e.g., on crowded, multiple-use trails); not slowing enough when approaching blind corners; or where they surprise people because they move quickly and quietly (Moore, 1994; Cessford, 1995a). These are valid concerns that managers do recognise (Chavez et al. 1993; Chavez, 1996b), and it is apparent that the behaviour of some riders has posed a hazard. Keller (1990) noted a number of problems from the reactions of horses to bikes in particular. With reference to data from an unpublished survey of almost 1500 walkers (Pettit & Pontes, 1987), both Grost (1989) and Jacoby (1990) noted that most did not consider bikes were a safety hazard, and in fact characterised riders as being polite. Jacoby (1990) also noted that only 15 bike encounters were cited by walkers as potentially hazardous, and the only actual accident reported involved bikes hitting each other while making way for a walker. From a survey of 40 resource managers, Chavez et al. (1993) found only one case of reported walker injury. From 300 accident records, Edger (1997) stated very few resulted from bike-walker collisions. Almost none of the many thousands of incidents reported in several years of accident statistics in the German Alps involved bikes and walkers (Woehrstein, 1998). And on the Queen Charlotte track itself, while managers were aware of some accidents, these were all bike-only (Grose, 2001).

There is some indication that increased familiarity with biking and accumulated experience of encounters with bikes may change the hazard perceptions of walkers (Chavez et al., 1993; Bannister et al., 1992; Horn, 1994; Woehrstein, 1998). When referring to the Pettit & Pontes (1987), study, Chavez et al. (1993) noted that negative attitudes by walkers toward bikes remained constant despite an increase in riding use-levels from 7 to 24% in two years, and safety issues remained minimal.

While it does appear that actual safety hazards are over-estimated by walkers, it seems clear that some will feel uncomfortable knowing that bikes may be present, whether a real hazard exists or not. Reducing this social impact issue is of concern to track managers. The real danger from bikes appears to be for their own riders.

Perceptions of Social Impacts

Perceived conflict between walking and biking parallels other widely documented inter-activity conflicts. As has been apparent for biking, the perceived impacts of motorised use have similarly emphasised environmental impact and safety; the appearance, noise, behaviour, presence of mechanisation; and the inappropriateness of these in natural settings. Implicit in this has been the assumption that the recreation objectives, environmental attitudes, and values of these other recreationists are also different.

Inter-activity conflict research has often found clear differences that reflect these perceptions, such as those between the recreation preferences and motivations of snowmobilers and cross-country skiers (Knopp & Tyger, 1973; Butler, 1974; Devall and Harry, 1981; Jackson & Wong, 1982). When both groups are trying to use the same settings, perceptions of conflict are almost inevitable. Similar patterns of experience preferences were also reflected in the other activities in which these groups participated. Given these differences, it was concluded that such groups would always tend to be in conflict, even when in different activities and settings. The main question here is if such differences are represented between walking and biking.

Qualitative comments made about bikes (e.g. Keller, 1990, Horn, 1994) indicate that for many walkers (and managers), bikes are conceptually indistinct from motorised off-road vehicles. The characteristic conflict perception asymmetry, where walkers perceived bikers more negatively than vice versa, has also been identified (Watson et al., 1991; Ramthun, 1995; Carothers et al., 2001). Biking is visually very distinctive. Qualitative comments commonly indicate that the use of bright cycling clothing and the mechanised appearance of bike and rider can create conflict perceptions from walkers (e.g. Keller, 1990; Horn, 1994). In addition, most research profiles of riders (e.g. Cessford, 1995b; Hollenhorst et al., 1995; Horn; 1994; Ruff & Mellors, 1993; Keller, 1990), show that riders usually over-represent males and younger ages relative to walkers. Such obvious visible differences will have had effects on the general perceptions of biking. However, it is not clear whether these differences are also reflected in the actual motivations, preferences and environmental attitudes of riders.

While some differences are found, the main studies that have compared the attitudes and preferences of the two groups have found they are more similar than was perceived. (Watson, et al., 1991, 1997; Horn, 1994; Ramthun, 1995). When Watson et al. (1991) compared perceptions of similarity with the actual characteristics, they found that for hikers in particular, the perceptions were different from the reality. In addition, the degree of asymmetry in these perceptions was less than anticipated given the characteristic patterns found in wider conflict research. In follow-up work to the 1991 study, Watson et al. (1997) found a high proportion of walkers and riders did both activities. In the European setting where use intensity is higher and bicycle riding in general is more common, differences between walkers and bikers appear even less distinct. While restrictions commonly remain on single-track riding, shared tracks are becoming more common, more walkers are also riding, and perceptions of conflict appear to be reducing in general (Woehrstein, 1998; ADFC, 2001;). While comparative research has not been extensive, results suggest that differences in attitudes and preferences between bikers and walkers are less than is generally perceived. This inconsistency may diminish as participants gain greater familiarity with each other. For example, a reduction in conflict perceptions from 30 to 21% was identified over a 5 year period (Watson et al, 1997).

However, among the complicating factors that may affect the validity of conflict perception measures is the possibility that this reduction results in part from recreation displacement (Bjorkman 1996; Watson et al., 1997). Another is that the conflict levels reported often exceed those that actually occurred (Countryside Agency, 2001). And there is also a distinction between conflict perceptions based on wider social values, and those based on actual interpersonal encounters in the field. Some of inconsistencies in walker perceptions of conflict with biking point to such an effect (Carothers et al., 2001), and the following brief research results provide another example of such inconsistency.

CONFLICT PERCEPTIONS ON THE QUEEN CHARLOTTE TRACK

Shared use of the track was established as a trial. This survey of 370 walkers was carried out to monitor walkers' acceptance of this arrangement, and their opinions about bikes. However, when the walkers who encountered bikes were distinguished from those who did not, it has also provided useful insight into the difference between perceived and actual conflict situations. Results relating to this difference are the main ones reported here.

Satisfaction and seeing bikes

The most important primary results for managers were those related to the high levels of walker satisfaction on the track. In total, 97% of walkers stated they were totally or mostly satisfied with their visit, and this high level did not significantly vary according to any walker characteristics or visit experiences. Among these visit experiences were encounters with bikes. These results indicated that walkers who encountered bikes were no less satisfied with their visit were those who did not. Reinforcing this, when walkers who encountered bikes were specifically asked if these bikes caused them dissatisfaction in any way, 88% indicated that they did not. And when walkers who did not expect to encounter bikes were asked if they might have changed their trip plans had they known, 92% said that they would have come to the track anyway.

Overall, these represent very positive results for this management arrangement. However, in acknowledgement that overall satisfaction scales are often coarse measures, some additional evaluative questions were asked of all walkers. Firstly, they were asked if seeing bikes had, or would have, affected their enjoyment of the track. Bikes were reported as having no actual or anticipated effect on enjoyment by 69% of walkers, as having positive enhancing effects by a further 10%, and having negative detracting effects by the remaining 21%. While these are highly positive results for the shared track approach, the notable proportion of people feeling bikes had or would have detracted from their experience does require management consideration.

Who perceived conflicts with bikes?

To improve understanding of the conflicts walkers have with bikes, additional data analysis was carried out on these enjoyment perceptions. This was done using a classification tree approach suitable for the primarily categorical data generated from the survey (D'eath & Fabricus, 2000), which in this case comes from the *AnswerTree* application associated with *SPSS 10*. Figure 1 was generated from this application, and represents a map of significant relationships between variables. The effect of bikes on walker enjoyment was the target variable, and notable variations in response were identified.

Most variation was related to whether walkers had encountered bikes on the track or not (Figure 1). Surprisingly, the more negative perceptions of bikes came from walkers who had not encountered any (32%). This reflects the distinction between perceptions based on wider social values and those based more on actual interpersonal encounters in the field, as described by Carothers et al. (2001).

Among those not encountering bikes, this negative effect was strongest among the older walkers (58%). Among those who did encounter bikes, the negative effect (14%) was greater among those not expecting to see them there. While omitted from Figure 1 due to space constraints, it is notable that among those not expecting to see bikes, the negative effect (24%) was again stronger for the older walkers than the younger (8%).

This gives managers a clear message that many of the social conflict issues surrounding bikes on this track are based on perceptions about meeting bikes, which appear to be different from the reality of experiencing them. In addition, a specific group of older walkers appear more inclined to hold these negative perceptions. These key distinctions were reinforced when specific opinions about bikes were explored.

Conflict perception issues

Walkers were asked to indicate their level of agreement with a set of characteristic opinion statements commonly made in association with bike conflict issues (Table 1).

These results are largely self-explanatory, and show that opinions both for and against biking varied considerably among walkers. The strongest responses were the 74% of walkers who considered most problems came from a few irresponsible riders, the 60% who disagreed that biking should be banned on the track, and the 58% who disagreed that biking and walking have similar track impacts. The latter is a particularly interesting example of the power of perception, when it appears that research has not established any notably greater effects from bikes on tracks. What is apparent on wet tracks with poorly consolidated surfaces is that the visibility of tyre-tracks is much higher than that of boot-prints. In that situation, attributing greater impacts to bikes is not surprising, even if it may be somewhat misplaced.

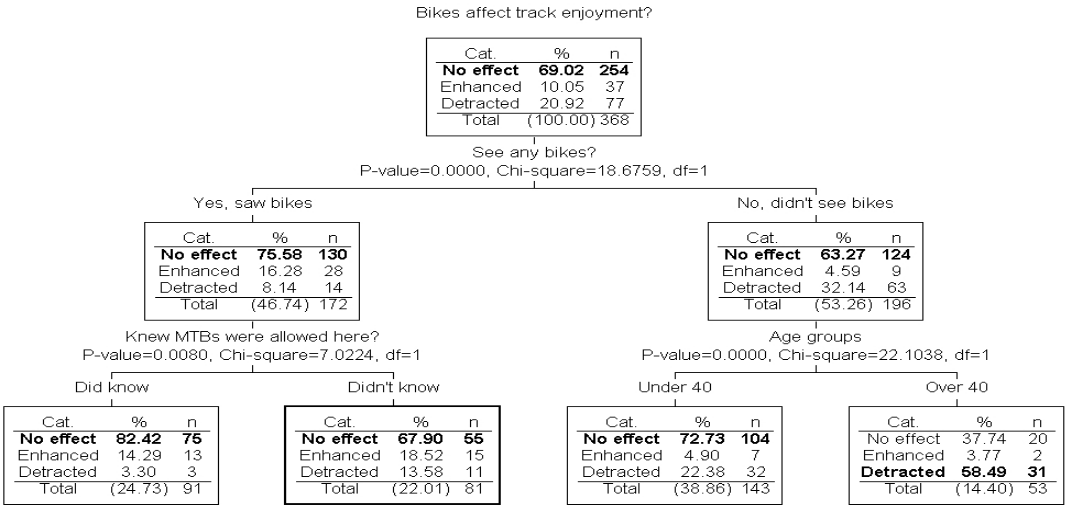

Figure 1: Factors influencing enjoyment effects caused by bikes

Common opinions on biking	**Agree**	**Neutral**	**Disagree**	**Compared by encounters with bikes**	**Compared by age-group**
Biker behaviour					
Bikers are reckless and go past walkers too fast	29	27	44	***Not seen - agree more	***>40 - agree more
Bikers are reckless and go round corners too fast	27	36	37	*** Not seen - agree more	***>40 - agree more
Only a few irresponsible riders cause most problems	74	18	8	-	-
People over-estimate danger to walkers from bikes	38	36	26	-	-
People over-estimate conflict between bikers/walkers	42	41	17	-	-
Biker characteristics					
Bikers and walkers are different sorts of people	23	25	52	-	***>40 - disagree more
Walkers are more interested in the environment	41	22	37	-	***>40 - agree more
Bikers are louder and noisier than walkers	28	21	51	-	*>40 - agree more
Bike management					
Biking and walking have similar impact on tracks	25	17	58	-	-
As bikers learn better behaviours, conflicts will reduce	52	34	15	-	-
As people get used to bikes, conflicts will reduce	40	32	28	**Seen -agree more	*>40 - disagree more
Shared tracks for walking and biking won't work	25	25	50	***Not seen - agree more	***>40 - agree more
Biking should be banned on the Queen Charlotte	18	22	60	***Not seen – agree more	***>40 - agree more

Table 1: Walker opinions on biking
*(Chi² test significance - * p<.05, ** p<.01 ***p<.000)*

While many of these responses may be encouraging to park managers considering provision of shared-track approaches, notable proportions of negative opinions are apparent. Almost 30% considered that bikes go too fast when passing people or going around corners. A notable minority (23%) considered bikers and walkers were different kinds of people, while a majority (41%) considered walkers were more interested in the environment. As briefly noted earlier, these types of negative perceptions of behaviour and inter-group differences are the foundation for wider conflict perceptions. They are therefore important areas for improved management understanding and practice.

Acknowledging this need, it is notable that, as with overall visit evaluations, there was also distinct variation in opinions according to age, and to the occurrence of bike encounters (Figure 2). Those walkers who had encountered bikes on the track had more positive opinions about them in general. For example, walker opinions about hazard from bikes going too fast were less negative among those who actually met bikes. And opinions about biking were consistently more negative among those walkers over 40. This again draws attention to the distinction apparent between the evaluations of biking made according to perceived and actual situations, and to the consistently more negative perceptions of older walkers about bikes.

MANAGEMENT CONCLUSIONS

The emerging conclusions from research on bike impacts, and the largely positive evaluative results from specific surveys such as that on the Queen Charlotte Track, suggest a positive outlook for developing shared tracks. It seems that the perceptions and realities of impacts can sometimes be quite different, and that greater awareness and experience can lead to a reduction in problem perceptions. The generally more positive perceptions among those who actually encountered bikes suggests that some 'encounter-effect' may occur that somehow results in reduced negative feelings. This may reflect some unanticipated positive aspect from experiencing bikes and their riders, such as friendly contact, and riding behaviour that was less threatening than expected. Or, it may reflect some form of conciliatory coping response by visitors when faced with perceived conflict situations, as widely documented in conflict literature. Some caution is required regarding possible displacement effects on the more 'bike-sensitive' walkers, such as the older walkers on the Queen Charlotte Track. All of these possibilities suggest fundamental and important research questions for managers to address if considering shared-track options.

There is a general need to ensure people are aware that bikes are likely to be encountered, and that biker behaviour is appropriate and friendly. The efforts of biking advocates to promote positive riding and encounter behaviours through codes of conduct would appear to be very appropriate. How these strategies may affect walker perceptions of biking over time represent another important area of research. Managers who are concerned about the notable proportion of walkers feeling that bikes detract from their enjoyment should be concentrating attention on the needs and concerns of older walkers, and how this might change as they are succeeded by the younger generation.

Given the emerging understanding of the differences between the perceptions and realities of conflict, opting to provide for shared tracks will require managers to become more proficient at conflict management processes. Emphasis will be required on the types of indirect (education, information) and bridge-building (co-operation, volunteerism) approaches described by Moore (1994), Chavez (1996) and others.

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Resolving Inter-Group Conflict in Winter Recreation: Chilkoot Trail National Historic Site, British Columbia

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Abstract: The Chilkoot Trail National Historic Site, in British Columbia, Canada, is well-known for its summer historic gold rush hiking route, and is popular in the winter with local residents for skiing, snowmobiling and other winter sports. Park managers implemented a strategy of temporal segregation to mitigate known conflicts between motorised and non-motorised winter users. This study evaluated the effectiveness of separating users, by monitoring visitor satisfaction and support for the management strategy, and assessing the key differences between user groups within the theory of asymmetrical conflict. The results show that separating users does increase satisfaction for non-motorised users; however, support for controlled access is moderate to low among all users. This study alerts park managers using direct tools such as controlled access, in that dissatisfaction may shift from those who were most affected by the inter-group conflict (non-motorised users) to the motorised group, who are dissatisfied with increased access limitations and loss of freedom.

INTRODUCTION

Park areas with regionally important winter recreation opportunities attract diverse, and sometimes competing, recreationists. This can present managers and recreationists with a variety of challenges, such as conflicting recreation values, motivations and behaviours that can negatively impact on other visitors' use, satisfaction or safety.

At 140km from Whitehorse, Yukon Territories, Canada, the Chilkoot Trail National Historic Site (CTNHS) is seemingly distant from local populations, however it is a regionally important winter recreation resource to residents of Juneau and Skagway (Alaska), Whitehorse and nearby Northern BC communities (Figure 1). With few roads in the area, this site's good terrain, leeward weather and snow conditions offer some of the region's best, most accessible ski and snowmobile opportunities.

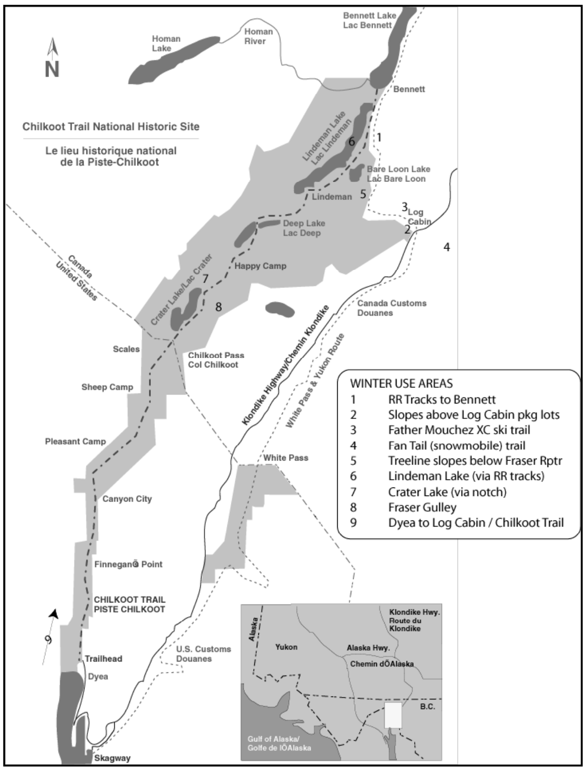

Figure1, Study area: Chilkoot Trail National Historic Site, BC (Parks Canada, modified)

The challenge then is how to provide a quality winter outdoor recreation experience for a diverse, and sometimes competing, range of visitors. Knowledge about what motivates individuals, what factors increase or decrease satisfaction, and testing the effectiveness of conflict management strategies will contribute to the tool-kit for resolving inter-group recreation conflict. This study offered an opportunity to explore all three of these issues, and to see where are the greatest chance of achieving balanced allocation of resources and opportunity across competing recreation interests.

Prior to 1997/98 CTNHS park management was aware of dissatisfaction and recreation conflict at the site. Using a multi-stakeholder approach to decision-making, they jointly developed the Winter Recreation Use Strategy (WRUS). The WRUS addressed recreation conflict through designating "non-motorised" only weekends, and proposing separate trails and parking areas. It also contained elements directed at clarifying public safety responsibilities and heritage/artifact protection.

PREVIOUS WINTER RECREATION CONFLICT RESEARCH

Increasing competition for outdoor resources on a limited public land base fuels conflict situations. Combined with a growing population, both participation rates and frequency of participation have steadily increased in almost all outdoor recreation activities (Cordell 1997). As participation in winter recreation increases and evolves, so does the potential for conflict between non-motorised and motorised recreationists (often referred to as simply skier - snowmobiler conflict). Recent changes in snowmobile technology and design enable these machines to travel on steep slopes and through deep snow, terrain formerly accessible only by helicopter or skis.

Several studies have sought to understand the activity specific motivations of skiers and snowmobilers. Jackson and Wong (1982) found three distinct motivational dimensions: natural environment, escapism, and socialization. Cross-country skiers indicated a greater importance on the natural environment, including quiet and undisturbed nature, while snowmobilers perceived a greater importance on escapism and socialization factors, such as adventure, being away from work/TV/home and being with family and meeting others (Jackson and Wong 1982, 57-58).

Similar differences were found in earlier work by McCool and Curtis (1980). Nature learning/ appreciation was the most important and stress release/solitude was the least important dimension for skiers. Affiliation (socialization) was most important for snowmobilers, while competence/ challenge was the least important.

In addition to personal motivation, activity specialisation is also a source of recreation conflict, between activity groups (Muth and Fairey 1995; Devall and Harry 1981). The general hypothesis is that user-perceived crowding results not only from too many users, but also from the mix of various technologies at the site. Additionally, the "low-tech" activities are often characterised by quiet, slow speed, and an appreciation for nature, while the increasingly "high-tech" activities are defined by parallel increases in speed and noise (Devall and Harry 1981).

All of these studies *(and more, see references)* describe distinct differences between the motorised and non-motorised winter recreation groups, equipment and technology, motivation, and sensitivity to others' activities. As many of the skiers' goals are based on physical setting attributes, such as nature and quiet, conflict is likely when an area is shared with snowmobilers. As many of the goals of snowmobilers are based on experiential and social attributes (e.g. adventure and being with family/friends) the presence of skiers during their recreation is unlikely to have a negative impact.

A different angle toward resolving recreation conflict was highlighted in a recent study of winter visitors in Yellowstone National Park (Borrie *et al* 1999). Researchers found that visitor expectations played a large role in visitors' acceptance of encountering other visitors. When visitors expected to encounter others they were generally accepting of those encounters. Similarly, when people had more encounters than they expected, they were less tolerant of the encounters (Borrie *et al* 1999). This outcome suggests that intolerance for encounters may be reduced by ensuring visitors are informed of and prepared for the experiences they will have during their recreation visit. For example, educating visitors that a recreation area is multi-use enables them to arrive with appropriate expectations or to move to a single-use different area.

METHODS

The primary tool for assessing the effectiveness of the WRUS was an on-site visitor survey administered over 10 weeks during the first year of implementation (1997/98). Questions about visitor motivations, achievement and areas of satisfaction and dissatisfaction enabled comparisons with earlier recreation conflict studies done in areas without an active conflict resolution strategy.

Visitor motivations for visiting CTNHS were measured using a modified Recreation Experience Preference (REP) motivation scale (McCool and Curtis 1980, 65). A 26 item motivation scale was used to identify and quantify the relative importance of different psychological and physical outcomes that are desired and expected from recreation participation.

In a related area of investigation *goal achievement* was explored, with visitors asked to rank the extent to which they had achieved each possible REP motivation. This question allows examination of a key element of recreation conflict theory, that of *asymmetrical goal interference*, where the goals of different recreation groups are unevenly affected (Jacob and Schreyer 1980; Horn *et al* 1994; Jackson and Wong, 1982). The approach is derived from Importance-Performance Analysis in the field of marketing research (Martilla and James 1977).

A more direct approach to measuring inter-group conflict was also applied, through asking respondents how inter-group encounters influenced their recreation experience in different park areas.

Visitors' perception of problems was measured using a list of potential problem items - those related to inter-group conflict were noise associated with motorised or non-motorised users, activities of motorised or non-motorised users.

Finally, this study afforded the unique opportunity to understand if the direct management tool, segregation, was a) supported by visitors; and b) redressed the satisfaction imbalance between activity groups. This was done by asking the degree to which actual visitors (constituents) agreed with the strategy developed *on their behalf* by the stakeholder group and Parks Canada.

SELECTED RESULTS

Motivation - Importance - Achievement

Respondents were asked how important a series of 26 possible motivations were in regard to their current trip. Next they were asked how well they achieved those motivations during their visit. For each group (motorised and non-motorised), the relative performance of an item was compared against that same item's importance, creating a measure of achievement (Figure 2).

Select results demonstrate that non-motorised

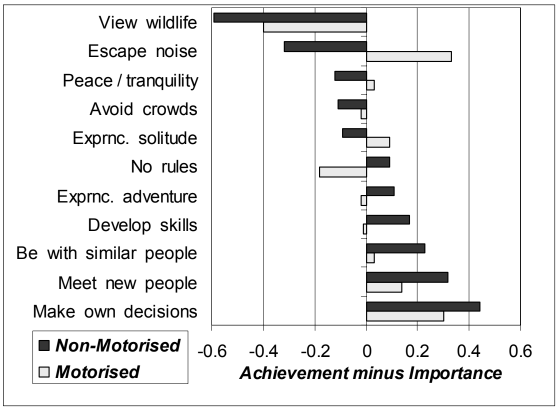

Figure 2. Importance-Performance Matrix (modified from Jackson 2001).

visitors generally "under-achieved" their desire to view wildlife, escape noise, experience peace/tranquillity, avoid crowds and experience solitude. Non-motorised users surpassed their importance values in a number of areas, including making own decisions, meeting new people, being with people who enjoy the same things, develop skills, experience adventure and having "no rules".

Motorised visitors "under-achieved" in viewing wildlife and having "no rules". However, they surpassed their importance values for escaping noise, meeting new people and making own decisions.

Categorizing Visitors by Motivation

The primary difference between motorised and non-motorised visitors is the strength of the nature-based component for non-motorised users (Figure 3). As found in other recreation conflict studies, in both winter and non-winter recreation settings, expectations and goals may lay the foundation for conflict to arise from inter-group encounters (Jacob and Schreyer 1980; Jackson and Wong 1982; Borrie *et al* 1999). Viewed this way, skiers are almost "setting themselves up" for disappointment when venturing into a multi-use area if they are seeking a peaceful, nature-based experience. The moment a snowmobile enters the area, there is the potential for the skier to experience goal-interference. Conversely, the snowmobilers in this study were likely seeking social interaction, and challenge/adventure. The snowmobilers' goals are not apt to be affected by skiers' presence and activities. Hence we see the basis for asymmetrical conflict to occur on-site, and for goal-interference to impede the skiers' enjoyment of the area.

Encounters With Other Users

Encounters with motorised users, in all locations, detracted from recreational experiences for non-motorised users. Conversely, encounters with non-motorised users, in all locations, enhanced recreation experiences statistically significantly more for non-motorised users than for motorised users. This result is unsurprising, in that for both groups encounters with nother similar users enhanced experiences more so than encounters with other types of users.

Perception of Problems

The concept of asymmetrical inter-group conflict is further evident in the problem areas indicated by each group. Non-motorised users found, the noise and activities of motorised users were, respectively, a serious (22%) and very serious (16%) problem. Conversely, no motorised respondents indicated problems with the noise or activities of either motorised or non-motorised visitors. A small number of motorised visitors (about 8%) indicated "too many rules" as a serious problem.

As no other problems were identified from the diverse list of potential issues, this would suggest that the main source of dissatisfaction for any visitors is related to the noise and activities of motorised users.

Support for Strategy

Respondents were asked about the extent to which they opposed or supported each component of the WRUS. There were no statistically

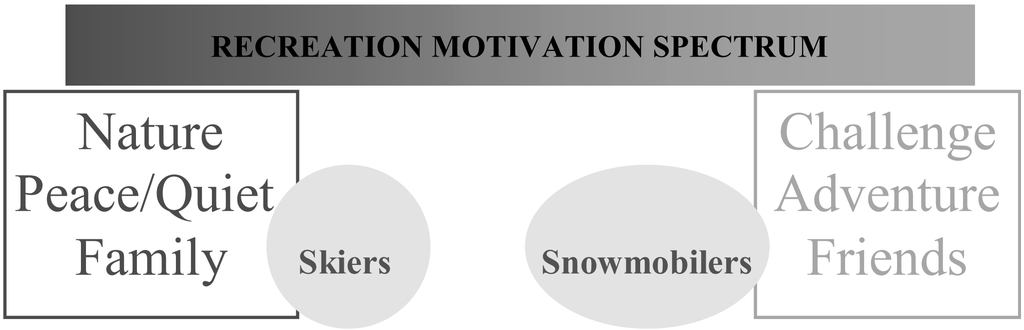

Figure3. Recreation Motivation Spectrum for Winter User Groups on the Chilkoot Trail

significant differences between motorised and non-motorised users with respect to winter users responsible for their own safety, and the construction of a new lot for motorised users. The pattern that was evident however, was that motorised users were significantly more opposed than non-motorised users to all components of the strategy. Simply put, motorised visitors are more likely to object to direct management actions.

CONCLUSIONS AND OUTLOOK

Perhaps the most significant finding of this research is the empirical evidence that separating use, by location and by time of use, does reduce inter-group conflict. As motorised users were earlier identified as causing, not experiencing, conflict, management prohibited their access on every third weekend. On restricted weekends, non-motorised users had sole access to the park without the presence of snowmobiles. This restriction did increase skier satisfaction, both overall and even more so on restricted weekends, by reducing the negative effects of inter-group encounters experienced by non-motorised users. Conversely, motorised users did indicate less support for restrictive measures, although it is notable that motorised user satisfaction is still high overall. As most visitors ski or snowmobile at the CTNHS multiple times each season, knowledge of the restricted use policy will likely improve acceptance over time by all groups by enabling their planning of their recreational activities around the weekend restrictions.

Furthermore, the WRUS strategy was generally supported by all respondents, although it was developed through a stakeholder based participation process. This finding demonstrates that enabling stakeholder representatives to speak, act and make decisions on behalf of their "constituents" is an efficient yet publicly inclusive method of resolving inter-group conflict.

While the strength of support for different winter management strategies differed between activity groups, the general rank preference was similar between the groups. For example, both groups agreed with improved parking lot maintenance and trail signage, and generally disagreed with permanent trail closures. A strong general pattern showed motorised respondents were less supportive of restrictions and closures than of improved facilities. Non-motorised respondents preferences were less black and white; they supported some forms of restrictions but tended not to highly support new facilities or infrastructure, unless it served to separate the two activity groups.

In understanding the basic motivators for each group, this study determined that not all goals differ, although there are key differences between motorised and non-motorised visitors. Both groups were motivated by social interactions, whereas motorised visitors also sought challenge and adventure while non-motorised visitors focused on nature and solitude.

This study's findings regarding motivations, expectations and conflict mitigation align with a recent multi-site Yellowstone winter recreation study (Borrie *et al* 1999), in which it is suggested that expectations of encounters play a major role in the tolerance for or effect of those encounters. There is a high potential that as the winter recreation management strategies for the Chilkoot Trail area become better known amongst local users, winter recreationists will arrive on-site with expectations that are attuned with actual circumstances. Skiers will be able to plan their visit for non-motorised weekends, if that is important to them. If they arrive on multi-use weekends, they will do so expecting to encounter snowmobiles.

FURTHER RESEARCH

As evidenced in this study, there is a clear need to monitor the cumulative effect of conflict resolution strategies across user groups. Do the management actions achieve the desired result of reducing conflict and increasing visitor satisfaction? Are there sufficient alternative areas for all visitors to pursue their activities in the region, or does a single area continue to draw negative inter-group conflict? Are there satisfactory ways for traditionally conflicting activity groups to equitably share a recreation area? Focusing on adaptive management solutions to conflict enables recreation managers to continue to provide or create high quality recreation experiences.

The nature of a northern Canadian population raises the possibility that the "non-motorised" visitors in this study could in fact be snowmobilers on another day, or in another place. This study did not ask visitors to identify any crossover of activity participation between motorised and non-motorised activities. The nature of the inter-group conflict may in fact be more dramatic than this study showed if "cross-over" participants were filtered during analysis.

Finally, further exploration of the conditions under which asymmetrical conflict becomes symmetrical. It is possible that the source group of conflict, in this study motorised users, might also experience conflict when the affected group becomes active in their efforts to ban or limit the activities of the "causal" group. In this case, it is possible that if skiers become more active and more successful in having limits placed on the activities of snowmobilers, then snowmobilers will develop a negative effect caused by skiers (Horn *et al* 1994).

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Stated Preference & Choice Models – A Versatile Alternative to Traditional Recreation Research

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Abstract: In outdoor recreation research and visitor management applications, stated preference and choice methods have not enjoyed the same amount of popularity when compared to other directions of applied research. This is somewhat surprising considering the fact that decisions that managers of protected areas and outdoor recreation in general face are typically multi-attribute in nature and require an understanding of the trade-offs that decision-makers of clients are willing to make. This paper provides an overview to stated choice research by explaining the essential considerations during the design and analysis of this approach. The various stages will be explained on hand of a simple example. Then the versatility of the approach will be demonstrated by discussing research design options in more detail.

INTRODUCTION

Stated preference and choice methods have received less attention in recreation research and visitor management of protected areas, compared to other research approaches. Yet, I will argue that under certain conditions, and for certain research questions, stated preference / choice approaches are more appropriate than visitor monitoring, or traditional social psychology methods.

Over the past few years, the analysis of observed behavior (visitor monitoring) has witnessed significant progress with the introduction of innovative monitoring equipment and GIS, both of which are accompanied by more sophisticated analytical techniques. Many contributions to this conference document these developments. However, by definition, such observational data are confined to past behavior, and if more details are desired about underlying explanations of the behavior, or evaluations about the effects of pending management decisions are desired, then observational data are of limited value.

Therefore, a wide range of behavioral research techniques, many of which are survey based, have been introduced and adapted to recreation research over the past 30 years. Behavioral research provides insights into the various behavioral antecedents, explaining why visitors behave in certain ways, and these insights might also be used for predicting future behavior. Studies focus on attitudes, motivation, satisfaction, perception, or simply preferences. Much of the traditional visitor management literature is built on these foundations of social psychology.

Research on the phenomenon of choice does not slot into the one or the other category conveniently. Choice research may be undertaken with observation type data, because any form actual human behavior actually manifests some choice. Such analysis is referred to as revealed preference or choice analysis. On the other hand, researchers may also inquire about future choices or behavioral intentions, which the literature refers to as stated preferences or choice research.

This paper will focus on the latter, stated preference and choice research. Specifically, I will present variations of the discrete choice experiment, a multivariate method that permits one to evaluate scenarios of recreation experiences, management alternatives or outcomes by describing these in scenarios composed of several attributes. Such evaluations may include currently non-existent alternatives, and provide insights into the trade-off behavior of respondents. [ultimately supporting decision making] In this paper I will provide a brief theoretical background to the method, explain the basic statistical concepts, present a simple study from recreational fishing, and document the versatility of the method by discussing variations of its application.

MODELLING PREFERENCE AND CHOICE BEHAVIOUR

Many management problems in visitor and protected areas management are of a multi-attribute nature and involve tradeoffs between several desirable policy or management goals. Among the various methods that have emerged in multi-attribute preference research, it is useful to distinguish between (a) revealed preference /choice approaches, in which the importance of salient variables influencing a decision is inferred by statistical analysis from actual behaviour, and (b) stated preference approaches, in which survey respondents evaluate hypothetical questions (Timmermans 1984). Discrete choice models, which rely on revealed preference data, have been applied successfully to transportation research (Ben-Akiva and Lerman 1985; Train, 1986), spatial analysis (Wrigley 1985; Kanaroglou and Ferguson 1996 and 1998) and also to recreation (Stynes and Peterson 1984).

Among the stated preference/choice approaches, it is important to distinguish between compositional and decompositional methods (Timmermans 1984). In compositional approaches, such as the theory of reasoned action (Ajzen and Fishbein 1980), respondents evaluate each aspect of a complex management issue separately, and thereafter the researcher calculates ('composes') an overall utility value for an alternative by combining the components of an alternative according to some predefined decision rule. Despite some interesting attempts towards wider application in various fields of environmental management (see, for example, Peterson et al. 1988), the operationalization of these compositional models has proven difficult.

In contrast, decompositional multi-attribute preference models have been applied to complex management issues with considerable success (for summaries see Timmermans 1984; Timmermans and Golledge 1990). These models have proven to be versatile, since they account for the multi-attribute nature of the management issues, permit the exploration of non-existing alternatives, and avoid the problem of multicolinearity. In these models, alternatives are defined as combinations of a set of attributes, and each set is evaluated as a whole. The alternative profiles are constructed by following statistical design principles, such as fractional factorial designs (for example, Raktoe et al. 1981). If respondents rate or rank each full profile separately, the technique is usually referred to as conjoint analysis (Green and Srinavasan, 1978). In a discrete choice experiment (DCE), two or more such hypothetical profiles are combined to choice sets, and respondents choose the most preferred alternative (profile) from each set they are asked to evaluate (Louviere and Woodworth 1983; Louviere et al. 2000). The advantage associated with a choice based response task is that the statistical analysis can be conducted with the same multinomial logit regression model (see below) that is typically applied in discrete choice models. In other words, DCEs combine the analytical elegance of the random utility model (McFadden 1974) with the experimental rigour of conjoint analysis (Green and Srinavasan, 1978). The advantages of stated choice over traditional conjoint analysis are that behaviorally, the analysis of choice - even though it is only hypothetical choice – is closer to actual behavior than a rating or ranking task, and that the statistical analysis has a rigorous error theory included (see below).

DCEs have been applied to spatial consumer choice behaviour (Timmermans et al. 1992), and to tourism and recreation issues (Louviere and Timmermans 1990; Haider and Ewing 1990). Lately, they have gained increasing popularity in resource economics (Swallow et al. 1994); more specifically, several recent studies have compared the performance of revealed and stated preference methods for resource valuation (Boxall et al. 1996; Adamowicz et al. 1997 and 1998). This interesting topic with significant relevance to outdoor recreation remains outside the scope of this paper.

THEORY - THE DCE

There are several stages to desinging a proper DCE. First, the attributes and attribute levels that are crucial to a recreation experience and/or a decision-making context need to be identified. Second, an experimental design needs to be selected. Third, statistical analysis needs to be undertaken. Finally, the results may be presented in a computerized decision support system. An example from a simple study in recreational fishing (ice fishers around Sudbury, Canada) will be used to demonstrate the various research stages of data.

Defining attributes and attribute levels

A realistic choice task requires the identification of crucial attributes and attribute levels that typically influence a respondent’s decision when purchasing a good or service, or when selecting a recreational trip. Usually one considers attributes that contribute to the quality of the experience as well as the regulatory framework. Attributes and their specifications can be identified from the literature; management issues will be conveyed by managers; any variables pertaining to the experience may be elicited from potential respondents through informal interviews or in focus groups sessions. Attributes and their specifications for the ice fishing study are summarized in Table 1.

Selecting a fractional factorial design

Second, profiles need to be created, and thereafter two or more profiles need to be combined to choice sets. If one were to use all possible profiles (combinations of attribute levels) in a study, one would refer to it as a full factorial design, and ANOVA could be used as statistical analytical procedure. Given the large number of attributes and levels that make up a DCE, a full factorial approach is out of question. An alternative is to show respondents only a small set of all possible combinations. For that purpose, one can select appropriate fractional factorial design plans, which follow precise statistical design principles (for example, Raktoe et al. 1981). In most cases such fractional factorial designs ensure that attributes remain orthogonal (independent) of each other; The cost of employing a fractional factorial design is that many or all interactions may not be estimable (they are aliased with main effects). The obvious advantage is that respondents consider the attributes in the context of each other.

ATTRIBUTE	LEVELS
Travel	
Travel time to lake	• Half as much as today's • Same as today's • Twice as much as today's
Regulations	
Size limit	• None • 40-50cm slot
Creel limit	• 6 fish per day • 4 fish per day
Gear restrictions	• 2 lines • 1 line
Bait restrictions	• live bait allowed • artificial lures only
Length of season	• current (Jan 1 – April 30) • closes February 28
Expectations	
Number of fish	• many • few
Size of fish	• mostly small fish • mostly large fish

Table 1:List of Attributes and Levels for the ice fishing study.

If respondents rate or rank each profile separately, the technique is usually referred to as conjoint analysis (Green and Srinavasan, 1978). In a DCE, two or more such hypothetical profiles are combined to choice sets by following one further simple factorial design plan. Respondents choose the most preferred alternative (profile) from each set they are asked to evaluate (Louviere and Woodworth 1983; Louviere 2000). For a simple example of a choice set, see Table 2.

In the ice fishing study we used a total of eight attributes, seven of which were presented on two levels, and one as a three-level variable. We selected a 16^2 resolution III fractional factorial design plan (Raktoe et al. 1981), which permitted the estimation of all main effects. The three-level variable (travel time) was accommodated into the design by showing only two of the three levels in each of the two profiles of a choice set. Interviews were conducted at the fishing sites, and therefore the 16 choice sets that were required by the design were divided into four sets of four choice cards each, so that each respondent faced four choices. Respondents choose either of the two hypothetical lakes (Lake A or Lake B), or could also select to not fish. Presenting such a common base alternative is important, because it provides a shared platform for analysis.

	LAKE A	**LAKE B**
Travel time	Half of today's	Same as today
Size limit	40-50 cm slot	None
Creel limit	4 fish /day	6 fish / day
Gear	2 lines	1 line
Bait	Artifical lures only	Live bait only
Season	Current	Closes feb. 28
Number	Few	Many
Size	Mostly small	Mostly small
YOUR ' CHOICE	❒ **Lake A** ❒ **Would not fish**	❒ **Lake B**

Table 2: Example of a choice set.

Statistical analysis

The analysis of DCEs is based on the assumptions of the general discrete choice model (McFadden 1974 – also referred to as the random utility model), which in its original form is used for analysis of revealed preferences and is based on the following assumptions. Individual behaviour is considered as deterministic, but because of the inability of the research process to account for all influencing attributes and the need to aggregate individual choices across individuals, the modelling of behaviour is undertaken stochastically (Train 1986; Ben-Akiva and Lerman 1985). Therefore, it is assumed that the overall utility (U_i) contained in any one alternative is represented by a utility function that contains a deterministic component (V_i) and a stochastic component (e_i). Selection of one alternative over another implies that the utility (U_i) of that alternative is greater than the utility of any other alternative (U_j). The overall utility of alternative i is represented as (McFadden 1974; Train 1986):

$U_i = V_i + \varepsilon_i$
(Equation 1)

An individual will choose alternative i if $U_i > U_j$ for all $j \neq i$. However, since the utilities include a stochastic component, one can only describe the probability of choosing alternative i as:

Prob {i chosen} = prob $\{V_i + \varepsilon_i > V_j + \varepsilon_j ; \forall j \in C\}$
(Equation 2)

where C is the set of all possible alternatives. If one assumes that, for the entire sample, the stochastic elements of the utilities follow a Gumbel distribution, the standard multinomial logit (MNL) model can be specified (McFadden 1974; Ben-Akiva and Lerman 1985):

Prob {i chosen} = $e^{Vi} / \quad e^{Vj}$
(Equation 3)

where the aggregate probability of choosing alternative i equals the exponent of all the measurable elements of alternative i over the sum of the exponent of all measurable elements of all j alternatives. This standard MNL model supports the estimation of parameters that allow one to express the choice probability of a given alternative as a function of the attributes comprising that alternative and those attributes of all other alternatives in the choice set.

The analysis produces regression estimates for each attribute level, which are referred to as partworth utilities, and typically are presented in a table jointly with standard error and t-value associated with each estimate (Table 3). All attributes were dummy coded (0,1). The estimate represents the part-worth utility for the attribute level compared to its 0-level, i.e. the level not shown. All the estimates have the expected signs, and all estimates are significant at the 5% level except size limit, and creel limit is significant at the 10% level only. In the design, the variables were arranged so that the interaction between the variables gear and bait was also estimable, and it was significant in the sense that if both attributes were changed to a more restrictive level at the same time then the support for these policies would decline even further. The results show that enacting gear and bait restrictions would be the least popular regulatory changes, while other regulations are more acceptable. With such knowledge resource managers can make more informed decisions between acceptability of regulations and their likely effects on the resource.

Attribute	**Estimate**	**Standard Error**	**t-value**
Intercept	2.033	0.045	45.446
Travel (same)	0.208	0.030	6.885
Travel (half)	0.147	0.019	7.797
Size limit (slot)	0.012	0.016	0.726
Creel limit (4 fish)	-0.030	0.016	-1.874
Gear (1 line)	-0.178	0.016	-11.345
Bait (artificial)	-0.298	0.017	-17.545
Season (short)	-0.087	0.016	-5.436
Exp_numb (many)	0.088	0.017	5.286
Exp_size (m. large)	0.159	0.017	9.537
Interaction Gear*Bait	0.096	0.019	4.994

Table 3: Results of the ice fishing study

A DECISION SUPPORT SYSTEM

In addition to documenting the part-worth utilities for each of the variable levels, the decompositional nature of the DCE also permits the instantaneous evaluation of any profile that can possibly be generated as a combination of the experimental variables. In other words one can model the joint effects of several changes simultaneously. This overall evaluation is based on the calculation of the probability of choice for one alternative over any other alternative(s), as suggested by the last equation above. The layout of such a decision support system (DSS) follows the original layout of the choice sets closely (Figure 1). It is interactive in the sense that any possible profile can be evaluated by simply changing any attribute levels in the interface window.

In the example of Figure 1, Lake A represents pretty well the current situation, except that the travel time is halved. Lake B contains several regulatory changes (a lower creel limit, only one line, artificial lures only, and a shorter season), while the expectations remain the same. As to be expected, Alternative B is considered much less attractive. Its market share reduces to 22%, while Alternative A's increases to 72%. The rate of non-anglers increases by almost 2%. One can now continue with the evaluative game and assume that such a drastic change in regulations would eventually improve the quality of the fishery. By adjusting the size and number of fish one can expect to catch to the more favorable levels, the share of Lake B would recover to a certain extent to 31.8%. Obviously one can play through several demographic or experience related criteria.

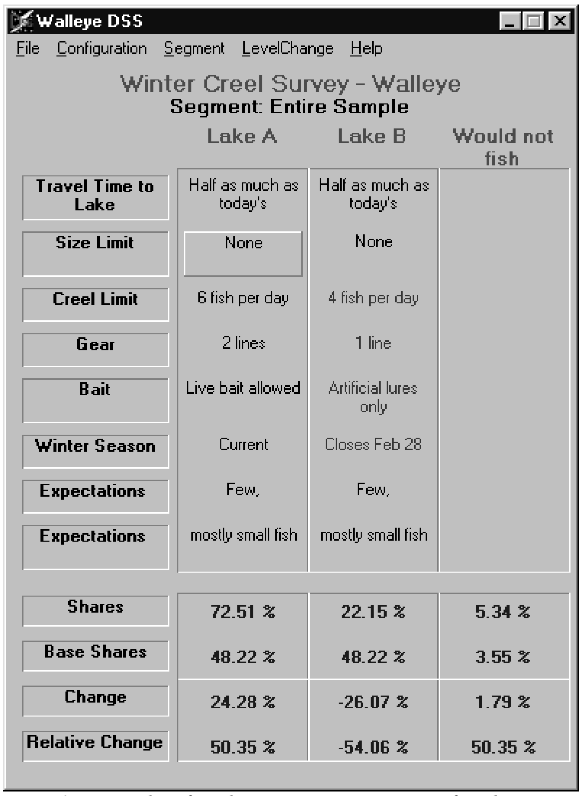

Figure 1: Example of a decision support system for the ice fishing study.

THE VERSATILITY OF DCES DURING APPLICATIONS

A DCE does not need to be constrained to a simple choice between two hypothetical scenarios. In the contrary, any one of its features can be adapted to suit the purpose of investigation. Several options will be explored below. The limited space available in these proceedings does not permit me to show examples for all these issues. These examples will be presented during the conference.

Number and types of scenarios in a choice set

Rather than asking respondents to choose among two alternatives, one may ask them to choose among several alternatives. Including more than two scenarios into a choice set may not be very useful in a generic model (i.e. the profiles are simply labeled A vs. B as in the example above). However, in many applications the realism of a choice set may increase by labeling the scenarios, which leads to an alternative specific design. Theoretically, any variable can take on the role of defining the alternatives. Usually one has a good reason for selecting an alternative specific variable, such as trip destinations (Haider and Ewing 1990), brand names such as sports equipment, or fish species (Aas et al. 2000; Fedler et al. 1999). One needs to estimate an intercept (constant) for each alternative, which amounts to an estimate for that variable.

Response tasks and use of base alternatives

In some situations it might be appropriate to consider an alternative to the simple binomial or multinomial choice task. Especially in recreation studies it frequently appears appropriate to model the repeated allocation of choice between different scenarios over the course of a season or for the duration of a trip. In such a case, one can ask respondents to allocate a total of, say, ten trips among the scenarios in one choice set. A respondent may then allocate five out of ten recreational day trips to a protected area among hiking, mountain biking, and kayaking. Depending on which other variables are associated with the study, the choice among these options might vary considerably from choice set to choice set. The advantages of such an allocation task are that one actually collects more data with the same amount of effort. Furthermore, depending on the circumstances, an allocation task might also be behaviorally more meaningful.

Depending on the respondent's decision making or choice context, it might be of interest to disaggregate the base alternative further. For example, if respondents do not find any of the scenarios presented in a choice acceptable, one might want to know if they would consider a different activity in the same location, or would rather search for an activity substitute in the vicinity, or would consider a substitute in a very different region, or would decide to abandon both activity and location. Obviously, the method can be used for designing sophisticated research on substitution behavior.

Interactions and Cross-effects

Modelling the interactions between variables is possible, if a design is set up accordingly from the beginning (see example above). Many designs have sufficient room for targeting a couple of two-way interactions. If one can anticipate the most salient interactions a priory, a design can be laid out in such a manner that the desired interaction will be estimated. Dellaert et al. (1995) present a rather elaborate study of interactions in an application to urban tourism.

In alternative specific models it might be of interest to determine potential effects from one alternative on the other. This phenomenon is referred to as the cross-effect, which also can be estimated. However, in praxis it is often difficult to interpret such cross-effects when they emerge as significant.

Alternative presentation of stimuli

In most cases the attributes and choice sets are simply presented as written statements. In recreation research, visual landscape components might constitute important determinants of choice. Such concerns might range from the attractivity of outstanding landscape features, and issues of crowding, to human effects such as logging. It is conceivable that one any one attribute can be presented visually. In one study on the effects of forest harvesting on tourism we presented the quality of the forested landscape in northern Ontario in digitally calibrated images (Orland et al 1995). The digital calibration of images refers to a much more rigorous design process, in which one or several variables describing the landscape become an integral component of the fractional factorial design, and then a digital imaging technique is used to create a photo-realistic landscape image that represents these attributes. Figure 2 shows one example of the calibration process for the study in northern Ontario. The two columns on the left list the eight variables that were created in the image. In this study we used a total of 64 different images, which where then embedded into each scenario. Other attributes described the type and quality of the fly-in fishing location, and the fishing quality.

Nested and partial designs

The basic assumption in most DCEs is that respondents process all information simultaneously. In certain recreation applications such an assumption may be incorrect, when recreationists might consider experience components separately. For example, a destination and a mode of transportation, both of which are multiattribute phenomena in their own right, may be considered sequentially or separately. In such a situation a hierarchical or nested model structure might be appropriate, in which respondents evaluate one

Scene 1	
Attribute:	**Levels:**
Buffer Width -	100m
Residuals -	single conifers
Road -	no road
Forest Type -	conifer
Size -	large
Shape -	regular
# Blocks -	multiple
Colours -	fresh brown

Figure 2: An example of a digitally calibrated image

component before the other. Sometimes the number of attributes that a researcher desires to include in a study might be too large for presentation in one scenario. In that case, again a hierarchical design, or a partial design, in which only a subset of all variables appear in each choice set are elegant ways for building a larger model while still keeping the response task manageable. For a thorough discussion of many of these issues, see Dellaert et al. (1997) and Oppewal et al (1994).

CONCLUSIONS

The above presentation documents the versatility and adaptability of stated choice modeling to different behavioral context as well as to theoretical questions and applied issues. The main advantages associated with stated choice methods can be summarized as the following:

- respondents evaluate a recreation experience or the outcome of a management action as a whole, while the statistical analysis derive utility measures for each attribute;
- respondents think inevitably in terms of trade-offs, and whatever issue might be at the forefront of management concerns is somewhat disguised in the larger context;
- respondents may be better at expressing relative preferences than absolute ones;
- the statistical design ensures attributes are uncorrelated, obviating the problem of multicolinearity often encountered in revealed preference studies;
- the method allows the researcher to control the alternatives and choice sets presented to the respondent;
- truly different alternatives, some of which may not exist presently, can be evaluated.

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Segmentation of Outdoor Recreationists: A Comparison of Recreationists' Perceptions of Importance and Satisfaction Across Activities

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Abstract: The purpose of this study was to explore levels of importance and satisfaction with various attributes of customer service among selected segments of outdoor recreationists. The study also examined the nature of the relationships between satisfaction attributes and overall satisfaction. These relationships were tested for four dimensions of satisfaction (facilities, services, information, and recreation experience), across three water-based user groups (ramp users, campers, and day users). This study builds on previous customer satisfaction research conducted by both consumer behavior specialists and recreation researchers. In congruence with previous research on customer satisfaction, many of the constructs associated with quality in a recreation environment are intangible, elusive, and extremely difficult to measure. Study results showed that there are significant differences between different segments of users in reported levels of importance and satisfaction with various aspects of a recreational visit, but the nature of the relationships between the various domains and overall satisfaction varies little across the user segments.

INTRODUCTION

Recreation satisfaction has been examined from many different perspectives. Satisfaction has been identified as the principle product of the recreation experience (Driver & Tocher, 1970) and the major goal of recreation resource management (Lucas & Stankey, 1974). Zeithaml and Bitner (1996) describe satisfaction as a broad evaluation of a product or service that is influenced by perceptions of service quality, product quality and price, and other factors.

The notion of different levels of importance and satisfaction for distinctly different market segments or recreation user groups is examined in this paper. In a 1981 effort, Graefe identified different subgroups of anglers based on socio-economic differences, reasons for fishing, and participation levels. As early as 1978, Tinsley and Kass conducted research that focused on the differences in leisure activity needs between males and females, finding that leisure activities differ in their need satisfying properties.

Kuss, Graefe and Vaske (1990) examined the different needs of diverse user groups in outdoor recreation settings, based on the notion that a single management strategy cannot satisfy all visitors. This research effort attempted to develop visitor typologies, based on participation rates, preferences, demographics, and geographical location. Andereck and Caldwell (1994) examined segmentation in a public zoo setting, remarking that "understanding the diversity of participant needs and desires allows organizations to manage resources in the most efficient manner" (p. 19). Donnelly, Vaske, DeRuiter, and King (1996) pursued the notion of person-occasion segmentation, which focuses on not only the different user groups visiting the recreation area, but the different natural resource attributes of the area that they were visiting. Howat, Absher, Crilley and Milne (1996) measured visitor characteristics, demonstrating that variables such as gender, age, and disability status impact overall satisfaction levels of users to sporting events and leisure centers in Australia and New Zealand.

BACKGROUND

The purpose of this study was to explore the nature of customer satisfaction at US Army Corps of Engineers outdoor recreation settings. Data were collected as part of a larger study of customer satisfaction levels funded by the US Army Corps of Engineers Recreation Research Program. The parent study ran from mid 1995 to mid 1998, and resulted in a nationwide study of customer satisfaction levels at Corps lakes. Particular attention was placed on ensuring that the study was carried out at recreation sites dispersed throughout the country to capture the satisfaction levels of the Corps' nationwide water-based recreation customers.

Ten of the US Army Corps of Engineers' 465 lakes, located in ten different states, were selected for this study. These ten lakes were selected because of their broad range of surrounding populations, their dispersed geographical locations, their relatively high usage rates, and their representativeness of Corps recreation users in the United States.

A random sample of 2,933 recreationists at Corps of Engineers lakes were selected to participate in this study. The sample was stratified and conducted on-site at 67 individual recreation sites at the participating lakes. The interviews were collected in entirety through on-site, face-to-face interviews. Respondents were approached by the interviewers while they were in a recreation setting, such as a campground, boat ramp area, or day use area (beach, picnic area, etc.). Refusals were very limited (29 returned refusal sheets) due to the on-site methodology of the study.

The visitors were asked what recreational activities they were pursuing and then asked to rank those activities by listing their primary, secondary, and tertiary activities by level of importance. The respondents were categorized accordingly, falling into one of three primary user segments (ramp use, camping, or day use). Of the 2,933 respondents interviewed, 35% reported that their primary activity was day use, another 35% indicated that camping was their primary activity, and 30% reported ramp-use as their primary activity (Table 1).

Activity	N	%
Ramp use	720	30.3
Camping	820	34.5
Day use	837	35.2

Table 1. Primary Activity Frequencies.

INSTRUMENTATION

This study was designed to measure visitors' expectations and satisfaction with facilities, services, information, and their recreation experience. Customer satisfaction was measured using a battery of 19 items patterned after instruments developed by Parasuraman, Zeithaml, and Berry (1985) for use in consumer research, and MacKay and Crompton (1990) and Howat, Absher, Crilley and Milne (1996) in the outdoor recreation field. These researchers used several "domains" under which a battery of items was nested. The number of domains has ranged from three to ten, and the number of customer service items has ranged from 11 to 77 in different studies.

In this study, 19 items under four different domains were used to attempt to explain overall satisfaction (Table 2). Respondents were asked to rate both the importance of and their satisfaction with the attributes using a five point Likert scale ranging from "not at all important" to "extremely important" and "not at all satisfied" to "extremely satisfied."

To identify specific areas of satisfaction, each of the 19 items represented one of four satisfaction domains (facilities, services, information, and recreation experience). The satisfaction level associated with each of these four domains was also measured using a 5-point Likert scale. The final satisfaction measure was an overall measure of satisfaction, designed to query visitors as to their satisfaction with their overall experience on that visit. A 10-point scale, ranging from "1" to "10" (where 1 is worst and 10 is best) was used to measure overall satisfaction.

RESULTS

The mean importance and satisfaction scores were relatively high, with the highest importance score (safety and security at the area; mean = 4.50) found in the services domain, followed closely by appearance and maintenance of the area (4.47), in the facility domain (Table 2). The lowest importance scores were noted for the information domain, with the lowest individual item being nature/historical information about the area (3.33). The highest satisfaction indicator was found in the services domain (courteous and friendly staff; 4.34). The lowest satisfaction score was the same as the lowest importance item (nature/historical information about the area; 3.73).

Comparison of User Groups

For the purpose of this paper, recreation users were asked to indicate what their primary activity was (ramp use, camping, or day use) on the day they were interviewed at the recreation site (see Table 1). One-way analysis of variance was used to compare satisfaction levels for various aspects of the trip experience. Sheffe's post hoc analysis was used to examine the multiple comparisons of the mean scores.

Significant differences were noted for satisfaction within all four customer service domains (Table 3). In each case, the campers showed the highest mean scores among the three user groups. The greatest differences were noted in satisfaction with services. Campers showed the highest scores for this measure (mean = 4.28), followed by day users (4.09) and ramp users (4.06). Satisfaction with information showed the second greatest degree of difference across the three user groups, with campers (4.14) indicating the highest mean scores for this item, and no significant difference noted between ramp users (3.98) and day users (3.97). Similarly, campers showed the strongest satisfaction levels for satisfaction with

Satisfaction Domain	Item	Mean Importance	Mean Performance
Facilities	Accessibility for those with disabilities	3.67	3.88
Facilities	Sufficient number of recreation areas	4.24	4.04
Facilities	Appearance and maintenance of the area	4.47	4.26
Facilities	Value for fee paid	4.08	4.19
Services	Availability of staff to answer my questions	3.65	3.97
Services	Visibility of staff	3.72	4.05
Services	Safety and security at the area	4.50	4.27
Services	Courteous and friendly staff	4.24	4.34
Services	Opportunity to offer suggestions to the staff	3.60	3.97
Services	Adequate ranger/visitor assistance patrols	4.14	4.20
Information	General information about the area	3.56	3.89
Information	Nature/historical information about the area	3.33	3.73
Information	Safety information	3.98	3.94
Information	Ease of obtaining information	3.85	4.03
Information	Current and accurate information	3.92	4.04
Experience	Opportunity to recreate without feeling crowded	4.21	4.09
Experience	Opportunity to recreate without interference from other visitors	4.15	4.11
Experience	Compatibility of recreation activities at the area	3.87	4.11
Experience	Places to recreate without conflict from other visitors	4.35	4.26

Table 2. Mean Importance and Satisfaction Scores for Customer Service Items.

One-way ANOVA	Ramp Users	Campers	Day Users	
	Mean Values			F Value
Satisfaction with Facilities	4.18[a]	4.30[b]	4.27[ab]	4.84**
Satisfaction with Services	4.06[a]	4.28[b]	4.09[a]	18.78***
Satisfaction with Information	3.98[a]	4.14[b]	3.97[a]	11.30***
Satisfaction with Recreation Experience	4.32[a]	4.42[b]	4.35[a]	4.60**

***= Significant at p < .001 ** =Significant at p < .01 * =Significant at p < .05
a Means with different superscripts differ significantly at the .05 level

Table 3. Comparison of Satisfaction with Facilities, Services, Information, and Recreation Experience Domains, by Type of User.

facilities (4.30), followed closely by day users (4.27). The ramp users (4.18) were significantly less satisfied with facilities than the campers (4.30). The smallest differences were noted for satisfaction with the recreation experience, although campers again showed a slightly higher satisfaction score (4.42) than day users (4.35) and ramp users (4.32).

Further analyses compared the individual satisfaction attributes across the three user groups. Significant differences were noted between the three groups for each of the 19 importance items (Table 4). A clear pattern of campers reporting significantly different perceptions of importance was noted. Campers reported the highest importance scores for 16 of the 19 items, although one item was matched in importance by the ramp users. The accessibility for persons with disabilities stood out as being significantly more important to the day users (3.80) and campers (3.76) than to the ramp users (3.46). This item was an anomaly among the 19 items in that only a small proportion of respondents reported that they had a disability and answered the question.

The day users showed the lowest importance scores for 12 of the 19 items, while the ramp users reported the lowest importance scores for the remaining seven items. Only one clear pattern emerged across the four domains, with the day users

One-way ANOVA	Ramp Users	Campers	Day Users	
	Mean Values			F Value*
Facilities Domain				
Accessibility for those with disabilities	3.46 [a]	3.76 [b]	3.80 [b]	11.63
Sufficient number of recreation areas	4.21 [a]	4.37 [b]	4.08 [c]	26.68
Appearance and maintenance of the area	4.39 [a]	4.57 [b]	4.43 [c]	15.69
Value for fee paid	4.06 [a]	4.25 [b]	3.95 [a]	21.59
Services Domain				
Availability of staff to answer my questions	3.61 [a]	3.94 [b]	3.46 [c]	44.75
Visibility of staff	3.70 [a]	3.98 [b]	3.48 [c]	50.88
Safety and security at the area	4.40 [a]	4.61 [b]	4.44 [a]	21.55
Courteous and friendly staff	4.15 [a]	4.37 [b]	4.16 [a]	20.84
Opportunity to offer suggestions to the staff	3.66 [a]	3.74 [a]	3.34 [b]	35.26
Adequate ranger/visitor assistance patrols	4.13 [a]	4.38 [b]	3.95 [c]	46.65
Information Domain				
General information about the area	3.46 [a]	3.75 [b]	3.48 [a]	22.30
Nature/historical information about the area	3.14 [a]	3.42 [b]	3.33 [a]	11.94
Safety information	3.93 [a]	4.12 [b]	3.87 [a]	15.31
Ease of obtaining information	3.80 [a]	4.00 [b]	3.72 [a]	21.83
Current and accurate information	3.93 [a]	4.03 [a]	3.80 [b]	13.51
Recreation Experience Domain				
Opportunity to recreate without feeling crowded	4.25 [a]	4.30 [a]	4.11 [b]	10.92
Opportunity to recreate without interference from other visitors	4.21 [a]	4.18 [a]	4.06 [b]	5.94
Compatibility of recreation activities at the area	3.90 [a]	3.90 [a]	3.77 [b]	8.50
Places to recreate without conflict from other visitors	4.39 [a]	4.42 [a]	4.24 [b]	13.19

*= All F Values Significant at $p < .001$.
[a] Means with different superscripts differ significantly at the .05 level

Table 4. Comparison of Importance of Individual Customer Service Items, by Type of User.

One-way ANOVA	Ramp Users	Campers	Day Users	
	Mean Values			F Value
Facilities Domain				
Accessibility for those with disabilities	3.81	3.92	3.91	1.80
Sufficient number of recreation areas	3.93 [a]	4.11 [b]	4.13 [b]	10.24***
Appearance and maintenance of the area	4.24	4.34	4.26	3.26*
Value for fee paid	4.10 [a]	4.28 [b]	4.23 [b]	8.65***
Services Domain				
Availability of staff to answer my questions	3.94 [a]	4.16 [b]	3.83 [c]	29.94***
Visibility of staff	3.97 [a]	4.19 [b]	3.86 [c]	30.87***
Safety and security at the area	4.20 [a]	4.43 [b]	4.18 [a]	27.15***
Courteous and friendly staff	4.28 [a]	4.46 [b]	4.24 [a]	19.33***
Opportunity to offer suggestions to the staff	3.95 [a]	4.09 [b]	3.76 [c]	26.40***
Adequate ranger/visitor assistance patrols	4.15 [a]	4.36 [b]	4.07 [a]	25.12***
Information Domain				
General information about the area	3.83 [a]	4.00 [b]	3.83 [a]	11.44***
Nature/historical information about the area	3.68	3.76	3.70	1.43
Safety information	3.90 [a]	4.05 [b]	3.81 [a]	14.99***
Ease of obtaining information	3.98 [a]	4.21 [b]	3.87 [c]	34.91***
Current and accurate information	4.00 [a]	4.19 [b]	3.89 [c]	27.01***
Recreation Experience Domain				
Opportunity to recreate without feeling crowded	3.96 [a]	4.20 [b]	4.02 [a]	13.73***
Opportunity to recreate without interference from other visitors	3.98 [a]	4.22 [b]	4.09 [c]	14.42***
Compatibility of recreation activities at the area	4.07 [a]	4.16 [b]	4.06 [a]	4.16*
Places to recreate without conflict from other visitors	4.16 [a]	4.34 [b]	4.23 [a]	10.11***

***= Significant at p < .001 ** =Significant at p < .01 * =Significant at p < .05
[a] Means with different superscripts differ significantly at the .05 level

Table 5. Comparison of Satisfaction with Individual Customer Service Items, by Type of User.

Independent Variable	**Ramp Users**		Campers		Day Users	
	R	Beta	R	Beta	R	Beta
Satisfaction with Facilities	.27***	.07	.33***	.15*	.36***	.16*
Satisfaction with Services	.22***	-.00	.28***	.04	.35***	.12*
Satisfaction with Information	.30***	.16*	.33***	.14*	.38***	.16*
Satisfaction with Recreation Experience	.31***	.18*	.33***	.16*	.30***	.06
	$R^2 = .12$		$R^2 = .15$		$R^2 = .17$	
	F = 23.22***		F = 36.00***		F = 42.16***	

Dependent Variable = Overall Satisfaction
***= Significant at p < .001

Table 6. Multiple Regression of Overall Satisfaction with Facilities, Services, Information, and Recreation Experience Domain Satisfaction, by Type of User.

reporting the lowest mean importance scores for all four of the recreation experience items. Ramp users (mean = 4.21) and campers (mean = 4.18) indicated that the opportunity to recreate without interference from other visitors was more important to them than the day users (mean = 4.06). This same pattern held true for the remaining items within the recreation experience domain.

The examination of the item satisfaction scores showed some interesting patterns across the three user groups. As was noted in the importance analysis, the campers continued the trend of showing the highest mean satisfaction scores (Table 5). This was the case for all but one of the satisfaction items, where the day users showed higher satisfaction scores for "sufficient number of recreation areas." Several patterns emerged within the domains for the satisfaction items. The day users showed the lowest mean satisfaction scores for all six of the service items and three of the five information items (one item tied for lowest mean score between the ramp users and the day users). The ramp users showed the lowest satisfaction scores for all of the facilities items and for three of the four recreation experience domain items. As with the importance scores, the campers usually stood out as the most distinct group.

Predicting Overall Satisfaction

To understand the extent to which each of the domains was related to overall satisfaction, the four domain satisfaction scores were regressed against overall satisfaction for each of the three user groups (Table 6). In each instance there were at least two significant predictors of overall satisfaction, although the significant predictors varied for the three groups.

An examination of the ramp users showed that the recreation experience domain (*Beta* = .18) and the information domain (*Beta* = .16) were significant predictors of overall satisfaction. This model accounted for about 12% of the variance associated with overall satisfaction. The campers showed significant effects for the recreation experience domain (*Beta* = .16), the facilities domain (*Beta* = .15), and the information domain (*Beta* = .14). These independent variables accounted for about 15% of the variance in overall satisfaction. Day users' results also indicated three significant predictors of overall satisfaction. The facilities domain (*Beta* = .16), information domain (*Beta* = .16), and services domain (*Beta* = .12) together accounted for 17% of the variance associated with overall satisfaction.

One pattern that emerged from these regression models was that all three user groups showed a significant effect from the information domain. The facilities domain showed a significant influence for both the campers and the day users, while the ramp users and the campers showed a significant influence from the recreation experience domain. The services domain was significant for only one user group (day users).

A Fisher's Z test was used to test the significance of the differences between the correlations for the three different user groups. Few significant differences were noted between the three user groups. In the comparison of ramp users and day users, only the services domain score showed a significant difference ($Z = 2.69$, $p = .007$). Satisfaction with services was more strongly correlated with overall satisfaction for day users ($r = .35$) than for ramp users ($r = .22$). No other significant differences were found between the user groups with respect to the correlations between overall satisfaction and satisfaction with each of the domains.

CONCLUSIONS

This study examined three distinct recreation user groups to better understand the levels of importance and satisfaction for a battery of 19 items within four customer service domains. Respondents were segmented based on their self-described primary recreation activity (ramp use, camping, or day use). This was done to determine if the satisfaction model hypothesized in this study was an adequate measure of customer satisfaction for the three primary activities (ramp use, camping, or day use) that typically occur at Corps of Engineers recreation areas.

One clear pattern that emerged is that the campers were often significantly different from the ramp users and day users regarding their importance and satisfaction levels. When examining the individual satisfaction items and domains, one may note that a camper might have a completely different need associated with an item such as adequate ranger/visitor assistance patrols or visibility of staff than would a ramp user or day user. Campers are different from ramp users and day users in one key aspect: they sleep at the recreation site in tents, recreational vehicles, cabins, etc. Perhaps this commitment to stay at the recreation site leads to a closer evaluation of the importance variables, resulting in higher importance item ratings.

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Predictive Model of Responsible Environmental Behaviour: Application as a Visitor-Monitoring Tool

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Abstract: This working paper presents a framework for understanding responsible environmental behaviour as a visitor-monitoring tool. Visitor use data forms the basis of any successful visitor management plan to understand user knowledge, awareness and attitudes about pollution issues in order to develop management policies and actions that enhance appropriate visitor behaviour. A case study of the application of a predictive behavioural model on the Chesapeake Bay, Maryland, USA involving boater environmental behaviour as a social indicator is discussed. Results indicate that knowledge of water pollution issues, awareness of the consequences, equipment issues such as boat length and boat type, and situational factors that constrain or hinder appropriate behaviour were indicators of appropriate behaviour. A structural equation path diagram model was tested using AMOS student version 4.01 using up to seven of the eight predictors from boating behaviour case study to demonstrate the strength of a path analysis procedure. Results model those of the stepwise regression procedures used in the original study, yet the path diagrams demonstrate ease of interpreting the structural relationships among variables in a regression equation. Implications for management actions in the case study situation are given followed by a proposed research-monitoring program coupling social science techniques with the natural sciences.

INTRODUCTION

The environmental impacts of recreational boating in protected waters are recognised, but not well understood. Much of the available information is descriptive or anecdotal, with little hard data and analysis. Most studies are of a short-term nature, and long-term impacts are rarely addressed. The monitoring of environmental impacts of boating is not carried out in the majority of protected area marine parks in developing countries. There is rarely any baseline data with which to compare current situations, and neither is time-series data available for analysing trends. There is a lack of integrated monitoring and management, and no definition of indicators by which to evaluate the environmental performance of protected area tourism. It is recommended that simple social and environmental impact monitoring strategies are implemented, and controls on certain aspects of visitor and boater use are enforced (Goodwin et al., 1997). This paper examines specific issue responsible environmental behaviour as a social indicator in visitor monitoring within a marine resource setting. However, note that the concepts are intended for a broader context of visitor monitoring in protected areas.

Since the 1970's, the concern for the environmental quality of our planet has generated much research on the measurement of responsible environmental behaviour. From a social psychological perspective, environmental quality represents a collective action and a social norm problem (Heberlein, 1975). A litter-free beach zone, for instance, can only be achieved when the vast majority of sun-seekers dispose of their trash appropriately. Similarly, a pollution free marine park will not be realised if visitors do not collectively adhere to the regulations regarding waste disposal. General responsible environmental behaviour is defined as any individual or group action aimed to do what is right to help protect the environment in general daily practise – e.g., recycling (Sivek & Hungerford, 1989-1990). Meanwhile, specific responsible environmental behaviour is any behaviour that is more activity specific in nature (e.g., littering while backpacking in an alpine region) as related to rule compliance or illegal, inappropriate, or non-sustainable behaviour (Heberlein & Black, 1976; Hungerford & Volk, 1990). Although studies of attitudes towards specific issues are limited in overall generalisiability beyond the environmental issues under examination, the literature indicates that attitude measures specific to a given behaviour are better predictors of that behaviour than are more general measures (Cottrell & Graefe, 1997; Heberlein & Black, 1976; Hungerford & Volk, 1990; Marcinkowski, 1988). Yet, research implications imply that by including both, one can better predict behaviour from attitudes and show how actions and beliefs are part of a larger cognitive construct. By including both issue-specific and general attitudes within a predictive model, findings enhance further understanding of the interrelation between variables pertinent to the illegal or nonsustainable behaviour in question.

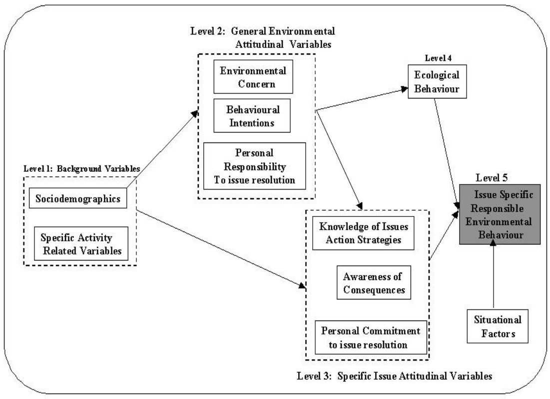
The purpose of this working paper is to present a framework for understanding responsible environmental behaviour as a visitor-monitoring tool (see Figure 1). The basis of a successful visitor management plan is the collection of visitor use data to understand user behaviour, needs, and expectations in order to develop management policies and actions that enhance appropriate visitor behaviour. Next follows a brief summary of a case study of boating impacts on the Chesapeake Bay in Maryland in which a similar predictive model was applied. A structural equation path diagram model was tested using AMOS student version 4.01 with up to seven of the eight predictors from the boating behaviour case study data to demonstrate the strength of a path analysis procedure. Results model those of the stepwise regression procedures used in the original study, yet the path diagrams demonstrate ease of interpretation of the structural relationships among variables in a regression equation. Finally, a proposed research design including visitor surveys of both observed and unobserved rule compliant boaters for comparison of results follow this up.

PREDICTIVE MODEL OF RESPONSIBLE ENVIRONMENTAL BEHAVIOR

This framework was based on recommendations found in the environmental behaviour literature to test a predictive model of responsible environmental behaviour including both general and specific issue behaviours (Hines et al., 1986/87; Hungerford & Volk, 1990; Sivek & Hungerford, 1989/90). Findings from previous testing (see Cottrell, 1993; Cottrell & Graefe, 1997) of a similar model imply that background variables (i.e., education and specific activity related variables), environmental concern, knowledge of environmental issues and awareness of the consequences of behaviour, were moderate to strong predictors of behaviour in both general and specific issue situations. Secondly, the more specific the indicator of behaviour, the better predictive ability that indicator had of specific behaviour. The author argues that a predictive model of responsible environmental behaviour is a useful tool for monitoring visitor behaviour pertinent to a greater understanding of behaviour leading to better visitor management planning.

Figure 1 shows five levels of variables arranged from left to right to represent an increasing strength of relationship between those variables and the primary dependent variable (specific issue responsible environmental behaviour (SREB)). Activity specific variables (i.e., activity type, equipment, skill level, participation, past experience), income, age, education, and political ideologies are some variables that comprise an individual's background. Background characteristics (level 1) precede other variables in the model and are necessary to understand responsible environmental behaviour (Cottrell & Graefe, 1997; Dunlap & Van Liere, 1984; Hines et al., 1987; Marcinskowski, 1988).

Figure 1. Predictive Framework of Responsible Environmental Behaviour (adapted from Cottrell, 1993).



The next two levels in the framework show two groups of variables: general environmental attitudinal and specific issue attitudinal variables. The general environmental group (level 2) includes environmental concern, behavioural intentions, and personal responsibility for issue resolution. As concern (item adopted from Dunlap & Van Liere, 1978) for different aspects of the environment develops, more specific attitudes about specific acts (e.g., water pollution) will evolve and influence feelings of personal responsibility toward an action and verbal commitment to an issue or problem resolution. Ajzen (1991) posed a theory of planned behaviour that has been used to examine indicators of responsible environmental behaviour (see Ajzen in Hrubes et al., 2001). In summary, his theory refers to human action that is guided by three forms of belief: behavioural – beliefs about the likely consequences of the behaviour, normative - beliefs about the normative expectations of others, and control - beliefs about the presence of factors that may further or hinder performance of the behaviour, a form of locus of control. Hrubes et al. (2001) argues that intentions remain a central indicator of actual behaviour and previous studies support their claim (Cottrell, 1993; Cottrell & Graefe, 1997).

An ecological behaviour scale is available and has been tested in a number of studies (Hartig, Kaiser, & Bowler, 2001; Kaiser, Ranney, Hartig, and Bowler, 1999). The scale consists of 51 items, which represent different types of ecological behaviour. This scale offers a more current construct of general environmental behaviour than used in Cottrell's (1993) dissertation and may result in a greater percentage of variance explained by the combined effect of the predictor variables in a regression model. In summary, the level 2 variables are shown to directly influence the specific issue group of variables (level 3) and to directly influence ecological behaviour (level 4), which in turn, influences specific REB (level 5).

The specific issue group of variables (level 3) includes knowledge of issues, which breaks down into three scales (i.e., knowledge about water pollution, knowledge about the laws pertinent to the specific issue and action strategies for rule compliance), awareness of consequences, and personal commitment to issue resolution. In order for an individual to act responsibly towards a given object or situation, a person must have some knowledge or information about it. For instance, to engage in recycling, they must know what they can recycle, where to take the recyclable, and when. Third, some awareness about consequences (e.g., threats to the marine environment) resulting from recycling may influence actual behaviour. Awareness of consequences of behaviour influences personal commitment for a particular action (Heberlein & Black, 1976). The stronger the sense of responsibility, the stronger the personal commitment to performing a particular act should be. Specific issue REB is shaded dark grey to denote its position as the primary dependent variable. Lastly, even though an individual's intentions to comply responsibly may be positive, certain situations and/or constraints might interfere with actual behaviour. Therefore, the variable category, situational factors, is shown in the diagram to influence actual behaviour.

BOATING CASE STUDY

The predictive model of responsible environmental behaviour was tested in an examination of responsible environmental boating behaviour on the Chesapeake Bay in Maryland (see Cottrell's dissertation, 1993). The following paragraphs summarise the main study results within the context of managing for sewage disposal from boaters as used by the Maryland State Boating Administration, USA.

Background

Recreational boating represents an important activity as it pertains to travel and tourism in the Chesapeake Region where there are an estimated 200,000-registered boats. Chesapeake Bay, the largest coastal embayment on the eastern seaboard, provides excellent opportunities for pleasure boating from sailing to sunbathing. The bay also provides areas for recreational claming, fishing, and crabbing. These recreational boating activities can have a potentially large impact on water quality via the dumping of raw sewage by boaters in high use areas (i.e., marinas, bays and lagoons) and pollution via hydrocarbon loading from boat exhausts. Sewage dumping is an important issue because of eutrophication caused by increased nutrient loads, hypoxia resulting from nutrient loading, high turbidity, and the release of coliform bacteria and other micro organisms of concern to human health. Marine toilets that directly discharge raw sewage are illegal in US territorial waters (i.e., within three miles of the coast). While the effect of a single boat may seem insignificant, the large number of boats on the water, especially during periods of peak use (weekends and holidays) lead to significant impacts on water quality. Marinas, boat anchorage's, and raft-up spots are typically located in quiet, protected waters such as small bays and inlets. Previous research has shown that these sites are frequently ecologically sensitive areas with restricted water flow, which means pollutants are flushed out slowly, thereby decreasing water quality. Recognising the threat of sewage from recreational boats to the quality of water in the Chesapeake Bay region, the General Assembly of Maryland passed legislation in 1988 to allow for use of waterway improvement funds to construct marine sewage pumpout facilities at public or private marinas (Arney, 1990; (Recreational Boat Pollution, 1991).

Problem clarification

Methods of proper disposal of sewage are common knowledge among owners of vessels with portable or marine toilets with holding tanks; yet, most vessel owner/operators generally discharge raw effluent within the three-mile limit. Multiple factors and/or constraints contribute to this behaviour: the inconvenience of travelling offshore, lack of sewage dump stations in the local area, lack of accessible and/or inconvenience of dump station locations, lack of adequate law enforcement, lack of knowledge about coastal marine laws and about the potential threat raw sewage imposes to public health and living resources, and a lack of responsible environmental attitudes (Recreational Boat Pollution, 1991). Another factor contributing to the illegal discharge of raw effluent is that most marine head holding tanks are limited in overall capacity (e.g., 15 gallon capacity on a 35 foot vessel); therefore, when used properly holding tanks fill rapidly, which requires frequent pumping out. The cruising vessel underway daily and travelling offshore while pleasure cruising is able to pump out a holding tank on a frequent basis. However, for those live-aboard vessels that remain indefinitely at a mooring, proper disposal of sewage is inconvenient, although sewage dump stations may be easily accessible (Cottrell, 1993). Thus, the discharge of human waste from recreational boats on the Chesapeake Bay is one aspect of marine pollution to confront as part of the overall problem of marine pollution in protected area waters.

Methods

This case study examined relationships between several of the variables depicted in Figure 1. Independent variables were age, boat length, boat type, years boating experience, knowledge about water pollution issues, awareness of the consequences of raw sewage on water quality, and the convenience of sewage pumpout station usage and the percent of human waste discharged in a sewage pumpout station (dependent variable - SREB). The methods used were:

- Household survey sent to 751 registered owners of boats 22 feet or longer to insure boats had a marine toilet. Sample was reduced to 713 due to insufficient addresses. Response was 41% (n=291), which was surprising due to self-reports of illegal behaviour (raw sewage discharge).
- Descriptive statistics, one-way analysis of variance, and multiple regression techniques were used to examine the predictive strength of the independent variables on the dependent variable (% sewage pumped in a pumpout station).

Note: for a complete overview of the analysis see Cottrell, 1993; Cottrell & Graefe, 1997.

Selected Results

Eight predictors of responsible environmental behaviour was determined accounting for 46% of the total variance explained in the % of waste pumped in a pumpout station (Cottrell & Graefe, 1994).

- As length of boat increased, % of waste pumped in a sewage pumpout station decreased[1].
- As years boating experience increased, sewage pumpout station usage decreased[1].
- As education & environmental concern increased, sewage pumpout station use decreased[1].
- As age of boaters increased, sewage pumpout station usage decreased[2]. Boaters 50 or less were more aware of the negative impacts raw sewage discharge has on water quality.

[1] Predictor variable(s) of specific behaviour in Cottrell, 1993.
[2] Correlate of specific behaviour only, Cottrell, 1993

Boat owners in this sample represent an affluent white middle/upper class group who have been boating a long time (average age=50; average years experience=21, boat length=31) and the implementation of a comprehensive SPS program in Maryland was recent at the time this study was conducted (1992). Findings indicate that there is a substantial difference between younger and older age boaters and their environmental attitudes and behaviour in this case study. Much of these results can be explained by situational factors – or in this case, those aspects of pumpout station usage that hinder appropriate behaviour. Although intentions to comply with certain laws or willingness to participate in pro-environmental behaviour may be high, each situation involves barriers or constraints to proactive behaviour (namely - cost, waiting in line, inconvenient location, closed facilities, and ease of use). To develop management implications requires an identification of those constraints to proactive behaviour. Thus, five constraints items combined to create a 5-point agreement scale to measure the convenience of SPS usage (mean=2.7). Reasons for the low mean score included cost, waiting in line, inconvenient location, closed facilities, and ease of use of pumpout stations.

Implications lead to further discussion about the convenience of SPS use and percentage of waste pumped into an SPS. In this case study, the convenience of SPS usage was significantly correlated with boat length. As length of boat increased, the convenience factor decreased, likewise, the percentage of waste pumped in an SPS decreased. Boat owners in this sample have relatively large boats (average length=31 feet). To manoeuvre a large boat within the confines of a marina setting is quite difficult at times. Thus, the degree of boating skill must be greater to bring a larger boat to an SPS location. In essence, to use a sanitation pumpout facility means that boaters must dock their boats twice, once to pump out and again on return to their dockage point. In sum, the larger the boat the less the boater used a sanitation pumpout station, and the more raw sewage was pumped in the Chesapeake Bay. Although an SPS in a marina is important, the convenience of SPS usage must be considered further on the part of marina management. For instance, mobile pumpout units are relatively inexpensive and easy to use, which may encourage further use by both older age cohorts and large boat owners.

- Upon examination of boat type, power boaters used an SPS (77% of waste pumped) significantly more than sailboaters (44%).

This finding relates to the convenience of use issue. Logic implies that powerboats are easier and quicker to manoeuvre than sailboats, which may influence the increased usage among powerboat owners.

Respondents were asked “what would make you use a pumpout station more often”. Only 31% indicated that they use a pumpout station every time they go boating. Sixty-one percent said that more convenient hours would help and 42% felt that better designed facilities would encourage more use. Only 20% felt that shorter waiting lines would enhance more use; yet 51% thought that a lower cost to use a pumpout would be of benefit. 42% marked that availability of mobile pumpout units would facilitate more use (see Table 1).

	N	% Yes
Always use pumpout stations	213	31.5
Availability of mobile facilities	147	42.2
More convenient location	147	61.2
More convenient hours	147	42.2
Shorter waiting lines	147	19.7
Better designed facilities	147	42.2
Lower cost of using facilities	147	51.0

Table 1. Percentage of response to use pumpout more often

- As knowledge about water pollution issues, knowledge about the laws concerning discharge of waste at sea, and awareness of the consequences of human waste on water quality increased, sewage pumpout station usage increased; thereby indicating the strength of the knowledge and awareness related variables (note: predictor variables in Cottrell, 1993) .

In summary, these findings imply that public information and boater education may influence pro-environmental behaviour. Management implications suggest that a new approach is necessary to educate or encourage more SPS usage among this particular group of boaters (large boat owner's age 50 or greater).

Conclusions

From a monitoring of visitor behaviour perspective by focusing on responsible environmental behaviour as a social indicator of appropriate behaviour, Maryland State boating administration personal can see the need for alternative measures to encourage further use of pumpout stations in marinas. One conclusion was the need for more mobile pumpout units in large marinas occupied by elite boat owners. Secondly, location of fixed pumpout stations is critical to accessibility by larger boats. Thirdly, there was a large discrepancy between pumpout fees between marinas that participated in the federal grant reimbursement program ($5/pumpout) and those that did not ($15/pumpout). To pump raw sewage overboard from any location on the Chesapeake Bay is illegal. Due to the sensitive nature of this issue, measuring this specific behaviour (i.e., whether or not boaters pump raw effluent overboard) by self-reported methods was cause for some concern. Therefore, a replication of the study proposal is recommended (see study proposal later in the paper).

Structural Equation Modelling – an example

A structural equation path diagram (AMOS student version 4.01) was used to re-examine seven of the eight predictors of specific behaviour in the boating behaviour case study to demonstrate the strength of a path analysis procedure (See Cottrell & Graefe (1997) for the detailed operationalisation of the variables used in this analysis). ***Note*** that AMOS 4.01 student version limits the number of variables to eight total. Variables included were years boating experience, length of boat, formal education, knowledge of the law about discharge on inland waters, knowledge of water pollution issues, awareness of the consequences sewage has on water quality and environmental concern which explained 42% of the variance in the % of sewage pumped in a pumpout station on shore. Results resemble (see Figure 2) those of the stepwise regression procedures using SPSS software in the Cottrell & Graefe (1997) study (R^2 = .42; or 42% of the variance explained by seven variables), yet the path diagram demonstrates ease of interpretation of the structural relationships among variables in a regression equation. ***Note*** that the intent was not to report specific results of the path analysis but to demonstrate its potential as a statistical tool for analysis of complex relationships in visitor behaviour for monitoring purposes.

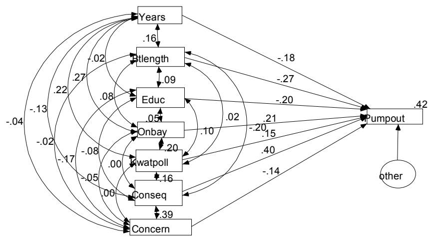


Figure 2. Path diagram of predictors of specific responsible environmental behavior

In Figure 2, the value -.18 between YEARS boating experience and PUMPOUT (the specific behaviour variable - % waste pumped in an SPS) is a standardised regression weight. The value .16 is the correlation between Years experience and Boatlength. The number .42 is the squared multiple correlation (R^2 value) of PUMPOUT with years experience, boatlength, formal education, knowledge of dumping laws on bay, knowledge of water pollution issues (KWATPOLL), awareness of the consequences of sewage discharge on water quality (CONSEQ), and environmental concern (CONCERN).

To further demonstrate path diagrams use as a statistical tool, three new variables (Awareness of Consequences; Ascription to Responsibility, and Behavioural Commitment) were introduced to the structural equation model replacing EDUC, CONCERN, and CONSEQ. The new variables (see Table 2) were operationalised as multiple item scales in accordance with recommendations of Vaske et al., (1997 unpublished) in their norm activation study of behaviour and introduced here on an exploratory basis.

Scaled item measures
Awareness of Consequences Scale [1]
• Sewage discharge from boats is significant enough to cause disease
• Sewage discharge from boats contributes to water pollution
• Disposing sewage at proper sanitation facility on shore will significantly reduce the amount of water pollution.
Ascription of Responsibility Scale[1]
• I think I am doing enough to reduce water pollution
• I feel my own actions do not cause water pollution
Behaviour Commitment Scale [1]
• Make a special effort to use a marine sewage pumpout station when I go boating.
• Used a sanitation facility every time holding tank was full

1. Variables coded on a 5-point scale from "strongly disagree" (1) to "strongly agree" (5).

Table 2. New variables examined in Figure 3 Model

This analysis was done in an attempt to increase the percentage of variance explained via the net effect of the seven variables. Years boating experience, boat length, onbay, and Kwatpoll remained in the diagram (see Figure 3).

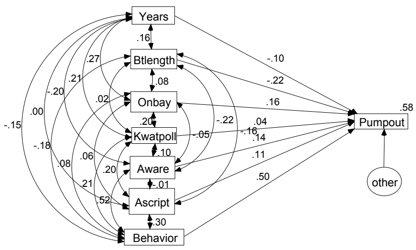


Figure 3. Path diagram of new predictors of specific responsible environmental behavior

Note that the squared multiple correlation value (R^2) increased from .42 in Figure 2 to .58 in Figure 3 indicating that the predictive strength of the seven variables combined explained 58% of the variance in the percentage of waste pumped in a PUMPOUT station on shore. In conclusion, AMOS path diagram software is useful to examine interrelationships between a set of attitudinal and behavioural variables to monitor visitor behaviour. By entering behavioural commitment, ascription to responsibility, and the reconstructed awareness of consequences variables the squared multiple correlation increased. Strength of other variables can be explored by entering them into the path diagram as well. Secondly, managers can examine those variables that have the greatest predictive strength - such as knowledge (onbay), awareness and behaviour commitment for instance, and the strength of the correlation between each to determine underlying relationships. In this case, as ascription of responsibility, behaviour commitment, and the awareness of consequences increased, the greater % of sewage boaters reported pumping in a pumpout station. Meanwhile, as boatlength increased the % of waste pumped decreased. The same holds true for years boating experience - which at first appears illogical. Therefore, examining the background variables becomes important to note differences in boater types, age, status, etc. In this case, as stated previously, affluent boaters with large boats need additional or alternative attention in terms of information and awareness raising measures to encourage a change in their behaviour.

STUDY PROPOSAL IN THE WORKS

This study proposes to couple social science techniques with the natural sciences in a comparative study of environmental behaviour among boaters on the Chesapeake Bay, USA and the IJsselmeer, The Netherlands. The project proposes to direct sustainable economic growth and water resource utilisation in a coastal marine embayment while preserving its environmental quality and aid in the design of effective strategies for the management of marine water resources for recreational boating. The study will apply the model discussed previously (Figure 1) in combination with water quality data and GIS to link spatially both data sets to provide marine resource managers information to make decisions on the sustainable management of Inland waters for public recreational use. Objectives are: 1) To examine the Maryland Pumpout Station Grant Incentive Program through assessing usage of the pumpout stations and the percentage of human waste recreational boaters pump legally and/or illegally. 2) To examine water quality and pollution from boat exhausts in selected high-use areas to determine the impact of recreational boaters in those areas (e.g., a number of large marinas and popular anchorage's in both rural and metropolitan areas). 3) To identify recreational boaters' perceptions about specific water quality problems resulting from the illegal disposal of human waste. 4) To develop recommendations for enhancing boater education about sewage pumpout usage and responsible environmental boating behaviour at both a regional and national level. 5) To develop a Geographic Information System (GIS) database for display and analysis of data collected in Objectives 1 and 2. Benefits include: GIS maps illustrating the usage of sewage pumpout stations and water quality in high-use waterways adjacent to pumpout stations, and a descriptive profile of the boaters and their perceptions about water quality. Results may be used by resource managers to make recommendations for further public educational efforts and water resource management. Maps of water quality data will elucidate the degree of boating impact on water resources in high-use areas where pumpout stations are available and will serve as a benchmark for further Bay-wide strategies for managing boating resources to maintain high water quality. A direct economic benefit of this project will be to substantiate the effectiveness of expenditures by the Maryland DNR pumpout grant program. Indirect but equally important economic benefits will be those guidelines determined for the maintenance of water quality levels needed to support fisheries and waterways for pleasure boaters.

Methods

Proposed *social science methods* are: 1) A multiple mail survey sent to registered boat owners of vessels 22 feet or greater to assess boater behaviour with regard to sewage pumpout usage. 2) A number of marinas (accepting funds for pumpout stations) will be selected, one representing each of 15 counties bordering the Chesapeake Bay. A mail survey will be sent to boaters observed using pumpout stations at the 15 locations. Similar techniques will be used along the IJsselmeer. 3) A mail survey of marina managers will be conducted of those marinas participating in the pumpout grant program. Data derived from boaters and marina managers will help to establish linkages between pumpout station usage, gallons of sewage removed, and boater/marina manager perceptions of pumpout grant program effectiveness. Qualitative methods include both in-depth interviews of boaters and marina mangers and participant observation of visitors to the area in question.

Natural science methods: To assess impacts on water quality, several sites representing the highest percentage of boating use will be selected and sampled. At each site, surface and bottom water samples will be taken at high slack tide and maximum ebb tide, both adjacent to the high-use area and at the mouth of the estuary (entrance to the Bay). At these sites and times, we will analyse for nutrients (nitrate, phosphate), dissolved oxygen, turbidity, and polyaromatic hydrocarbons (an indicator of oil and gas contamination). In addition at each station, a surface sample will be taken in a sterile bottle for counting of fecal coliform bacteria. A pre-season sample will be taken as a control measure followed by sampling on holiday weekends. Additional sampling will occur on non-- holiday weekends and during the week to compare results of peak versus normal use. In this way, we will assess the environmental impact of recreational boating in terms of nutrient loading and fecal contamination from sewage discharge and hydrocarbon emission from boat exhaust. Impacts on the high use waterways and their inputs into the main basin of the Bay can then be integrated into the statistical model and GIS maps.

Analysis procedures involve multiple regression, path analysis or structural equation modelling to determine the predictive strength of the associated variables in the model. Findings and implications can thus be linked directly with those facets of visitor behaviour noted as inappropriate, illegal, or nonsustainable to develop direct and indirect action strategies aimed towards influencing appropriate user behaviour among visitors.

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Integrating Multiple Wilderness Values into a Decision-Making Model for Denali National Park and Preserve

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Abstract: Decisions about how to manage wilderness recreation in Denali National Park and Preserve require managers to integrate a diverse set of public values, a process that typically involves balancing tradeoffs among multiple and often competing values. While decisions about how to manage wilderness are often contentious, previous research suggests that if managers are able to predict public support for various management alternatives the decisions become more tractable. This study develops a decision-making model that integrates social, resource, and managerial values associated with the Denali wilderness experience. Specifically, stated choice analysis is used to evaluate the choices overnight wilderness visitors make when faced with hypothetical tradeoffs among the conditions of social, resource, and management attributes of the Denali wilderness. Study findings offer an empirical approach for predicting and evaluating the likelihood of public support for Denali wilderness management alternatives.

INTRODUCTION

Recent research suggests that recreation use of wilderness is on the rise, particularly in the national parks (Cole, 1996). In the face of burgeoning public demand for outdoor recreation, national park and wilderness managers must make decisions that integrate a broad array of public values. Several decades of research suggest that wilderness recreationists' values span a range of social, ecological, and management factors (Manning, 1999). For example, wilderness recreationists value, to varying degrees, opportunities for solitude, pristine resource conditions, and recreation opportunities unconstrained by management restrictions. Decisions about how to integrate the diverse set of public wilderness values is complex and involve potential tradeoffs among competing values (Hall, 2001; Lawson & Manning, 2000a; 2000b; 2001a; 2001b; In press; Manning et al., 1999). For example, a fundamental tradeoff managers face among wilderness values is between providing public access to wilderness and protecting resource conditions and opportunities for solitude. Visitor use of a wilderness area could be limited through a permit system to protect resource conditions and opportunities for visitors to experience solitude, but fewer people would be allowed to enjoy the wilderness area. Conversely, managers could emphasize public access to a wilderness by reducing or eliminating use limits, but this might result in more resource impacts and diminish the quality of the visitor experience. While decisions about how to manage wilderness are often contentious, Cole, Watson, Hall, and Spildie (1997) and Shindler and Shelby (1993) suggest that if managers are able to predict public support for various management alternatives the decisions become more tractable.

This study develops a decision-making model that integrates wilderness values characterized by social, resource, and managerial attributes of the Denali wilderness experience. The model provides managers with a tool to predict public support for a range of wilderness management alternatives. Specifically, stated choice analysis is used to evaluate the choices overnight wilderness visitors in Denali National Park and Preserve make when faced with hypothetical tradeoffs among the conditions of selected social, resource, and management attributes of the wilderness portion of the park. By making the tradeoffs associated with Denali wilderness management explicit to respondents, this study measures what respondents think *ought to be managed for* given the relationships among multiple management objectives. Study results provide managers with insight into the relative importance visitors place on values associated with the Denali wilderness experience and allow managers to predict public support for management alternatives that emphasize those values to varying degrees.

DENALI NATIONAL PARK AND PRESERVE

In 1980, with the passage of the Alaska National Interest Lands Conservation Act, Mt. McKinley National Park was expanded from two million acres to six million acres, and renamed Denali National Park and Preserve. Most of the original two million acres of the park was designated wilderness, forming the core of Denali National Park and Preserve. Visitor use of the Denali wilderness is managed through a permit system to maintain the area's primitive, undeveloped character. Strict quotas on the number of overnight visitors issued a permit for each of 43 wilderness management units are used to control resource degradation and to provide visitors with opportunities to experience solitude. The primitive character of Denali's wilderness is maintained through other management techniques as well. For example, trails and bridges are not provided and there are no established campsites in the Denali wilderness.

Park managers and planners are currently formulating a new wilderness management plan for Denali. Revision will include decisions to maintain, reduce, or increase the number of permits issued for each of the Denali wilderness management units. Previous research (Bultena, Albrecht, & Womble, 1981) concluded that Denali visitors supported use limitations, but also suggested that future decisions will have to weigh the importance of protecting park resources and the quality of visitors' experiences against the benefit of granting more visitors access to the Denali wilderness. Our study uses stated choice analysis to provide park managers with information about overnight wilderness visitors' choices regarding such tradeoffs.

STATED CHOICE ANALYSIS

In stated choice analysis, respondents are asked to make choices among alternative configurations of a multi-attribute good (Louviere & Timmermans, 1990a). Each alternative configuration is defined by varying levels of selected attributes of the good (Mackenzie, 1993). For example, respondents may be asked to choose between alternative recreation settings that vary in the number of other groups encountered, the quality of the natural environment, and the intensity of management regulations imposed on visitors. Respondents' choices among the alternatives are evaluated to estimate the relative importance of each attribute to the overall utility derived from the recreational setting. Further, stated choice analysis models are used to estimate public preferences or support for alternative combinations of the attribute levels (Dennis, 1998).[1]

Stated choice analysis has been applied to study public preferences concerning a range of recreation-related issues (Adamowicz, Louviere, & Williams, 1994; Boxall, Adamowicz, Swait, Williams, & Louviere, 1996; Bullock, Elston, & Chalmers, 1998; Haider & Ewing, 1990; Louviere & Timmermans, 1990a; Louviere & Timmermans, 1990b; Louviere & Woodworth, 1985; Mackenzie, 1993; Schroeder, Dwyer, Louviere, & Anderson, 1990). A strength of choice models lies in their ability to predict how the public will respond to various policy alternatives, including arrangements of resources, facilities, and/or services that may not currently exist.

STUDY METHODS

Selection of Attributes and Levels

Research is helping to identify resource, social, and managerial setting attributes that reflect wilderness management objectives and influence the quality of the wilderness recreation experience (Merigliano, 1990; Roggenbuck, Williams, & Watson, 1993; Shindler & Shelby, 1992; Whittaker, 1992). Based on previous literature reviews (Manning, 1999) and consultation with Denali park staff a set of six wilderness setting attributes were selected to define the social, resource, and management conditions at Denali. Three levels were defined for each of the six wilderness setting attributes, based on recommendations from Park staff (see Table 1).

Experimental Design

Given three levels of each of the six study attributes, a full factorial design would produce a total of 3^6 (729) hypothetical Denali wilderness settings. Therefore, an orthogonal fractional factorial design was constructed containing 36 paired comparisons blocked into four questionnaire versions, each containing nine pairwise comparisons (Green & Srinivasan, 1978; Seiden, 1954). [2] An example of a wilderness setting comparison is presented in Figure 1.

Survey Administration

Overnight wilderness visitors in Denali are required to obtain a permit and a bear resistant food container from the Visitor Center prior to their backpacking trip. The stated choice analysis survey was administered to overnight wilderness visitors at the Visitor Center when they returned the bear resistant food container at the end of their backpacking trip. The survey was administered from July 24 through September 2, 2000. Study participants were randomly assigned to complete one of four versions of the questionnaire on a laptop computer. In each of the nine choice questions included in each version of the questionnaire, respondents were asked to read through each setting description (A and B) and indicate which they preferred. The response rate for the stated choice analysis survey was 81.2%, resulting in a total of 311 completed questionnaires (approximately 78 respondents for each version of the questionnaire) and 2,799 pairwise comparisons.

Effects coding was used to represent the wilderness setting attributes in the statistical model. For more information about the effects coding used in this study see Lawson and Manning (In press).

<u>*Social conditions*</u>
Number of other groups encountered per day while hiking:
Encounter 0 other groups per day while hiking
Encounter up to 2 other groups per day while hiking
Encounter up to 4 other groups per day while hiking
Opportunity to camp out of sight and sound of other groups:
Able to camp out of sight and sound of other groups all nights
Able to camp out of sight and sound of other groups most nights
Able to camp out of sight and sound of other groups a minority of nights
<u>*Resource conditions*</u>
Extent and character of hiking trails:
Hiking is along intermittent, animal like trails
Hiking is along continuous single track trails developed from prior human use
Hiking is along continuous trails with multiple tracks developed from prior human use
Signs of human use at camping sites:
Camping sites have little or no signs of human use
Camping sites have some signs of human use – light vegetation damage, a few moved rocks
Camping sites have extensive signs of human use – bare soil, many rocks moved for wind protection and cooking
<u>*Management conditions*</u>
Regulation of camping:
Allowed to camp in any zone on any night
Required to camp in specified zones
Required to camp in designated sites
Chance of receiving an overnight backcountry permit:
Most visitors are able to get a permit for their preferred trip
Most visitors are able to get a permit for at least their second choice trip
Only a minority of visitors are able to get a backcountry permit

Table 1. Denali Wilderness Setting Attributes and Levels

Backcountry Setting A	**Backcountry Setting B**
• Encounter up to 2 other groups per day while hiking.	• Encounter up to 4 other groups per day while hiking.
• Able to camp out of sight and sound of other groups *all* nights.	• Able to camp out of sight and sound of other groups *most* nights.
• Hiking is along continuous, *single track* trails developed from prior human use.	• Hiking is along intermittent, animal-like trails.
• Camping sites have *some* signs of human use – light vegetation damage, a few moved rocks.	• Camping sites have *some* signs of human use – light vegetation damage, a few moved rocks.
• Required to camp at *designated sites*.	• Required to camp at *designated sites*.

Figure 1. Example Denali wilderness setting comparison

Variable	Coefficient	Standard Error	Wald Chi-Square	P Value
Encounters with other groups per day while hiking:				
0 other groups	0.440*	-	-	-
Up to 2 other groups	0.065	0.043	2.246	0.134
Up to 4 other groups	-0.504	0.044	132.826	<0.001
Able to camp out of sight and sound of other groups:				
All nights	0.295*	-	-	-
Most nights	0.145	0.044	11.148	<0.001
A minority of nights	-0.440	0.045	94.814	<0.001
Hiking is along:				
Intermittent, animal like trails	0.319*	-	-	-
Single track trails developed from human use	-0.028	0.044	0.403	0.526
Multiple track trails developed from human use	-0.291	0.043	46.340	<0.001
Camping sites have:				
Little or no signs of human use	0.582*	-	-	-
Some signs of human use	0.207	0.044	22.151	<0.001
Extensive signs of human use	-0.790	0.049	264.972	<0.001
Regulation of camping:				
Allowed to camp in any zone on any night	0.072*	-	-	-
Required to camp in specified zones	0.140	0.048	8.620	0.003
Required to camp in designated sites	-0.212	0.045	21.948	<0.001
Chance visitors have of receiving a permit:				
Most get a permit for their preferred trip	0.073*	-	-	-
Most get a permit for at least their second choice	0.143	0.044	10.424	0.001
Only a minority get a permit	-0.216	0.043	24.656	<0.001

*Coefficients for the excluded level of the attribute were not estimated by the statistical model. They were calculated as the negative sum of the coefficients on the other two levels of the corresponding attribute.

Table 2. Coefficient Estimates for Wilderness Setting Attributes

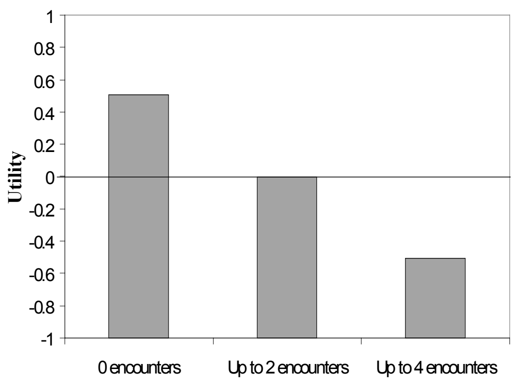
STUDY FINDINGS

Logistic regression was used to analyze the stated choice data. The coefficients of the utility difference function corresponding to the Denali wilderness setting attributes, together with their standard errors, Wald Chi-Square values, and P values are presented in Table 2. All coefficients are significantly different than zero at the <.001% level, except the coefficients on "Up to 2 other groups" and "Intermittent animal like trails". The overall fit of the model is supported by the results of the Hosmer and Lemeshow goodness of fit test (χ^2 = 3.492, p = 0.836).

The magnitude of the coefficients reflects the relative importance of the corresponding level of the attribute to wilderness visitors (Table 2). Signs of human use at campsites influence Denali overnight wilderness visitors' utility or satisfaction more than any other wilderness setting attribute considered. Solitude-related attributes represent a second tier of importance to Denali wilderness visitors (Table 2). The extent and character of trails, regulations concerning where visitors are allowed to camp in the Denali wilderness, and the availability of backcountry permits are less important to Denali overnight wilderness visitors, relative to campsite impacts and solitude-related attributes of the Denali wilderness.

The coefficients of the stated choice model can also be examined graphically. As an example, Figure 2 plots the coefficients of the attribute representing the number of other groups encountered while hiking. Values on the x-axis represent the level of the hiking encounters attribute. Values on the y-axis represent the amount by which the utility of the corresponding level of the attribute deviates from average utility or satisfaction associated with all possible combinations of the six Denali wilderness setting attributes. Levels of the attribute with high utility values are preferred to levels of the attribute with lower utility values. For plots of all six study attributes and further interpretation of the coefficients of the stated choice model see Lawson and Manning (In press).

Figure 2. Hiking Encounters per Day



As mentioned earlier in this paper, the stated choice model developed in this study can be used to predict visitor preferences for alternative wilderness management scenarios. For example, consider two hypothetical Denali wilderness management alternatives that emphasize potentially competing wilderness values; opportunities for solitude and freedom from management constraints. Under the "Solitude Alternative", overnight wilderness visitors would encounter zero other groups per day while hiking and be able to camp out of sight and sound of other groups all nights. However, visitors would be required to camp in designated sites and only a minority of visitors would be able to get a backcountry permit. Under the "Freedom Alternative", overnight wilderness visitors would be able to camp in any zone on any night, and most visitors would be able to get a permit for their preferred trip. However, visitors would encounter up to four other groups per day while hiking, and they would be able to camp out of sight and sound of other groups only a minority of nights. In both alternatives, the extent of social trails and the amount of impact to campsites would be fixed at the intermediate level. At the heart of the comparison between the "Solitude Alternative" and the "Freedom Alternative" are Denali overnight wilderness visitors' evaluations of the tradeoff between freedom of access to the Denali wilderness and the opportunity to experience solitude.

The maximum likelihood coefficients and the effects codes corresponding to the levels of the six wilderness setting attributes for each hypothetical alternative are presented in Table 3. The model predicts that in a hypothetical referendum, 75% of Denali overnight wilderness visitors would choose the "Solitude Alternative" and only 25% would choose the "Freedom Alternative".[3] This result implies that, in general, Denali overnight wilderness visitors would prefer to forgo some freedom from management to improve opportunities to experience solitude. These findings are suggestive of the balance overnight wilderness visitors think ought to be struck among these potentially competing wilderness values. In the context of this example, if Denali wilderness managers choose a balance of tradeoffs more consistent with the "Freedom Alternative", they may receive relatively little public support for their management actions as a consequence.

DISCUSSION AND CONCLUSIONS

In this study, stated choice analysis has been used to integrate a range of public wilderness values characterized by conditions of social, resource, and managerial attributes of the Denali wilderness into decisions about how to manage the park's wilderness. The results of the stated choice analysis presented in this paper have several potential implications for wilderness management at Denali and elsewhere.

Study findings provide Denali wilderness managers with information about the relative importance overnight wilderness visitors place on the attributes of the Denali wilderness experience selected for this study. For example, study results suggest that visitors would be willing to tolerate, and in fact support, management restrictions, including use limits, to achieve desired social and resource setting attribute conditions. Information concerning the relative importance of the attributes included in this study reflects how visitors think managers ought to prioritize the wilderness values

	Solitude Alternative	Freedom Alternative
Hiking Encounters:	0 groups per day	Up to 4 groups per day
Campsite Solitude:	All nights	A minority of nights
Hiking Trails:	Single track trails	Single track trails
Campsite Impacts:	Some signs of human use	Some signs of human use
Camping Regulations:	Designated sites	Any zone on any night
Availability of permits:	Only a minority of visitors receive a permit	Most get a permit for their preferred trip
Voting Proportion	75%	25%

Table 3- Scores for Two Hypothetical Denali Wilderness Management Alternatives

associated with the study attributes, given the relationships and inherent tradeoffs among these attributes.

The decision-making model developed in this study allows managers to predict Denali overnight wilderness visitors' support for alternative management scenarios. This allows managers to consider combinations of setting attributes that are not currently in place, but may offer a better alternative than the status quo. Additionally, alternatives being considered under the new wilderness management plan can be generalized to the model, and managers can predict the response of current users to each alternative. The results of the example application of the choice model provide evidence that visitors are willing to trade-off freedom from management restrictions for desired social conditions. Specifically, the results demonstrate that in a hypothetical referendum, Denali overnight wilderness visitors would prefer (by a margin of three to one) a wilderness setting that emphasizes solitude through relatively restrictive management actions over a more congested wilderness setting with limited management restrictions.

From a management perspective, these results suggest that the majority of Denali overnight wilderness visitors support backcountry permit quotas at Denali to protect the primitive character of the wilderness. Further, the results suggest that a moderately restrictive quota system that is designed to enhance overnight wilderness visitors' opportunities to experience solitude and to maintain relatively undisturbed campsite and trail conditions will receive substantial support from Denali overnight wilderness visitors. However, the results of the example application of the choice model suggest that there is also a substantial proportion of Denali overnight wilderness visitors (25.0%) that place high importance on freedom from management restrictions despite reduced opportunities to experience limited contact with other groups while hiking and camping. This finding suggests that Denali overnight wilderness visitors are at least somewhat diverse in their attitudes concerning the management of the Denali wilderness. Park managers could address this diversity through management of the Denali wilderness based on the concept of zoning to provide a spectrum of opportunities for visitors. For example, the quota system could be designed in such a way that quotas for most zones within the Denali wilderness are set at levels that emphasize opportunities for visitors to experience solitude, while quotas for a few zones of the wilderness are set at levels that provide greater visitor access.

Stated choice analysis shows promise as a tool to make complex and often controversial decisions of wilderness management more tractable. The decision-making model developed in this study provides managers with a means to predict support for various management alternatives, increasing the chances that wilderness management will reflect a balance among public values that visitors are likely to support. Further, by asking respondents to consider the tradeoffs associated with wilderness management, visitors may become more aware of the difficult task wilderness managers face in trying to balancing public wilderness values.

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FOOTNOTES

[1] Decision making models developed using stated choice analysis are based on the theoretical framework of random utility. Refer to Hanemann (1984) and Opaluch, Swallow, Weaver, Wessells, and Wichelns (1993) for detailed presentations of the random utility framework.

[2] The orthogonal fractional factorial design was constructed by Don Anderson of StatDesign Consulting, Evergreen, Colorado.

[3] Refer to Opaluch, Swallow, Weaver, Wessells, and Wichelns (1993) for a presentation of the methods used to calculate scores for the hypothetical management alternatives.

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Visitor Management and Ecological Integrity: One Example of an Integrated Management Approach Using Decision Analysis

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Abstract: In this paper we argue in favor of using a decision analysis framework for more integrated decision-making when managing protected areas. Such an approach will enable agencies to balance between the frequently conflicting goals of visitor management and ecological integrity. We present a case study from the West Coast Trail in Pacific Rim National Park Reserve, BC, Canada, in which we use ELECTRE and AHP to establish a ranking of several management options. We conclude by suggesting that such a more formal framework constitutes a more objective decision support tool, assists in framing relevant management questions and tradeoffs, and at the same time provides guidance for data collection.

INTRODUCTION

When managing protected areas, agencies typically need to balance several divergent objectives, such as striving for ecological integrity and ensuring visitor enjoyment. To assist in these tasks, ecosystem-based management has, over the last decade, been adopted by many agencies as their overarching management framework. This situation also applies to Parks Canada, the lead agency for managing National Parks in Canada.

In Canada, the National Parks Act (2000) recognises the mandate of ecological integrity as the primary objective. As a result, Parks Canada has adopted the concept of ecosystem-based management as its overarching management framework (Parks Canada, 2000). The concept acknowledges the inherent complexity of the task at hand, the need to integrate knowledge generated by several academic disciplines, and the need to accommodate aspects of uncertainty and risk in decision-making processes. Typically, this management approach strives to balance ecological, social and economic concerns (Grumbine, 1994; Slocombe, 1998).

However, the de facto management framework of Parks Canada is still dominated by a more traditional management structure, in which separate departments within the agency are charged with specific mandates, make their own decisions, and usually collect their own relevant information (Rudolphi 2000). For example, separate policies and guidelines direct visitor management, ecological monitoring, and impact assessment. Such a situation effectively impedes the implementation of a more integrated management framework for at least three reasons (Watson et al., 1987):

- Goal fragmentation and sliding of objectives;
- Costly duplications and overlapping efforts; and
- Low acceptance and compliance towards decisions made.

Given the lofty goal of ecosystem based management, we consider it essential that decision processes be provided with adequate and timely information for the tasks at hand. For that purpose, Parks Canada requires state-of-the-art 1) data gathering and information generating tools, 2) decision support tools, and 3) communication support tools.

Such tools will provide important support to all decision-making structures, whether they are more traditional top-down approaches that are formulated and implemented within an agency, or alternative participatory forms of decision-making. We would like to acknowledge at this point that many decisions involving Parks Canada are undertaken in a shared or participatory manner. Our critique is not directed towards the decision processes themselves, but at the processes that guide data and information gathering, as well as management, and presentation. In this paper we will argue that several methods in the field of decision analysis (DA) can assist Parks Canada, as well as many other land management agencies, in the task of collecting, synthesising, and presenting large amounts of information, as well as structuring decisions and evaluating alternatives.

The next section will provide a brief overview of DA, and present the specific methods we propose to use in our case study. Then we will explain the specific circumstances at the West Coast Trail in Pacific Rim National Park Reserve in British Columbia, Canada, followed by a brief example of how to work through such a data set. We will conclude with a discussion of the benefits that would accrue to a management agency by adopting

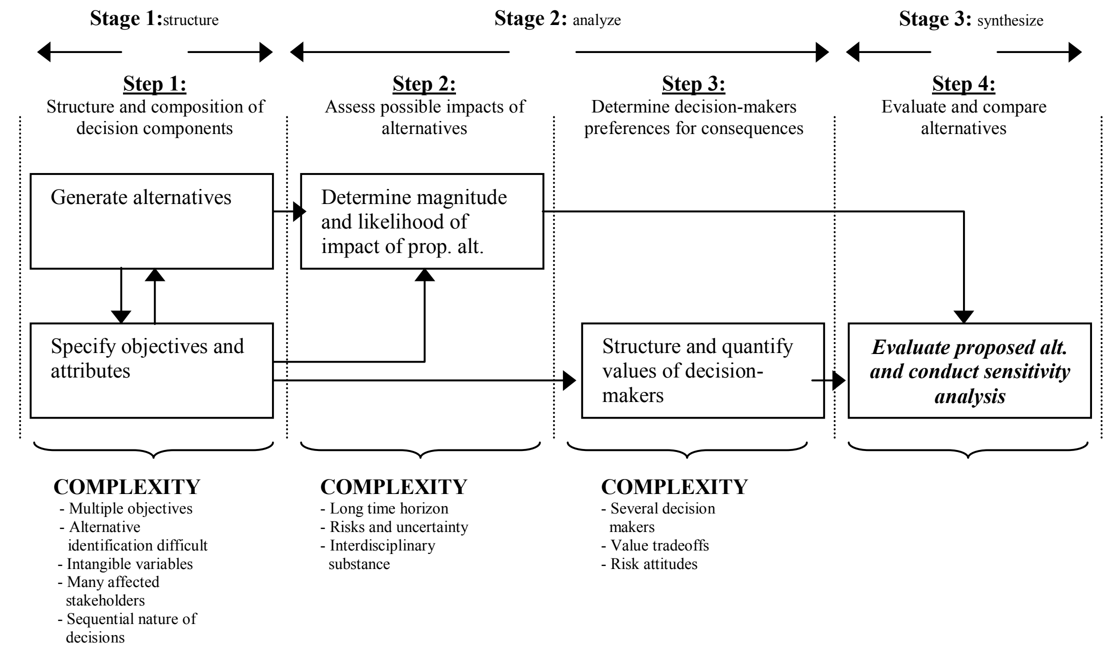

Figure 1: Schematic representation of a generic MADM process. Modified from Keeney (1982)

such a data and information and decision management methodology.

DECISION ANALYSIS

Decision Analysis refers to a diverse methodological field whose array of methods have in common that they all provide formal support for decision-makers in complex choice situations. In this paper we focus on Multi Attribute Decision Making (Vincke, 1992), and more specifically on two methods, the Analytical Hierarchy Process (AHP) (Saaty 1980) and the Elimination et choix traduisant la realite (ELECTRE) (Roy, 1990).

A typical MADM modelling process involves three iterative stages (Keeney, 1982) (Fig 1):

1) structuring -
2) analysis -
3) synthesis.

Structuring involves the specification of decision objectives, criteria and measurable attributes, and the identification of alternatives. To enhance transparency, these components are usually organized in a decision tree. During that stage, an initial screening of alternatives might discard unfeasible or inferior alternatives in order to trim the decision tree to a manageable size.

In the first step of analysis the potential magnitude, likelihood and uncertainty associated with the remaining alternatives are assessed. The second step in the analysis stage involves the elicitation of decision-makers' preferences for tradeoffs and/or willingness to take risks. It is on this latter point that many of the methods differ.

At the final stage, the alternatives' advantages and disadvantages are evaluated and compared against each other by amalgamating all available information (Keeney, 1982). Each alternative's situation specific efficacy is predicted using the preferences (utilities) determined earlier. The model will identify the alternative with the highest expected utility.

We will now present the two preference elicitation methods that we used in our case study. We decided on using elements of each of the two methods as each contains characteristics of particular importance to our application.

ELECTRE.

The Elimination et choix traduisant la realite (ELECTRE) method (Roy, 1990) is a widely used decision tool (e.g. Massam, 1980). The fundamental idea behind it's process is to establish rankings among several alternatives (Roy, 1990).

ELECTRE establishes the desirability of an alternative by using concordance and discordance analysis (Nijkamp and van Delft, 1977; Yoon, et al., 1995). The decision makers' preferences in regards to the objectives' and criteria's performance levels are used as indicators, forming importance thresholds for the objectives and criteria. An alternative's value is subsequently determined by the degree to which its attributes are in agreement (also referred to as being in "concordance"), minus disagreement (discordance), with the predetermined objectives/criteria and constraints (i.e. the thresholds). An alternative's ranking is then determined using the concept of outranking (Guitouni and Martel, 1998) as aggregation procedure. The set of alternatives that are non-dominated are singled out by associating the previously established thresholds, in combination with the criteria / objective weights, to an outranking relation, using status quo, or an ideal situation, as the reference point of comparison (ibid.).

The threshold levels are a subjective and influential ingredient in ELECTRE's outranking process. As these values are to serve as indicators for criteria performance in the subsequent concordance / discordance analysis, specifying one alternative's dominance over another, they should be given considerable attention and appointed with as much correctness and care as possible. Four different threshold levels (Vincke, 1990; Roy and Vincke, 1984) should be determined:

- Strong preference threshold, also referred to as the aspired range. This is the zone within which the decision makers find a criterion is preferred to be positioned.
- Weak preference threshold, or buffer zone. A performance range that represents the hesitation between the strong (above) and the indifference (below) threshold. Not a perfect place for a criterion to be located, but still acceptable.
- Indifference threshold. The acceptable range a measure can move within (+/-) before its deviation becomes significant to the decision makers.
- Veto threshold, or the minimum/maximum value. Any value placing itself above or below these thresholds would be considered unacceptable, as it would be affecting the situation too severely.

The Analytical Hierarchy Process (AHP)

Like ELECTRE, the AHP process has found wide application since the early 1980s (Saaty 1980) in many different decision-making processes (Gholomnezhad, 1981, Brown, et al., 2000). The main characteristic of the AHP method is its strong focus on identifying the underlying hierarchical structure for the decision problem at hand (Dyer, 1990) .

Preferences are not elicited for the alternatives directly, but for the attributes, objectives, and criteria, using a series of pairwise comparison evaluations. These evaluations then provide the weights for the decision trees (Saaty, 1980). The decision trees serve as the formal structure used to display the situation in an ordered and hierarchical manner, linking the situation's alternatives together with the goal(s), objectives, criteria, and attributes. The final aggregation procedure used by AHP, to rank one alternative over another, is, similar to ELECTRE, based on the concepts of outranking (Liang and Sheng, 1990). Combining AHP and ELECTRE will allow us to combine the most attractive aspects of either method.

STUDY AREA: THE WEST COAST TRAIL IN PACIFIC RIM NATIONAL PARK

The West Coast Trail (WCT) is a 75km long hiking trail along the Pacific Coast of British Columbia. It offers visitors encounters with sandy beaches and rocky headlands, bordered by a temperate coastal rainforest, and constitutes the main backcountry attraction of PCNPR. Thousands of hikers each year take between six and 10 days to hike the entire trail, or portions of it in single or two day hikes (Parks Canada, 1991). In 1992, Parks Canada introduced a reservation system to address concerns about environmental impacts, hikers' safety, and visitors' enjoyment (Parks Canada, 1994d). Now the trail is enjoyed by approximately 60 persons per day, resulting in about 8,000 hikers per season (ibid). Besides its ecological values and the experience related benefits provided to the visitors and residents of the area, the existence of the trail also supports business opportunities in the surrounding communities (Parks Canada, 1995).

In the case study below we take the current problem context of the West Coast Trail and structure the decision analysis based on hypothetical data.

SUGGESTED DECISION-ANALYSIS FRAMEWORK

Decision Problem

Obviously the large concentration of visitors in a relatively small and comparatively sensitive area, with many stakeholders and interest groups linked to its management, causes several direct and indirect impacts (e.g. trampling of vegetation, crowding, and cost of maintenance). The impacts are often paradoxical in that they frequently have a concurrent effect on environmental, social, and economical aspects, affecting the various stakeholders differently. Parks Canada needs to balance between concerns about the area's ecological integrity, various types of visitor requests, and a local businesses community which is dependent on a certain level of annual visitation. It would be in the interest of all parties involved to reach a long-term solution that balances conservation with the other social and economic interests.

IMPLEMENTING A DECISION ANALYSIS

We implemented our decision analysis in three stages.

Stage 1: Structure and composition of decision components - Defining management goals, objectives, and alternatives

The principal management goal at the West Coast Trail ought to be striving for maximum ecological integrity, as defined by the National

Parks Act of Canada. In addition to this overarching goal, the Field Unit of Pacific Rim National Park Reserve also needs to accommodate economic and social objectives. In this study, we identified these measures from relevant published literature. These objectives and criteria can be tabulated concisely in an assessment table for each respective group involved in the decision-making process (Table 1). Given the space limitations, we present the table for the parks management group and the visitor group only. The content of the table would look similar for the other groups participating in the decision making process (the local business community, and NGOs). Most of the objectives and criteria have been identified as relevant in the respective literature.

Based on these objectives and measurement criteria, one can define management alternatives (Table 2). Options 1 – 13 vary the attributes number of visitors per season, length and timing of season, and size and distribution of visitor groups. The remaining four alternatives vary according to the reallocation of the recreational activities to other parts in the study area, changes in the types of activities, and the construction of physical features. Before any analysis is undertaken, one can eliminate dominant alternatives during an initial screening procedure. During this initial screening, alternatives 14 to 17 were identified as lying outside Park Canada's mandate, and therefore eliminated from further analysis.

Stage 2: Analysis of alternatives

In the first step of this stage, the likelihood of an event occurring, the associated uncertainty, and the magnitude of each criterion associated with each alternative is estimated in one table (not shown here).

In a second step, first the ELECTRE method is applied to identify the preference benchmarks of strong preference, weak preference, indifference point, and veto level are identified for each criterion through formal interviews with decision-makers. Conceptually, these benchmarks resemble the concerns that are addressed in the Limits of Acceptable Change Process (Stankey et al, 1984).

Second, the pairwise comparison method of AHP is used to determine the criteria's relative importance (Table 3). These present values form the "base case", representing the present situation. Notably, the park management group's present values take precedence, except for criteria 8, 9, and 10. This assumption simplifies subsequent calculations, and could be changed if desirable. The criteria thresholds have been explained before. The indifference values are expressed in %-change relative to the base case. The second last column (W%) contains the relative weights for each criterion, and the last column represents the aggregated criteria weights (AW%).

DM group	Ecological aspect	Social aspect	Economical aspect
Park Management group: General management objectives	**Ecosystem Health**	**Serving Canadians**	**Wise and efficient management of funds**
Represented in this study by:	*Ecosystem Processes and Ecosystem Structures*	*Client satisfaction*	*Trail maintenance costs*
Measured in this study by:	<u>Unconsolidated organic matter</u>: Recorded % of trail segment's unconsolidated or loose organic matter not covered by vegetation on location (e.g. needles, leaves, twigs, pine cones). <u>Extent of erosion</u>: Recorded % of camping area eroded. Natural and human induced erosion separated when possible. <u>Fauna abundance</u>: Recorded # of individuals/spp X along trail segment.	<u>Fire rings</u>: # of fire rings, new and old, present within the campsite. <u>Size of parties of people</u>: Largest size of backpacker parties present on trail/day .	<u>Seasonal $ maintenance cost</u>: Direct cost, including items such as staff costs, material, time, etc. for trail maintenance related to the campsite and trail segment. <u>Seasonal rescue cost</u>: Rescue specific cost * number of rescues.
Visitors group: General management objectives	**Ecosystem Health**	**Trip Satisfaction**	**Willingness to Pay**
Represented in this study by:	*Perceived degradation*	*Privacy and wilderness experience*	*User fees*
Measured in this study by:	<u>Unconsolidated organic matter</u>: Same as above but measured by % encountered on trail segment/trip. <u>Extent of Erosion</u>: Same as above but measured by % encountered at campsite/trip. <u>Fauna Abundance</u>: Same as above but measured by # encounters/trip.	<u>Fire rings encounters:</u> Same as above but measured by # encounters at campsite/trip. <u>Parties of people encountered</u>: Same as above but measured by # encounters/day.	<u>Level of user fees</u>: Amount of trail user fee/person, including reservation fee, park use fee, two ferry fees.

Table 1: Group objectives and criteria for the case study (NGOs and business community are excluded).

Alternative	Number of visitors/season	Length and time of season	Size and distribution of groups	Reallocation or change of activity, and/or construct. Initiatives
Option 1 Base Case	**8 000**	**5 months May – September**	▪ **30% of groups ≤ 3 people, 55% of groups ≤ 8 people, 15% of groups up to 10 people** ▪ **maximum of 10 groups/5 km** ▪ **maximum of 10 groups/camp**	**N/A**
Option 2	75% of base case: (6 500)	▪ as base case	▪ as base case	N/A
Option 3	75% of base case: (6 500)	▪ 3 months (June – August)	▪ as base case	N/A
Option 4	75% of base case: (6 500)	▪ 3 months (June – August)	▪ 35% of groups ≤ 3 people, 60% of groups ≤ 8 people, 5% of groups up to 10 people ▪ maximum of 8 groups/5 km ▪ maximum of 6 groups/camp	N/A
Option 5	75% of base case: (6 5000)	▪ 6 months (May – October)	▪ as base case	N/A
Option 6	75% of base case: (6 5000)	▪ 6 months (May – October)	▪ 25% of groups ≤ 3 people, 50% of groups ≤ 8 people, 25% of groups up to 10 people ▪ maximum of 8 groups/5 km ▪ maximum of 10 groups/camp	N/A
Option 7	110% of base case: (8 800)	▪ as base case	▪ as base case	N/A
Option 8	110% of base case: (8 800)	▪ 3 months (June – August)	▪ as base case	N/A
Option 9	110% of base case: (8 800)	▪ 3 months (June – August)	▪ 40% of groups ≤ 3 people, 50% of groups ≤ 8 people, 10% of groups up to 10 people ▪ maximum of 8 groups/5 km ▪ maximum of 6 groups/camp	N/A
Option 10	110% of base case: (8 800)	▪ 6 months (June – August)	▪ as base case	N/A
Option 11	110% of base case: (8 000)	▪ 6 months (June – August)	▪ 20% of groups ≤ 3 people, 60% of groups ≤ 8 people, 20% of groups up to 10 people ▪ maximum of 8 groups/5 km ▪ maximum of 10 groups/camp	N/A
Option 12	50% of base case: (4 000)	▪ 2 months (June – July)	▪ 100% of groups ≤ 3 people ▪ maximum of 4 groups/5km ▪ maximum of 4 groups/camp	N/A
Option 13	200% of base case: (16 000)	▪ 8 months (March – September)	▪ 80% of groups ≤ 3 people, 20% of groups ≤ 8 people ▪ maximum of 10 groups/5 km ▪ maximum of 10 groups/camp	N/A
Option 14	as base case	▪ as base case	▪ as base case	Reallocation of present recreational activities during June-July.
Option 15	as base case	▪ as base case	▪ as base case	Option 14 + extension of the information centre at the trail head.
Option 16	as base case	▪ as base case	▪ as base case	Introducing mountain biking as a recreational activity along the trail (for ½ of the allowed quota).
Option 17	as base case	▪ as base case	▪ as base case	Construction of elevated boardwalks for especially exposed and vulnerable trail segments.

Table 2: Management Alternatives for the case study

Stage 3: Synthesis of information

Concordance and discordance matrices (not shown here) provide the formal base for comparing alternatives objectively. By combining the concordance and discordance measures, one can calculate a credibility matrix, which contains the ranking of the remaining alternatives (Table 5.8). The matrix reveals that only alternatives 1, 2, 3, 4, 5, 6, 7, and 10 reach a performance on each criterion so that no single veto level is violated, i.e. holds a credibility high enough to be interesting to pursue at this point. As such, the credibility matrix does provide a certain outranking in itself, indicating each alternative's strength over another. However, the analysis should also take into account the alternatives' performance significance levels, by relating the entries in the credibility matrix with the established levels of significance (i.e. the thresholds of indifference). This is the final step, in the ranking procedure that is, removing those alternatives from consideration that are not performing significantly better than at least one other alternative on at least one criterion.

DM groups and their respective objectives	Criteria; Indicators	Present value	Criteria threshold levels				W % (k)	AW (%)
			Strong (P)	Weak (Q)	Veto (V)	Indif. (I)		
Visitors group:								
Ecosystem Health								
Perceived degradation	Unconsolidated organic matter	35	0-30	31-59	60%	-1.15%	21	14
	Extent of Erosion:	15	0-10	11-59	60%	-2.00%	7	20
	Fauna Abundance:	5	5-7	3-4/ 8-20	2/21	+0%	30	20
Trip Satisfaction								
Privacy and wilderness experience	Fire rings encounters:	5	5-7	3-4/ 8-9	2/10	-1.50%	4	11
	Parties of people encountered:	12	6-7	4-5/ 8-14	3/15	-1.20%	27	14
Willingness to Pay								
User fees	Level of user fees:	125	-18% (and less)	+/-17	+18%	-0%	12	3

Table 3: Aggregated preference levels and criteria importance ratings for the DM groups (Parks Management, NGOs and business community are excluded)..

	BC	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
BC		0.2073	0.2169	0.2073	0.2092	0.2146	0.2022	-	-	0.2022	-	-	-
A2	0.2138		0.2146	0.2109	0.2037	0.2141	0.2022	-	-	0.2022	-	-	-
A3	0.2047	0.2059		0.2059	0.2058	0.2138	0.1950	-	-	0.1950	-	-	-
A4	0.2138	0.2109	0.2146		0.2037	0.2128	0.2022	-	-	0.2022	-	-	-
A5	0.2135	0.2106	0.2143	0.2106		0.2138	0.2022	-	-	0.2022	-	-	-
A6	0.2064	0.2065	0.2077	0.2051	0.2063		0.1950	-	-	0.1950	-	-	-
A7	0.2081	0.2092	0.2102	0.2092	0.2087	0.2102		-	-	0.2072	-	-	-
A8	-	-	-	-	-	-	-		-	-	-	-	-
A9	-	-	-	-	-	-	-	-		-	-	-	-
A10	0.2081	0.2092	0.2102	0.2092	0.2087	0.2102	0.2072	-	-		-	-	-
A11	-	-	-	-	-	-	-	-	-	-		-	-
A12	-	-	-	-	-	-	-	-	-	-	-		-
A13	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4: Credibility matrix

DISCUSSION & CONCLUSIONS

The hypothetical case study showed how a formal decision analysis framework can be applied to Park Canada's decision-making processes when complex decisions between several divergent objectives need to be made.

ELECTRE has been selected as the specific analytical tool because it includes different types of preferences, including threshold and veto options, which make it very attractive for modelling ecological concerns. AHP provides the final weighting of the alternatives. That combination constitutes an objective evaluative framework for pending decisions.

Such a decision support framework will improve the soundness and effectiveness of Parks Canada's decision-making and communication structures. The framework also facilitates the formal integration of existing data and information bases. The framework promotes:

- sound documentation practices, which increase the acceptance of and compliance with actual decisions;
- a formal and consistent method of assessment for various management situations;
- an increased ability to co-operate across various stakeholder interest, increasing the awareness of different management agendas and critical issues surrounding protected area management, and consequently decreasing the likelihood of goal fragmentation and sliding of objectives; and
- an increased ability to capitalise on existing data and information while identifying data gaps for further analysis, which reduces the risk of costly duplications and overlapping efforts. In addition, situation specific data and information becomes more readily available.

In conclusion, we would like to reiterate, that despite its name, decision analysis does not actually make decisions automatically. Plenty of thought needs to go into the design of such a framework, which we would rather label a more objective and integrated management and decision support tool, to be used in traditional as well as participatory decision processes.

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Destination Choice Modelling of Leisure Trips: The Case of Switzerland

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Abstract: In this paper the destination choice of Swiss within Switzerland is analysed. Information about variables influencing destination choice for different activity should be the result of the modelling process.
The analyses are based on three pillars. A detailed database for all Swiss municipalities is the first pillar, nation wide demand data the second pillar. Additionally a suitable method is necessary. Because destination choice is a choice between discrete alternatives, Multi-nominal Logit models are used.
Models for three different activity types - skiing, climbing and hiking respectively walking and swimming are estimated. In all models the importance of the distance between origin and destination becomes visible.

INTRODUCTION

Leisure has become the most important trip purpose. In 1994 60% of all person kilometres respectively 80 billion person kilometres travelled by the residents of Switzerland were made for the purpose leisure; half of those kilometres were performed abroad. Most of these leisure trips (66% of all trips made by Swiss in Switzerland) were made by private car. Therefore leisure traffic is a major contributor to the well known negative effects of motorised traffic. Especially in tourist areas leisure traffic has serious ecological and social impacts.

To analyse leisure traffic is not only interesting because of its volume, but also because of an other special feature. Leisure traffic is very heterogeneous - especially compared to work trips. Different leisure activities like sports, cultural sightseeing or visiting friends are carried out at the same destination; at the same time similar activities are carried out at different destinations. Additionally leisure activities are generally characterised by less rigid temporal constraints than for example work or school activities.

In contrast to the significant contributions of leisure traffic to overall traffic, it has received relatively little attention in travel modelling practice - mostly because of its heterogeneity and consequently the problems connected with analysing leisure trips. However, some recent studies have underscored the need to model leisure trips and predict visitor flows more systematically and to recognise the behavioural differences underlying travel decisions for different types of leisure trips (Bhat, 1998; Pozsgay and Bhat, forthcoming).

The aim of this paper is to contribute towards this growing literature on leisure travel. It especially focuses on destination choice within Switzerland for different activity types. Destination choice is a choice between discrete alternatives. Therefore the method of discrete choice models, which can analyse the choice of a destination dependent on the type of destination and the personal situation of the travellers, is appropriate here. Based on the results of the models conclusions can be drawn about how a municipality can act to reach its goal with regard to leisure and tourism. It is of special interest to investigate the influence of the quality of the natural environment on those choices.

The remainder of this paper is structured as follows: This foreword is followed by an introduction to the theory of the method used - discrete choice models. The next section presents very briefly the data base used. Then the different steps during the development and specification of the models presented are introduced. The fifth section shows the empirical results. The final section summarises the findings from the models and discusses the relevance of these findings.

DISCRETE CHOICE MODELS

Participation in traffic always forces persons to choose one alternative out of a set of alternatives which exclude each other mutually (for example mode choice: One cannot choose the car and ride a bike at the same time). Qualitative choices out of a set of distinct and non divisible alternatives can be modelled using *random utility discrete choice models*.

Theory

Discrete choice models are based on the assumption, that persons are trying to maximise the utility of their performed activities and therefore choose that alternative out of all possible activities which is likely to offer them the highest utility. Although it is obvious that this assumption is an oversimplification of human behaviour, models based on this assumption obtain results which are much more realistic than models based on gravitation or entropy theory. A more detailed description of discrete choice models can be found in Ben-Akiva and Lerman (1985), Maier and Weiss (1990), Ortúzar and Willumsen (1994); the basic ideas were developed by McFadden (1973).

There are different types of discrete choice models. All of them share the assumption, that out of a set of alternatives each person *q* expects a different utility (*U*). Each alternative *j* can be described by different characteristics *x*, whose values vary across different alternatives. Each utility depends on the different judgements of those characteristics. The judgements can at least partially be derived from different personal factors *p*, for example gender or age. Additionally the evaluation of the utility of an alternative depends on the situational factors *s*, for example the weather conditions or the travel time, which vary between different persons and alternatives.

As it is neither possible to know all relevant characteristics or choice alternatives nor to measure them exactly, the judgement is composed out of a deterministic and a (at least from the analyst's point of view) stochastic part. The total utility can thus be calculated as:

$$U_{jq} = V_{jq} + \varepsilon_{jq}$$

with V_{jq} as systematic and measurable part which describes the objective utility of alternative *j* for person *q* and the random error ε_{jq}, which modifies V_{jq} with regard to the individual judgements of a decision maker and possible errors in observation or measurement. The systematic utility is a function of characteristics describing the individuals, the situation and the alternative

$$V(X_{kjq}) = \alpha_j + \quad \beta_{k''j}\, p_{k''q} + \quad \beta_{k'j}\, s_{k'q} + \quad \beta_{kj}\, x_{kjq}$$

The stochastic part of the utility function depends on the assumption about its distribution which is at the same time the distinguishing mark between the different model types. The most simple and according to Maier and Weiss (1989) most commonly used version of discrete choice modelling is the *Multinominal Logit* (MNL), which is based on the assumption that ε_{jq} is *independent and identically gumbel distributed* (Ben-Akiva and Lerman, 1985). This so-called IIA-assumption (independence of irrelevant alternatives) implies some constraints on the application of the model which can be released in other model types. The linear utility function represents a further model restriction.

The probability *P* that an alternative *j* of a Person *q* is ranked first can be calculated as the utility of this alternative in relation to the sum of all alternatives (see equation 3). In the MNL the relationship between utility and probability of an alternative is described as follows. The alternative with the highest probability is chosen.

$$P_{jq} = \frac{e^{V_{jq}}}{\underset{\forall n}{} e^{V_{nq}}}$$

Destination choice

Destination choice models are rarer then mode choice models. With the choice of a specific destination for a leisure trip the decision making person excludes the choice of other destinations due to spatial and temporal constraints. Therefore the MNL model seems to be an appropriate method here. But it is important to mention a view particularities of destination choice.

- **IIA-assumption**: This assumption implies that the error terms of the utility function for all possible alternatives are independent and identically distributed with a gumbel distribution. If the error terms are independent, no common unobserved factors have any impact on the different alternatives. The assumption of identical distribution means that the level of impact of the factors, which were not detected, is identical across all alternatives. This assumption is often not fulfilled in destination choice. For example, the impact of different levels of comfort is different in a luxurious area compared to a camping region.
- **Homogeneity of travellers**: In a MNL it is assumed that different persons react homogeneously in response to attributes of alternatives regardless of their socio-demographic background. This assumption is also often violated for destination choice. For example, for some people it is important to go to a destination very far away in their holidays because of the image of such trips. Other people may avoid such trips in order to reduce their travel time.
- **Spatial issues**: Travel demand is influenced by at least three different spatial issues: spatial dependency, spatial heterogeneity and spatial heteroscedasticity (Bhat and Zhao, 2001). The spatial dependency describes the presence of unobserved spatial factors influencing travel behaviour - for example a beautiful landscape. The second issue, spatial heterogeneity, proposes that the relationship between the dependent variable and the independent one varies across spatial units - as a consequence, it may be possible that there is no single global relationship, but different local ones. The last possible source of biases is spatial heteroscedasticity, which reflects the fact that the variance of the unobserved influences may be different across spatial units.

Due to these limitations the MNL estimates give only first approximations about the impacts of different characteristics, but it should be kept in mind that its results may be biased and that more complicated models should be developed in the future.

DATA BASE

The aim of this paper is to estimate models describing destination choice within Switzerland for different activities at the municipal level. Destination choice is dependent on the characteristics of the alternatives and of the travellers. Therefore, it is necessary to have information about the demand and the supply side for the whole investigated area. Additionally the distance between the origin and the destination has to be considered (see Choice Set).

Supply side

A detailed data set was produced to describe the destinations and their supply. The data set contains detailed information about the residents, the supply in the leisure and tourist sector, the tourist demand as well as the allocation of the space to different purposes (hectare data bank). The hectare data bank includes even information about different vegetation types (for example open and closed forest or vines). The municipal level was chosen as investigation level, because it is the lowest level at which information for a whole nation can be collected.

There is a problem inherent in this investigation level. The travellers respectively visitors think in destination units rather than in municipal units. Sometimes this unit is much smaller than a municipality. The consideration of such small destinations would create an enormous number of different alternatives which would make the modelling process too difficult. At the same time, different municipalities are sometimes viewed as one destination. Especially for skiing holidays people visit a complete valley or ski region rather than a municipality. However, the municipality level is a compromise between these different requests, which seems to be a sufficient approximation of the reality.

Demand side

A nation wide analysis of destination choice requires demand information for the same area. In Switzerland several nation wide travel surveys exist – of those the *KEP* ('Kontinuierliche Erhebung zum Personenverkehr') and the *Zusatzmodul Reiseverhalten* are available and appropriate. They were pooled for this analysis.

- **KEP** (SBB CFF - Direktion Personenverkehr, 1996): The SBB (Swiss Federal Railways) are responsible for the KEP, which covers the travel behaviour of Swiss adults. During one year about 17'000 persons are interviewed. The KEP has been conducted yearly since the 80ies, but the destinations of car trips have only been coded in the last two years, while this was done longer for rail trips. Therefore just the survey years 2000 and 2001 are used which already includes about 120.000 trips.
- Information about the personal situation of the travellers and about their trips over three kilometres distance and a municipal boundary during the last week is collected. For each trip the destination is known except for trips abroad which are just coded as destination outside Switzerland. Attention should also be paid to the fact, that for public transport trips the rail station is assumed to be the final destination.
- **Zusatzmodul Reiseverhalten** (Bundesamt für Statistik, 1999): This survey was conducted by the BfS (Swiss federal statistical office) within the context of the Swiss income and consumption census in 1998. Therefore not only the trip characteristics and the typical person variables are available, but also information about a variety of other interesting variables, for example the living situation or the purchase of expensive consumer goods. Approximately 7.300 persons reported over 23.000 trips which were either a holiday trip within the last 6 months, a trip with up to three overnight stays within the last three months or an excursion within the last two weeks. Unfortunately only the destinations of the excursion are known.

MODEL PREPARATIONS

Several assumptions must be made, before models can be estimated. On the one hand the choice set must be generated. Because of the great number of possible alternatives this step is not trivial. On the other hand the variables used in the models must be selected. Here theoretical considerations and the availability of variables are decisive.

Basic idea

The models are based on the idea that leisure consists of very different activities which satisfy different desires and are influenced by completely different impacts. As leisure is so diverse, it is necessary to concentrate on different types of leisure activities. Three different activity groups, which represent popular outdoor activities, were chosen for the models presented here. **Skiing** is used as a representative of a winter activity, because it is one of the most important leisure activities in Switzerland. According to Brandner, Hirsch, Meier-Dallach, Sauvain and Stalder (1995) it is performed by approximately 20% of all Swiss at least once a year.

In summer the activity groups - **climbing and hiking** as well as **walking and swimming** - were chosen in order to avoid activities that are performed by just a very small subgroup of the population. The division in two different types was necessary, because a brief look at the visited destinations has shown that two different types of places were the most frequent visited destinations. One group consisted of places at lakes, which are suitable for walks as well as for swimming, the second group of popular places is located in the mountain regions.

Choice set

According to Swait (2001) the true choice set of travellers is normally unknown to the analysts, as only the chosen alternative can be observed. Consequently a choice set has to be constructed by the analyst. Biases in the choice set can occur, if an alternative is present that in reality is impossible for the traveller to choose. The alternatives inherent in a choice set can mostly be described by a variety of different variables, whereby the potential variables are dependent on the considered purpose.

Generation of alternatives

Modelling destination choice at the municipal level has to deal with the problem that a large number of alternatives is conceivable. One possibility to cope with this situation is to draw a subset of alternatives from the universal choice set for each trip. If the error terms are identically and independently distributed, this procedure is acceptable (McFadden, 1978). Ben Akiva, Gunn and Silman (1985) presented several methods how a subset can be drawn. The simplest approach which was adopted for example by Pozsgay and Bhat (forthcoming) is to add a random sample of non-chosen alternatives to the alternative which was indeed chosen.

This approach was also adopted here by adding nine randomly selected destinations, which were different from the chosen alternative, to the chosen alternative. As Switzerland consists of very different structured municipalities, the set of possible alternatives was restricted according to the considered activity types.

- **Model for skiing**: It was assumed that the destination of a trip with the purpose skiing must be a skiing resort. A municipality is regarded as a skiing resort if it has access to lifts - either directly or through a skibus. 176 municipalities fulfilled this criterion.
- **Model for hiking and climbing**: It was assumed that these activities are performed in municipalities located over 800 meters. Most of the sampled municipalities – in total 555 - are located in the Alps, which are popular for this kind of activities.
- **Model for walking and swimming**: It was assumed that municipalities located below 600 meters, which are not a town, are predestined for these activities. 1'716 municipalities were selected.

Selection of personal and situational variables

For the activity skiing objective factors, like price level, snow conditions, accessibility or number of lifts, as well as subjective factors, like the atmosphere or the friendliness of the other guests and residents, are important (Klassen, 2001; Klenosky, Gengler and Mulvey, 1993). A study about the price level of different Swiss skiing resorts has shown, that much variability can be explained by objective factors (Berwert, Bignasca and Filippini, 1995-1996). But the ski facilities themselves are not the only attraction for the tourists. Brandner, Hirsch, Meier-Dallach, Sauvain and Stalder (1995) pointed out, that new offers for special sport segments like snowboarding, aprés ski facilities and non-ski facilities in case of bad weather (for example public indoor pools) are also crucial for ski areas to attract tourists.

Most of these objective variables are in the data set, whereby height is used as indicator of the probability of good snow conditions. Additionally variables describing the subjective quality of the resort were added. These variables are based on a five point scale concerning the quality of the alpine ski tracks, the quality of snow board facilities, the quality of cross country ski tracks, the quality of aprés-ski and the presence of a skibus (ADAC, 2001).

Describing the supply for the summer activities is much more difficult than describing the supply for skiing, because these activities are not so dependent on a specific infrastructure. Additionally the literature is not as rich as in the case of skiing. Nevertheless it is necessary to make an attempt to model these activities, because hiking is the most popular outdoor leisure activity. Characteristics of this activity are that it is carried out unorganised, that beautiful landscapes are preferred and that people like to combine this activity with other activities (Mielke, 1994).

Although the destinations are not as easy to identify as for skiing, there are in summer municipalities which are more frequent visited than others. This observation suggests that there are natural elements respectively facilities which determine the attractiveness of a municipality as a destination for an excursion. A beautiful landscape, sport, cultural and eating facilities or bathing possibilities are conceivable variables whereby it is assumed that their influence differs with regards to the chosen activity (climbing and hiking versus walking and swimming).

Selection of personal and situational variables

The underlying utility function of discrete choice models distinguishes between variables characterising the destination (see 4.1), the travelling person and the actual situation. Each of these groups of variables is described separately, as relevant variables are identified based on former studies which have analysed factors influencing travel behaviour in general and destination choice in particular.

The demand data are not only used for describing the travellers, but also to restrict the data set. It was assumed that skiing trips were only carried out in the winter months (December, January, February, March), and trips for the summer activities in the summer months (June, July, August September), whereby only the defined subset of alternatives was allowed as destination. A further restriction refers to the kind of trip. Different leisure trip purposes were asked in the KEP, but only the categories 'excursion' and 'holiday' were considered in the following analyses

Persons

The participation in a special activity is the result of humans trying to satisfy their needs and maximise the utility of their behaviour. But the behaviour is limited due to different constraints. These constraints can be distinguished for leisure activities in intrapersonal and structural constraints (Crawford, Jackson and Godbey, 1991). The intrapersonal constraints include personal skills and abilities, while the structural constraints include spatial, temporal or financial constraints. Gilbert and Hudson (2000) certified this theory for skiing participation and showed that the intrapersonal constraints are responsible for the question if a person goes skiing at all, while the structural constraints are more important for the choice of a destination.

Temporal and spatial constraints depend to a large extend on different socio-demographic factors. The variables age, gender, employment status, time budget, car-availability, income, number and age of children were found to be important for leisure travel (Lu and Pas, 1999; Zängler, 2000; Lücking and Meyrat-Schlee, 1994). Additionally, different studies – either based on empirical findings or on theoretical considerations – pointed out that the living situation (Fuhrer and Kaiser, 1994), general values and preferences (Götz, Jahn and Schultz, 1997), the social context and friends (Blinde and Schlich, 2000), previous journeys (Oppermann, 1991) and the level of information of travellers (Klassen, 2000) also influence travel behaviour. Unfortunately, the last mentioned factors are not available in the used database.

Travel situation

The situational variables are connected to each trip and change, if a person goes to another destination (unlike the personal variables) or if different persons go to the same destination (unlike the variables describing the destination). Possible situational variables are the travel situation, the weather, the season or the type of day. Because of data restrictions only the influence of the travel situation is tested here.

The most important variables to describe the travel situation are the generalised costs between the origin and the destination. They are a measure for the impedance to go from one place to another. The most common forms to incorporate the generalised costs into the utility function are the linear form and the log-linear form (Fotheringham, 1983). A linear function would imply that the utility decreases proportional to increasing generalised costs - regardless whether the generalised costs are already high or not. A log-linear form suggests instead that the utility still decreases with increasing generalised costs, but the marginal utility decrease is lower for higher generalised costs.

The generalised costs were calculated with the software VISUM (© PTV AG, Karlsruhe). At this stage only the distances between two municipalities were considered, because the travel times between the municipalities are at the municipal level only available for the mode car, because not all municipalities have rail access. The shortest path - distances (time) were calculated using a national road network available at the IVT.

RESULTS

Based on the theory and the preparations steps models for the three activity types could be estimated. Starting point of the estimations was a model including the mentioned spatial variables, the travel distances between origin and destination as well as variables describing the person. The last group of variables can not directly be integrated in the model, but must be used either alternative specific or in conjunction with a generic variable (Maier and Weiss, 1990). The second possibility was chosen because of the nature of the choice set (always different alternatives), whereby theoretical meaningful combinations were tested.

The selection of variables was not only based on theoretical considerations and the availability of variables, but also on the correlations between the variables. Because variables which are highly correlated can cause problems during the estimation process, pairs of variables with a correlation coefficient greater than 0.6 were tested in greater detail. Mostly the inclusion of both variables in one modell was avoided.

This first models were modified according to the model results, whereby any modification was based on a-prior understanding and was not guided by the model results alone. The first attempts already showed some interesting results. On the hand, the person variables had very low, if any influence on the model results. So nearly all of them had to be omitted. The only exception was the ratio of inhabitants at the destination to the number of inhabitants at the origin. On the other hand the great importance of the distance variable became visible. So it seemed useful to present results with and without this variable. The log-linear function of the distance variable performed better than the linear function.

Model for skiing

The final model (see table 2) consists of a variety of different variables and has a high quality, whereby the fit of the model with the distance variable is much higher than the fit of the other model. This means that the distance between origin and destination is able to explain 40% of the model's variability. Destinations further away are less interesting than nearby skiing resorts.

The choice of a destination is additionally influenced by variables describing the quality of the skiing resort and by variables exceeding the traditional skiing supply. Interesting is that the influence of the variables 'length of alpine tracks' and 'quality of alpine skiing area' is negative. This kind of relationship could also be seen in respective scatter plots. By way of contrast the influence of the price level, entertainment and other sport facilities is positive. Especially the availability of a public indoor pool and indoor tennis courts increase the attractiveness of a municipality.

Furthermore it is interesting to analyse how the change of a variable influences the choice of an alternative. An appropriate tool for doing this are elasticities which specify the proportional demand increase or decrease caused by an one-percent change in a variable. The elasticities were computed for four chosen variables. The results (see table 1) confirm the importance of the distance variable.

Alternatives	***Distance***	***Price***	***Ski tracks***	***Indoor pool***
Not chosen alternative	***0.823***	***-0.525***	***0.111***	***-0.431***
Chosen alternative	***-1.589***	***0.380***	***-0.075***	***0.240***

Table 1 Elasticities for chosen variables of the skiing model

Model for climbing and hiking

As the model for skiing this model has a good model fit (see table 3), but this is again mainly due to the high explanatory power of the distance variable. The model for climbing and hiking contains variables describing the vegetation as well as variables describing the leisure infrastructure. All infrastructural variables have a positive impact on the choice of a specific destination. Especially the possibility of swimming seems to attract people. The situation is different in the case of the vegetation variables. Some of them have no significant effect (for example area with closed forest), some of them a negative one (for example area with open forest), some of them a positive one (for example area without vegetation).

	Models with distance		Models without distance	
	Coeffi cient	t-statistics	Coeffi cient	t-statistics
Height of municipality	0.002	6.30	-0.000	-2.57
Unvegetated or unproductive area [ha]	0.000	7.18	0.000	7.96
Employees in entertainment facilities	0.014	3.57	0.010	3.52
Inhabitants at destination/inh. at origin	-0.007	-2.74	-0.019	-4.97
Log of distance [km]	-2.429	-19.02		
Price for a one week ticket	0.004	1.79	0.003	2.26
Total length of alpine tracks	-0.001	-1.36	-0.002	-2.31
Quality of alpine skiing area	-0.182	-1.46	-0.143	-1.56
Quality of après-ski	0.217	2.71	0.191	3.24
Belonging to the skiing area	0.510	3.57	0.440	4.24
Nr. of public indoor tennis courts	1.025	7.08	0.750	6.86
Nr. of public indoor pools	0.269	6.96	0.261	8.95
Sample Size [trips]	715		715	
Log likelihood function [β]	-682.681		-1298.842	
ρ^2	0.585		0.211	

Table 2 Coefficients, t-statistics and model fit of the skiing models

Model for walking and swimming

This model is the model with the highest ρ^2 compared to the others, whereby the differences between the models are higher for the model type including the distance variable (see table 4). This means that in the model for walking and swimming even more variability can be explained by the distance variable. The two models - with and without - do not only differ in the values of the ρ^2s, but also in the significance of the coefficients and even in the signs.

The choice of a destination is positively influenced by all variables describing the supply in a municipality. Especially swimming facilities attract people. Nearly as important as the possibility to swim is the possibility to walk. Cultural facilities also tends to increase the probability of a destination to be chosen.

	Models with distance		Models without distance	
	Coefficient	t-statistics	Coefficient	t-statistics
Height of municipality	0.002	4.82	0.000	0.96
Area with open forest [ha]	-0.003	-2.12	-0.003	-4.19
Area with bushes [ha]	0.002	3.16	0.001	2.53
Area with copses [ha]	0.008	4.91	0.005	6.20
Area without vegetation [ha]	0.000	1.73	0.000	0.85
Area with meadows [ha]	-0.004	-4.38	-0.004	-6.78
Log of distance [km]	-2.181	-16.72		
Hiking paths [km]	0.004	1.61	0.005	3.73
Employees in gastronomy facilities	0.010	2.05	0.001	4.71
Nr.of bath in lake	0.770	2.58	0.415	2.63
Nr. of public outdoor pools	0.369	3,94	0.322	6.15
Sample Size [trips]	570		570	
Log likelihood function [β]	-266.422		-984.452	
ρ^2	0.797		0.250	

Table 3 Coefficients, t-statistics and model fit of the climbing and hinking models

	Models with distance		Models without distance	
	Coefficient	t-statistics	Coefficient	t-statistics
Nr. of inhabitants	0.000	-3.98	0.000	14.70
Area with closed forest [ha]	0.000	2.17	0.000	0.59
Area with parks [ha]	0.071	6.77	0.016	2.520
Inhabitants at destination/ inh. At origin	-0.041	-4.01	-0.122	-13.75
Log of distance [km]	-2.001	-44.58		
Hiking paths [km]	0.015	8.18	0.008	7.82
Employee ins gastronomy facilities	0.001	4.40	-0.000	-0.09
Nr. of cultural facilities	0.060	2.71	0.029	2.14
Nr.of bath in lake	0.546	9.64	0.350	11.27
Nr. of public outdoor pools	0.407	13.10	0.259	15.11
Sample Size [trips]	3210		3210	
Log likelihood function [β]	-1378.253		-5339.539	
ρ^2	0.814		0.278	

Table 4 Coefficients, t-statistics and model fit of the walking and swimming models

Interpretation

The low influence of the person variables on the model results support the statement of Gilbert an Hudson (2000) that the intrapersonal constraints are responsible for the question if a person carries out an activity at all, while the structural constraints are more important for the choice of a destination. Because only realised trips are regarded, differences in the socio-demography can not be seen. If a trip is carried out, the choice of a destination is mainly dependent on the destination specific characteristics.

The importance of the distance is another for all models valid result. It shows how sensitive people are to the distance they must travel. If the distance variable is omitted from the models, its influence is captured by other variables - sometimes leading to changes in the signs.

Besides these general findings each model contains further information

- **Skiing model**: One - perhaps surprising - result is that the availability of entertainment and additional sport facilities have a positive and greater impact on the choice of a destination than the skiing supply itself, but further functional forms need to be tested before this can be generalised.
- **Hiking and climbing model**: Whereas people clearly reward a good leisure infrastructure, there exist only trends with regard to the natural environment. Those vegetation types are interesting for people which are typical for alpine regions, for example areas without vegetation. Vegetation types, which can also be found in lower areas, are less appealing. This interpretation is supported by the fact that the height has a positive impact on the choice of a destination.
- **Walking and swimming**: Interesting in this model is the comparatively high explanatory power of the distance variable compared to the other models indicating that people are more distance sensitive for activities which more easily can be carried near the origin. A further finding is the importance of the infrastructure compared to the nature.

The unexpected results with regards to the skiing infrastructure and the general lack of explanatory power of the socio-demographic variables ask for further study. The heterogeneity of the persons can make point-estimates a difficult and potential misleading proposition. Mixed logit estimates (random parameter logit) will be performed in the future to account for these variabilities in taste between persons and contexts.

CONCLUSION

Modelling destination choice is at the moment a relative undeveloped area in transport modelling. But it is necessary to make progresses in this area, because leisure travel has become the most important trip purpose and the consequences of leisure travel are far reaching. The destinations themselves, especially small municipalities in the Alps, as well as municipalities on the main routes are often dominated by leisure travel. The carrying out of activities also has influence on the structure of municipalities.

Modelling destination choice requires suitable data sets and tools. Because the choice of a destination is a choice between discrete alternatives, one common form of discrete choice modelling - the MNL - was used here - knowing that not all particularities of destination choice can be captured and that further developments are desirable. But the results obtained give interesting hints on the relationships between the variables and the choice of a destination which are useful for planers and persons responsible for the supply in a municipality.

One main result of the models was that the choice of a destination is heavily influenced by the distance between origin and destination. Travellers weigh the attractiveness of a destination against the impedance between their origin and a potential alternative. This means that municipalities further away from the main cities must have a very attractive supply to attract people. Against this background the wish of many municipalities to have access to the main (road) network becomes understandable.

Most leisure activities require a respective infrastructure for carrying out them. For example skiing is not conceivable without lifts, walking is not conceivable without hiking paths. Therefore it is highly probable that a good infrastructure would be attractive for the potential users. In the case of skiing the initial model results do not support this hypothesis. The direct skiing infrastructure is not as important as other facilities - like a public indoor pool or aprés facilities - for the choice of a skiing resort. The length of ski tracks has even a negative impact. But at the same time the price of a ticket has a positive impact on the choice of destination - perhaps indicating the image of a skiing resort. However, in the case of walking the length of the hiking paths has a positive effect on the choice of a destination. But once again other facilities, like pools, possess a higher explanatory power.

In the skiing and walking model different types of infrastructural facilities determine the attractiveness of a municipality - of course dependent on the distance. The environment plays a subordinate role. The situation is different in the case of hiking. Besides the infrastructure vegetation types which are typical for higher located municipalities tend to attract people.

To sum up - the model results show the importance of a good accessibility and varied infrastructure. What do these results mean for planners and sellers of tourist services. Is the conclusion admissible that a tourism dependent municipality can only survive if it continuously improve its supply and its access. To some extent this conclusion is right, especially because the competition between destinations is becoming fiercer. But it should also be kept in mind that a nation wide analysis has no place for smaller innovations. For example, a municipality like Ardez will never reach the visitor numbers of the world-famous St. Moritz, but it can be successful in attracting a specific type of tourists. So the results should not be understood as an excuse for further, but not well considered extensions of the tourist infrastructures.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Modelling Visitor Flow from the Visitor Perspective: The Psychology of Landscape Navigation

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Abstract: This paper reviews basic issues underlying the monitoring and modeling of the movements of visitors in large-scale natural parks and recreation areas. Modeling of "visitor flow" is related to research and methods in associated fields, including environmental preference, environmental values/attitudes and wayfinding. Relevant psychophysiological and neurological research and theory is also reviewed to reveal the fundamental basis of dissociations between verbal reports and actions. It is argued that traditional verbal survey methods cannot in principle provide an adequate basis for models of human landscape navigation.

The need for "visitor management" at the world's major natural parks and protected areas is obvious to everyone. Certainly those charged with the management of such areas recognize that the "human dimension" is at once the most potent and the most problematic of the forces with which they must contend. The physical and biological forces of wind, fire, flood, insects and drought can be overwhelming and catastrophic, but natural systems have evolved in the context of just such disturbances, and generally adapt to them rather well. The onslaught of increasing multitudes of adoring human tourists, recreationists and seasonal residents, while perhaps not as dramatic as a hurricane or a flood, has proven much more relentless. Natural systems have not had the millennia required to evolve suitable adaptive responses to this very recent and sometimes erratic disturbance agent.

How can natural parks and protected areas be saved from being loved to death?

One obvious answer is to close the gate and keep people out altogether. But this policy is likely to be very unpopular when it is the public that is being kept out of public lands, and public support (financial and political) is essential for providing the resources required to maintain and protect these areas. Moreover, there are substantial benefits to individuals and to society of having people visit and recreate in these special natural places, benefits that can not be readily replaced by other experiences and activities. But unbridled access could degrade or destroy the natural environmental settings that are essential to these desired experiences. Clearly, as generations of park managers and the participants at this conference realize, a balance between public use and environmental protection is needed.

In the face of increasing populations and increasing demands on natural parks and protected areas, protection of threatened plants and wildlife species, sensitive ecosystems, and biodiversity on the planet justifies limitations of human access and use. The question is, how much limitation? In recent years policy has tended toward *providing acceptable (satisfactory) visitor benefits, so long as it does not threaten the long-term sustainability of sensitive environmental/ecological resources*. Visitor numbers are limited by the estimated "carrying capacity" of the park environment. The visitor is placed in the position of being guilty until proven innocent—that is, excluded unless it can be shown that his/her admission would not harm the environment. In contrast, a policy that leans more in the direction of meeting visitor wants and needs might be *providing the maximum visitor benefits consistent with conserving the sustainability of essential environmental/ecological resources and systems*. By this policy the visitor is innocent until proven guilty—that is, admitted unless it can be shown that doing so would injure the environment.

There is considerable room for reasoned debate about where on the environmental protection-visitor satisfaction dimension public park management policies should stand in the 21st Century, both in general terms and on a place by place basis. Wherever one may chose to draw that line, however, rational policy development and implementation requires some fundamental information about visitors, about their needs and wants from the park environment, and about the impacts of their visits/uses on that environment. Following the well established lead of the physical and biological dimensions of park management, these human dimension/visitor management information needs should be met through the application of careful and rigorous science. This must entail a thorough investigation and analysis of past visitor-environment interactions, an appropriately detailed inventory of current visitor-environment conditions, and the development of scientific theory and models sufficient to make precise and reliable predictions of the outcomes of future visitor-environment interactions for a range of relevant park policy and management scenarios. The conveners and participants at this conference are demonstrably dedicated to just such a cause.

There is, of course, already a considerable history of recreation and tourism research that can, and has, advised visitor management policies. The best developed areas of park visitor science have focused on the visitor. Much is known about visitor demographics, perceptions, attitudes, expectations and beliefs, reflecting the interests and perspectives of the social scientists that have been drawn to this field of research. There is also considerable knowledge about visitors' general satisfaction with park visits, and growing understanding of how that is affected by various biological, social and managerial features of parks and recreation areas. Less is known about how specific park features affect particular individual and social benefits of visitation, and less still is known about specific and cumulative impacts of individual and collective visitor activities on park environments, especially where complex ecosystem disturbances are of concern.

In short, while there is considerable knowledge about park visitors and park environments in general, and about some important interactions, much less is known about specific visitor-environment relationships. Visitor demand for the experiences and activities that natural parks and protected areas provide continues to increase. At the same time, the supply and resilience of quality park environments remains mostly fixed or declines. In this context, information about specific visitor-environment relationships will be essential to achieving balanced park management policies that are biologically and socially sustainable. For example, general carrying capacity concepts (number of visitors per park) are not sufficient for attaining balanced allocations of visitor access to parks and protected areas. Many heavily used parks already apply spatially and temporally specific limits on visitation, restricting specific uses in designated areas at particular times to control both environmental impacts (as on nesting birds) and social conflicts (as between snowmobiles and cross country skiers). When successfully applied, such temporal-spatial zoning can enable parks to meet increasing visitor demand while at the same time reducing adverse impacts on sensitive environmental resources and enhancing the quality of visitor experience. But this level of specificity in park management demands the support of more precise and more detailed park visitor science. Gross tallies of visitors and general characterizations of visitor-environment interactions will not be sufficient. Meeting these needs will require answers to a chain of W questions that are near to the heart of this conference on Visitor Flow.

WHO/WHERE/WHEN/WHAT?

Who is Where When, doing What? Answering this question correctly and with sufficient precision is essential to effective park visitor management. Knowing W/W/W/W, between and within parks and protected areas is the most basic data required for the development of a valid and useful park visitor science, and for more effective visitor management. W/W/W/W data is prerequisite to understanding visitor-environment relationships (from quality of visitor experience/satisfaction to visitor impacts on the park environment) and visitor-visitor relationships (from solitude to crowding). Knowing W/W/W/W now and in the past provides the building blocks for models and theories that enable predicting changes in W/W/W/W in the future, and for understanding *Why* those changes occur. Yet surprisingly few parks and protected areas can answer the W/W/W/W question with any precision or certainty in either the past or the present, and far fewer have any scientific basis for predicting the W/W/W/W implications for the alternative futures among which they must be prepared to choose.

Answering W/W/W/W is the goal of the Visitor Flow monitoring and modeling efforts represented at this conference. The papers presented here represent some of the world's most imaginative and innovative approaches to this question. Advanced monitoring and remote sensing, geo-referencing and geographic information processing, and computer simulation and modeling technologies have been enlisted, adapted and combined to locate visitors in time and space and to track their movements and actions with unprecedented precision. But this has not been the traditional approach to visitor research. More often, when managers and investigators wanted to answer the W/W/W/W question (or, more correctly, subsets of that question), they have just asked, and in more or less sophisticated ways, written down what visitors said. That is, the vast majority of W/W/W/W data has been collected using one form or another of the verbal survey.

Verbal surveys have been and will continue to be an essential tool for park visitor science. Many important questions can most efficiently and effectively be addressed by posing questions and obtaining answers in words. Some important questions can only be addressed this way. Moreover, in some venues (especially politics and public relations), what people say can be more important than what they do. But the verbal survey has become so ubiquitous that "human dimensions" research (and much of social science in general) has acquired a reputation as "paper and pencil science" (with commensurate expectations about equipment budgets). However, for answering the more basic W/W/W/W question for actual visitors in actual natural (park) environments, verbal surveys may be particularly inappropriate.

The empirical data base indicating that people do not always do what they say or say what they do, is large and venerable. The dissociation between verbally expressed "attitudes" and overt behavior is legendary in the social and behavioral sciences (Nisbitt and Wilson, 1977). Indeed, this observation has achieved recognition at the most basic levels in the colloquial distinction between "talk'n the talk" and "walk'n the walk."

Park visitor/recreator research is not immune from this general pattern of dissociation between what people say and what they do. The mismatch between words and deeds can at times be due to genuine failures of perception and/or memory (visitors don't always accurately know where they are or remember later what they did there), and at times it may derive from intentional deceit (e.g., "we did not go into the restricted area"). Recent psychophysiological and neurological research, however, provides evidence that word-action dissociations may be characteristic of humans, a result of the fundamental "modular" architecture of the mind/brain. Little or none of this basic research has involved visitors in natural parks or protected areas, of course. Indeed much of the work has used animals or human subjects manifesting specific neurological disorders. Healthy human subjects have been studied, but mostly in very constrained laboratory situations designed to identify the neurological substrates of perceptions, thoughts, feelings and actions. Still, this research potentially has important implications for determining the necessary and sufficient conditions for answering the W/W/W/W question that is basic to Visitor Flow. The brief (and superficial) review of research below argues for shifting park visitor research beyond verbal surveys to include greater use of more direct spatially and temporally precise monitoring and modeling of visitor behavior, i.e. to increase emphasis on Visitor Flow. At the very least, this research provides support for expanding park visitor-research equipment budgets beyond paper and pencils.

WORDS VERSUS ENVIRONMENTS

It is not uncommon for assessments of public responses to different environments or environmental conditions to be based on verbal descriptions of (or just labels for) those environments or conditions. Is there any evidence that such verbal descriptions are capable of supporting valid assessments? That is, are answers to such questions consistent with responses based on direct experience of the actual environments (or conditions) the questions intend to represent?

Environmental preference--Few studies have directly compared environmental preferences based on verbal descriptions with preferences based on direct experience (Daniel & Ittelson, 1981, provides an indirect comparison). In fact the environmental perception/environmental preference literature seems to have bypassed this question entirely on the way to asking whether photographs are a sufficient representation for obtaining valid responses to such questions (Daniel & Boster, 1976; Shutleworth, 1980; Sheppard, 1989; Stamps, 1990; Zube, et al, 1987).

For many relevant environmental preference questions, the weight of the evidence is that obtaining valid answers requires highly realistic visual representations (e.g., photographs) of the environments/conditions at issue. Even then, important limitations have been noted. For example, environments with significant dynamic elements (e.g., flowing rivers) may require dynamic (animated/motion) representations (Brown & Daniel, 1991). If sensory modalities other than vision are important in the environments (or conditions) being assessed, additional features (e.g., the sound of flowing water) may need to be added to the representation as well (Hetherington, et al 1994). More recent environmental representation studies have focused on the sufficiency of emerging computer-graphic/computer-simulation techniques. Environmental preferences (and other perceptual judgments) have been studied for computer representations ranging from still video images/montages to interactive virtual reality systems (Bergen et al, 1995; Bishop & Leahy, 1989; Daniel & Meitner, 2001; Oh, 1994; Orland, 1993; Vining & Orland, 1989). The indications are that very high levels of color and texture fidelity (viz the environments represented) are needed to achieve valid responses.

Wayfinding-- Going beyond assessments of passive environmental experiences to address questions about navigation through, and destination selection within the three-dimensional environment (issues much closer to Visitor Flow), the environmental representation standards would appear to increase. Verbal versus "pictorial" representations have been studied directly in the context of wayfinding, especially studies comparing the effectiveness of verbally presented directions (route descriptions) versus maps as aides to learning and navigating spaces. Studies have compared verbal and map-directed route navigation in real and simulated environments, with the general finding that both can lead to successful performance (e.g., Evans & Pezdek, 1980; Franklin & Tversky, 1990; Thorndike & Hayes-Roth, 1982). However, map representations are generally superior in supporting configural knowledge, as indicated by superior performance when the navigator is required to go off the primary route to avoid a roadblock, to get back on track after a navigational error, to find a successful shortcut, or to reverse the route.

Of course, both maps and verbal descriptions are abstractions of the environment, and learning routes by either of these means is not the same process, and often does not produce the same outcomes as learning by direct exploration of the environment.

This difference, between secondary (from maps and words) and primary (direct experience) spatial learning (Presson & Hazelrigg, 1984), affects knowledge of the space and performance on a number of navigation-related tasks. Learning from both verbal and map representations, for example, tends to distort actual spaces toward a more Cartesian reference system and to shift perception/memory of oblique intersections and curved paths toward right angles and straight paths (e.g., Evans & Pezdek, 1980).

The great majority of outdoor way-finding studies have been conducted in built environments (especially in and around college campuses), where streets (sidewalks) provide primary routes and buildings and other architectural features are the principal landmarks. Fewer studies address navigation in natural environmental settings where trails or passage ways would be less regular and changes in topography and/or vegetation would be principal landmarks. An exception is the small set of studies on "orienteering" (e.g., Malinowski & Gellespie, 2001), but subjects in these studies typically have access to verbal descriptions, maps and compasses, and they are trained in the use of navigational aides.

A number of investigators have noted the potential advantages of using virtual environments to study wayfinding (e.g., Bishop, 2001; Rohrmann & Bishop, in press). Computer simulation/VR research, like the preference research discussed above, has apparently by-passed the question of whether verbal descriptions would suffice to represent the virtual environments with which their subjects interact. As in the preference literature, texture and color fidelity/realism in environmental representations have been found (or assumed) to be important. In addition, studies using "walk-through" (or "drive-through") simulations have been especially concerned about motion parameters, both the depiction of movement of the navigator/viewer through the environment and the motion of dynamic elements in the environments represented. Indications are that, in addition to rather high levels of form and color realism, realistic movement/motion is also necessary for valid environmental responses. In particular, interactive capabilities must be sufficient to allow the subject to explore visually, and in depth, the environment represented (Bishop, 2001; Bishop et al, 2001). Moreover, efforts are increasing to develop more natural response options for VR systems. Based more on intuitions than on actual empirical study, verbal responses, and even mouse or joy stick systems, have apparently been judged inadequate to support valid conclusions about human navigation in three-dimensional environments.

Psychophysiological-neurological research— There is wide spread belief that exposure to natural environments, in either active or passive pursuits, is psychologically and physically beneficial, especially for highly stressed, urbanized humans (e.g., Parsons, 1991; Ulrich, 1983). Consistent with this belief, it has been shown that viewing natural environments (directly, in photographs or in video) can produce rapid and substantial physiological recovery from stress (e.g., Hartig et al, 1991; Parsons et al, 1998). As for the environmental preference research described above, there do not appear to be any studies that have directly investigated whether verbal descriptions (read or heard) of these environments would have similar effects. A recent review, however, suggests that concern about environmental representation in this context has instead focused on whether even high quality visual representations (photographs, video tapes and high-realism computer simulations) are sufficient to support the restoration effects of direct environmental experience (Parsons & Hartig, 2001).

There is long-standing evidence that visual/perceptual and verbal processing systems may be supported by somewhat independent brain/neurological systems in humans (e.g., Gazzaniga, 1985). Perhaps the most popular version of this distinction has been the notion that the left and right hemispheres of the brain are differentially specialized for verbal (left hemisphere, for right handed people) and visual/perceptual (right hemisphere, for right handed persons) processing. Fascinating studies with "split brain" subjects (persons whose left and right hemispheres have been separated by accidents or as a surgical treatment for severe epilepsy, for example) have revealed astonishing differences in the capabilities of the two sides of the brain (e.g., Gazzaniga, 1984; Sperry, 1968). For example, words presented only to the left side of the visual field (and thus only activating the right side of the brain in split brain subjects) can neither be read nor (in the case of instructions for action) responded to appropriately (such as selecting the named object from a set of objects). In contrast, when pictures of objects are exposed in the left visual field the subject can not name the object, but can accurately select the depicted object with the left hand (the hand primarily controlled by the right hemisphere). In normal (intact) brains stimulation from both sides of the visual field is neurologically simultaneously transmitted to both hemispheres, but careful experiments have revealed that the separation in verbal versus visual/perceptual function persists, and has important implications for normal cognition and behavior.

Studies of the neurological substrates of spatial learning and navigation in three-dimensional environments also indicate that only rather high-realism environmental representations are sufficient to produce neurological activation patterns that are similar to those that would be expected to occur in actual environmental encounters. For example, brain scans of subjects learning relatively abstract virtual mazes or towns differ from those of subjects learning from richer, more realistically depicted environments, and it is the latter representations that produce patterns of neural activity most consistent with those expected for direct spatial learning (Parsons & Hartig, 2001). One possible counter example cited by Parsons and Hartig was a study of experienced London taxi drivers who were instructed to imagine driving familiar routes through the city. Brain scans of the drivers showed patterns of neural activity substantially similar to those expected for navigation in actual environments. Whether novice drivers less familiar with the environment in question would produce similar results is not known.

The simple two-hemisphere, visual-versus-verbal dichotomy is no longer held, as recent work has indicated considerably more complex patterns of separation and sharing of verbal and perceptual and other functions between the hemispheres. Perhaps more importantly, neurological research has identified a much larger number of autonomous or semi-autonomous anatomical/functional distinctions. One such distinction that may be significant for understanding aspects of Visitor Flow is the separation of neurological systems for perception-for-representation (as for encoding objects into memory or for verbally describing a perceived object) versus perception-for-action (as for avoiding a collision or for grasping an object).

WORDS VERSUS ACTIONS

In some circumstances asking people verbally to report where they have been and what they did there may be sufficient. But there are many circumstances where this would not be an appropriate procedure. For an obvious example, while lost persons do exhibit consistent and predictable navigational patterns (Malinkowski & Gillespie, 2001), it would seem on the face of it to be inappropriate to ask them where they have been. Young children are quite capable of navigating though complex environments, but they are unlikely to have the verbal skills to describe sufficiently where they have gone/would go or how they would get there. In fact, there is some evidence that young children may only be able to indicate the extent of their spatial understanding through responses that are basically similar to actual navigation. In one study (Lehnung, et al 2001) preschool children performed significantly below older elementary school children on a spatial learning task when configural knowledge was assessed by moving a compass-like pointer to indicate the direction of a learned landmark (not in sight). However, when the same children were allowed to indicate the direction by orienting their body and pointing with an extended arm, the young children preformed as well as the older children. This finding is consistent with the fact that implied spatial learning and navigational ability for adult subjects can depend considerably on the tasks/responses used to assess that ability (e.g., Kitchin, 1996).

Saying versus doing the "right" thing--There are many contexts in which verbal reports and actions are inconsistent. Dissociations between self-reports of attitudes and behavioral intentions versus behavior have been the subject of a large number of psychological and social experiments. Studies of health promoting/protecting behaviors are one important example where stated intentions versus actions inconsistencies are notorious, especially with respect to diet, exercise, smoking and unprotected sexual behavior. In the environmental domain pervasive discrepancies have been reported between self-reports and actions regarding energy conservation and recycling (e.g., Ebreo & Vining, 1994; Corral-Verdugo, 1997). In the Corral-Verdugo study if was found that self reports of recycling were associated with reported agreement with conventional beliefs about the value of conservation and recycling practices, but self reports were not significantly correlated with behaviorally assessed personal motivations or competencies required for recycling behaviors. In contrast, recycling behavior (confirmed by direct observations) for the same respondents depended upon personal motivations and competencies, but was independent of expressed beliefs about the value of conservation and recycling.

It is tempting to attribute the above discrepancies between words and actions to insincere subjects, i.e., subjects strategically saying what they believe the experimenter (and society more generally) wants to hear. Such "task demand" effects are very likely important in many situations characteristic of verbal attitude surveys. But there is evidence that similar dissociations between words and actions may be much more fundamental.

Environmental affordances--No hiker would be surprised that people routinely overestimate the steepness of a hill they are about to climb, especially when burdened by a backpack. What may be more surprising is the finding that such exaggerations, consistently found in verbal reports, are not found when people indicate estimated steepness by their actions. For example, when people estimate the steepness of a hill by adjusting an unseen platform with their hand, the exaggeration goes away and slope estimates are much more accurate (e.g., Bhalla & Proffitt, 1997; Crème & Proffitt, 1998; Proffitt, et al 1995). A related experiment (Wraga, et al 2000) used an environmental-scale representation of the Muller-Lyer illusion, in which a line segment extending between two circles is consistently judged to be shorter than it is. When this illusion was arranged so that the line (between the circles) extended in front of the observer as a "path," verbal estimates of the length of the path showed the expected underestimation. When subjects were blindfolded and asked to walk to the end of the path, however, the bias in length estimation did not occur. These findings are consistent with the view that mental representations of environmental objects that support explicit memory or verbal reports are anatomically and functionally separate from the implicit representations that guide actions toward those objects (Milner & Goodale, 1995).

Psychophysiological and neurological bases—Consider the following observation: a woman is shown two objects, one a tall thin vertical rectangle and the other a much shorter-wider cube. When asked about the objects, she is unable to consistently tell the experimenter whether the two objects are the same or different. On the other hand, when asked to reach out and pick up one of the objects, she does so quickly and with ease. Further, video tape recordings of her action reveals that both the orientation and the extent (width) of her grasp were appropriately adjusted to fit the object being picked up well before her hand came in contact with the object (Milner & Goodale, 1995).

The behavior in the study described above is, of course, not normal. The subject in the experiment suffers from a particular neurological disorder caused by brain injury. But a large body of related studies with both brain damaged and normal subjects has lead psychologists and neuroscientists to make important distinctions between the processes of cognition and action. The perceptual and cognitive processes for representing objects for the purposes of remembering them and/or reporting about them versus the processes that direct actions toward the same objects appear to be associated with distinct and substantially independent underlying neurological systems in the brain. As the studies by Proffitt and his associates described above reveal, such dissociations between words and actions are not restricted to people with brain damage. Indeed, such word-action dissociations are very likely characteristic of many environmental perceptions and judgments that underlie the W/W/W/W questions that are central to understanding Visitor Flow.

IMPLICATIONS FOR VISITOR FLOW

The research outlined above indicates that it is very unlikely that verbal descriptions can provide valid environmental representations for the study of Visitor Flow. Indications are that for assessing visitor's aesthetic and other environmental preferences, only high fidelity, realistic environmental representations will suffice. For questions regarding visitor's navigation through the environment, representational standards are likely to be even higher, including high fidelity representations of movement parameters (for both the visitor and dynamic environmental components) and high levels of interactivity to support active exploration of the environments represented. The pervasive dissociations between words and actions that have generally plagued verbal surveys of attitudes, beliefs and intentions are increasingly believed to be a reflection of the fundamental architecture of the human mind/brain. Thus, verbal reports alone are unlikely ever to provide a valid basis for ascertaining visitor's preferences for and/or reactions to environmental conditions in parks and protected areas. At a minimum, the research outlined above strongly affirms the need for thorough empirical confirmation of the validity of any study that purports to answer the W/W/W/W questions that are most basic to understanding Visitor Flow. That is, it must be demonstrated that answers to W/W/W/W questions based on the environmental representations used and the responses obtained in the assessment are consistent with W/W/W/W answers for actual visitors in actual parks. Of course, making this comparison requires information about the actual behavior of visitors in actual parks and protected areas--that is information about Vistor Flow.

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Models to Predict Visitor Attendance Levels and the Presence of Specific User Groups

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Abstract: This paper proposes approaches to modeling visitor flows in the context of weather and outdoor recreation. The nature conservation area and area under investigation the Lobau, which is a part of the Danube Floodplains National Park, lies in close proximity to the large conurbation of Vienna, the capital city of Austria. This circumstance presents the managers and researchers of the Lobau with a variety of challenging problems, due to the high number of visitors and the multifaceted visitor structure. An ecologically and economically sustainable management of the recreation and conservation area Lobau requires a profound knowledge of the uses visitors make of this area and a reliable prediction of the potential numbers of visitors. The investigation of the prognostic model is based on the results of a visitor monitoring project. Within this project, video-cameras were installed at several entrance points to the Lobau to monitor recreational activities throughout one year. The prognostic models were based on the dependence of the daily number of visitors on external factors such as weather and day of the week. Using a linear regression, these relationships were investigated and used to predict visitor loads. For the model, a distinction was made between workdays and weekends and/or holidays. The weather was considered in a very differentiated way: Meteorological elements, i.e. air temperature, cloud cover, precipitation, appear directly as parameters in the models as well as indirectly in thermal comfort indices, e.g. the Physiological Equivalent Temperature (PET). Reliable models can be obtained for the daily totals of visitors as well as for specific user groups with high visitor loads, i.e. hikers and bikers. The day of the week has the greatest influence on the daily totals of visitors as well as on individual user groups. The numbers of bikers and hikers depend heavily on the Physiological Equivalent Temperature. The effects of precipitation and cloud cover during the preceding seven days are small. The usage patterns of joggers and dog walkers are more difficult to model as they are less influenced by the day of the week and weather related factors.

INTRODUCTION

Leisure-time activities in protected areas are a subject of interest for management and research. A lot of studies point at the necessity of a comprehensive understanding of recreational use for the sustainable and effective management of protected areas (Heywood, 1993). Only when detailed information on the leisure and recreational usage of these areas is available, is it possible to blend these with findings from the fields of natural science and sociology to arrive at an ecologically and economically sustainable management of recreation and conservation areas (Coch et al., 1998; Eagles et al., 1999). The results of these research activities have to fulfil scientific criteria, have to be suitable for planning and practice oriented. The results can only be included as a planning factor when both the planner and practitioner are capable of completely understanding and implementing the information provided by this data. Only when all these basic conditions are fulfilled, will visitor management measures receive increased acceptance (Harfst, 1980; Höppe et al., 1987).

The dependence of human well-being and, therefore, of recreationists on the weather is a well-known phenomenon and there has been widespread research into the relationship between recreational activities and the weather (De Freitas, 1999; Gibs, 1973; Hunziker, 1997; McCalla et al., 1987; McColl et al, 1990). Biometeorological research in these fields and in the field of thermic comfort has resulted in a considerable increase in knowledge for applied research and the implementation in planning and management demands.

The individual perceives weather as a combination of air temperature, humidity, cloudiness, wind, sunshine, solar radiation and complex values for human hygro-thermic sensitivity (Hoffmann, 1980; Blüthgen, 1980; de Freitas, 1999; Hammer et al., 1990; Jendritzky et al., 1979;

Höppe, 1997, 1999). In this context, mention must be made of the "Physiological Equivalent Temperature" which is defined as where the heat balance of a person, in an interior room (unaffected by wind or sun) is equivalent. This enables the layperson to compare the complex thermic conditions felt in the open air with his experience gained indoors - something he can easily relate to. (Jendritzky et al., 1979; Höppe, 1997, 1999).

Although thermal comfort can be achieved on most days of the year by adjusting one's clothing and activities accordingly, the weather still has a major influence on leisure and recreational behavior. In the case of the research area it seems to be quite clear: One might expect a higher number of visitors over the weekend and whenever the weather is fine, than on rainy workdays; the degree of influence of the respective factors, i.e. of the weather and day of the week, and their interaction is unknown. But, only knowledge of existing relationships between the numbers of visitors and weather, as well as the weekday, permits a detailed description of recreational attendance levels in a certain area. However, if it is intended to understand and forecast the recreational events in a specific area in detail - in terms of a prognosis model with a high temporal resolution of the attendance levels and user categories - it will be necessary to be in possession of quantitative data of high temporal resolution concerning both recreational use and the respective, current weather.

MATERIALS AND METHODS

The Danube Floodplains National Park is situated to the east of Vienna, the capital city of Austria, with a population of 1.6 million. A portion of about 2.400 ha (9.3 square miles) of this zone – the research area the so-called Lobau - actually lies within the Vienna city boundaries and is a traditional local recreation area. In 1996 the Danube Floodplains were declared a National Park and in 1997 received international recognition - IUCN category II. The protection of the floodplains is gaining in importance compared to the management of the recreational activities. The park management now has the task of fulfilling both the demands posed by intensive daily recreational use and by the need to protect the floodplains' forest ecosystem.

The Institute for Landscape Architecture and Landscape Management was commissioned by the Viennese City Forest Department to collect data on the attendance levels and structure of the visitors to the area as well as their spatial and temporal distribution.

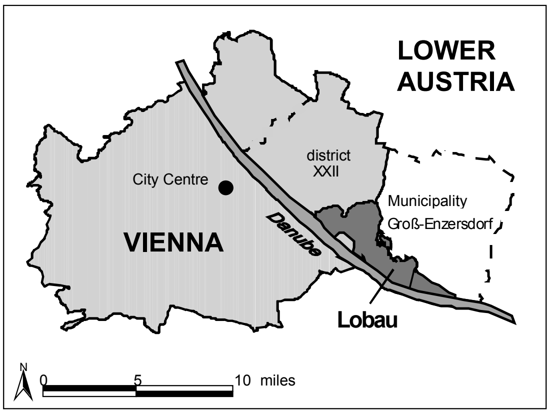

Figure 1: Study area: Lobau, the Viennese part of the Danube Floodplains National Park (Hinterberger, 2000, modified)

Permanent time-lapse video recording systems were installed at five entrance-points and recreational activities were monitored the whole year round, from dawn to dusk (Leatherberry & Lime, 1981; Vander Stoep, 1986). For the analysis of the video tapes only 15 minutes per hour of observations were taken into account. The data based on 15-minute evaluations were statistically verified by data of a complete survey. The examination using linear regression resulted in the R^2 value of 0.9 (Brandenburg, 2001). When analyzing the video tapes the following data were registered: date, day of the week, time, video station, number of persons in a group, direction of movement, user type (bikers, hikers, joggers, ...) and the number of dogs. The type of video system installed made it impossible to identify individual persons, thus guaranteeing anonymity. For modeling the daily number of visitors to the Lobau respectively the logarithm of these data was used. Days, when there was a loss of data of more than three hours at one of the video stations, were not included in the model. Therefore, 206 complete data sets of daily totals obtained when all cameras operated without failure, were available. The remaining data sets were used to verify the model.

In addition, on four days and at 12 entrance points to the park, visitors were counted and interviewed about their motives, activities and needs, etc. The survey took place on a Thursday and the immediately following Sunday, once in spring and once in summer. To collect as much data as possible, the survey was conducted on days with fine weather. The total sample size was 780 interviews. Temporal-selective counting, combined with video data, was needed for an extrapolation of the total number of visitors per year.

Meteorological data such as air temperature, precipitation, wind velocity, vapor pressure, relative humidity, cloud coverage and global radiation was provided by a nearby meteorological registration station of the Central Institute of Meteorology and Geodynamics in Vienna (ZAMG). The meteorological parameters 2 p.m. data, the day mean or categorized factors (i.e. cloud cover, precipitation, ...) were used for individual stages of the modeling. In addition, using meteorological parameters thermal comfort indices such as the Physiological Equivalent Temperature (PET) were calculated using 2 p.m. data of the meteorological elements. The calculation of the Physiological Equivalent Temperature was done by the RayMan Program (Matzarakis et al., 2000).

As a tool for studying the interaction between recreational use and external influences the univariate analysis of variance was used. The contribution of each variable factor in explaining the total variation of the dependent variables can be investigated independently. It is also possible to investigate their specific interaction. Using categorized factors with a variance analysis it is possible to depict non-linear connections.

The modeling of the connections and correlation between the number of visitors and user types and the external factors weather and day of the week were carried out successively. Firstly, the following demands on a prognostic model were formulated:

- Practical efficiency
- Existence of secure input-data
- Simple input-data accessibility
- Sufficient quantity of input-data
- Simple interpretation by the layperson
- Realization of the results by management
- Comparison of the results.

Basic questions concerning the modeling included: Do the weekday and season have an influence on the number of visitors and their recreational activities? What is the extent of the influence of each individual factor? Which meteorological elements – the day under observation and the weather progression – are particularly relevant for specific user-groups? How large is their influence on the kind and extent of recreational activity in the research area?

RESULTS

The recreational use of the research area

The long-term video monitoring in combination with the survey led to the following results, which were used as the basis for the modelling process:

- Temporal-spatial distribution of the visitors: for example, number of visitors for the whole year, by month or season; daily visits, peak days, minimum and average number of visitors per day, number of visitors using various entrance points, choice of direction at the intersection of paths.
- Linking of temporal and spatial data: for example, number of visitors at a certain entrance point at a certain time.
- Quantification of specific user groups and their distribution over space and time.
- Connecting the temporal and spatial data of visitors and visitor behaviour with meteorological data, such as temperature or precipitation etc..
- A basis for the development of prognostic models to predict visitor loads.

In order to better understand the visitor structure and, therefore, to interpret the results accordingly, some results of the surveys follow. More than 90 percent of the visitors interviewed came from Vienna and more than 60 percent of the interviewees visited the Lobau at least once a week. The Lobau can therefore be called the "Green Living Room" of a large number of Vienna's inhabitants (Arnberger et al. 2001a). The Lobau is visited by about 600,000 people per year. The main visiting period is between March and October, highest frequencies could be observed in May and on Sunday afternoons, when all visitor types can be found in the Lobau. The main year-round users of the Lobau are bikers with 58 % and hikers with 37 %. The main visiting period for bikers is the summer, for hikers it is spring. Joggers can be mainly observed between March and September (Arnberger et al, 2001b).

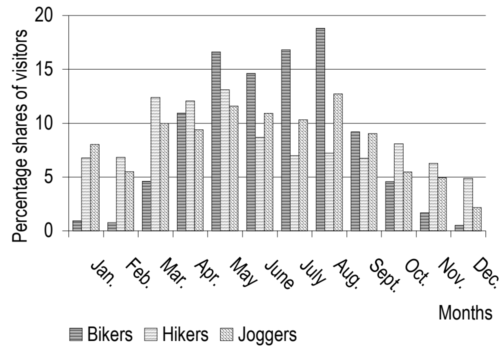

Figure 2: Relative Distribution of User Types over the Year 1998 - 1999, Data source: Video monitoring .09.1998-.08.1999

The workdays - Monday to Friday - are frequented by all user groups at a similar level. A significant increase in the number of visitors can be observed on Saturday and Sunday.

The observations of the individual types of visitors revealed a strongly differing pattern in respect to their dependence on the temperature. The number of bikers in the area is particularly susceptible to the temperature - an increased number can be observed only when the temperature rises above 10°C. Cloud cover played a more important role for bikers than for other users.

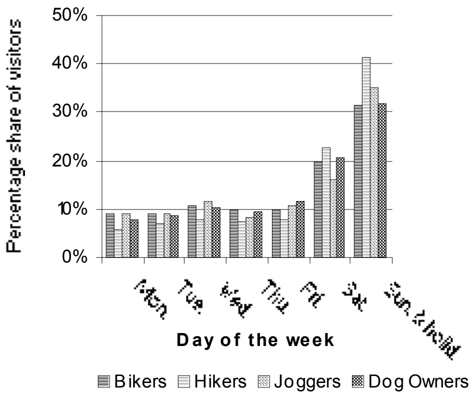

Figure 3: Visits per day of the week, Data source: Video monitoring .09.1998-.08.1999

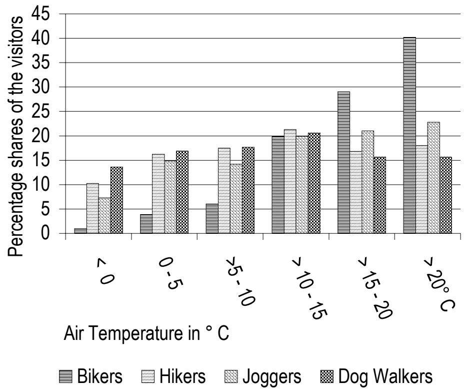

Figure 4: The Influence of Air Temperature on Visits to the Lobau, Data source: Video monitoring and ZAMG .09.1998-.08.1999

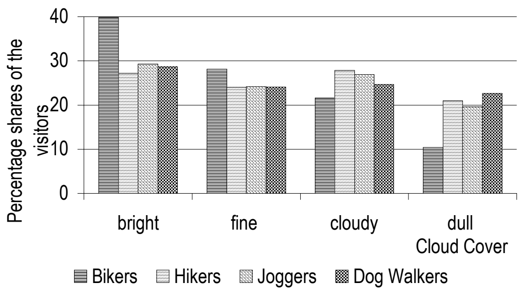

Figure 5: The Influence of Cloud Cover on Visits to the Lobau, Data source: Video monitoring and ZAMG .09.1998-.08.1999

Even a very superficial observation of the reasons for the various kinds and intensity of recreational use displays the influence of the weekday and weather. A fleeting look at the data appears to show clear-cut circumstances: One can count on more visitors on a fine weekend than on a rainy weekday. But, the dimension of the influence of the individual factors and their interaction is still unknown and it is precisely these parameters which are necessary for the prediction of the number of visitors and user types and, therefore, for effective visitor management.

The modeling process

In the first experiments, using daily total number of visitors, day of the week and only meteorological parameters such as cloud cover, cloud cover over the last seven days, precipitation during the day, wind velocity during the day, the day's mean air temperature and air temperature over the last seven days, no satisfactory results were obtained, particularly in interactive areas.

In the final model for the logarithm of daily visitor totals - without any distinction between the various user groups such as bikers, hikers etc. - the differentiation between workday (Monday to Friday), weekend or holiday (Saturday, Sunday, Holiday), the PET value according to the Ashrae scale (very cold (< 4 °C), cold (4 – 8 °C), cool (> 8 – 13 °C), coolish (> 13 – 18 °C), comfortable (>18 – 23 °C), mild (>23 – 29 °C), warm (>29 – 35 °C), hot (>35 – 41 °C), very hot (> 41°C) (Jendritzky et al., 1999)), occurrence (> 1 mm) or non-occurrence (0-1 mm) of precipitation at the principle activity times as well as the type of cloud cover (bright (< 2/10), fine weather (> 2/10 - 5/10), cloudy (> 5/10 - 8/10), dull weather (> 8/10) (Auer, 1990)), were all included. Even though cloudiness is used in the calculation of PET, it is also necessary for explaining visitor numbers as a separate covariant. This can be substantiated by the theory, that, among other things, the brightness of the sky is decisive for a person's psychological feeling.

Tests of Between-Subjects Effects
Dependent Variable:LN Daily total Number of the Visitors

Source	Type III Sum of Squares	df	Sig.	Eta Squared
Corrected Model	152,863	20	0,000	0,850
Intercept	1172,414	1	0,000	0,985
Day of the week	42,852	1	0,000	0,613
Cloud Cover	6,822	3	0,000	0,202
Type of PET	58,181	8	0,000	0,683
Percipitation	7,191	1	0,000	0,210
Day of the week * Type of PET	3,05	7	0,005	0,101
Error	27,026	185		
Total	8039,229	206		
Corrected Total	179,879	205		
a	R Squared = ,850 (Adjusted R Squared = ,834)			

Table 1: Evaluation of the Model of the Logarithm of Daily Totals of the Visitors

Using these results, it is possible to derive a formula for predicting visitor frequency:

Because of the greatly differing demands of these specific groups, it is necessary to develop an individual model, using partially different parameters, for each user group, for fine-tuning. Reliable models can be obtained for the total number of visitors per day as well as for specific, large user groups (i.e. hikers and bikers.)

Daily Totals of the Visitors = e (7,5 + (-0,735088 AF(1)) + (0 AF (2)) + (-0,320381 NSTYP(0)) + (0 NSTYP(1)+ (-1,913796 PETTYP (1))+ (-1,604032 PETTYP (2)) + (-1,126833 PETTYP (3)) +(-1,653791 PETTYP (4)) + (-1,245516 PETTYP (5)) + (-1,488712 PETTYP (6)) + (-0,589738 PETTYP (7)) + (0,0302933 PETTYP (8)) + (0 PETTYP (9)) + (0,461441 BEWÖLKTYP (0)) + (0,4303512 BEWÖLKTYP (1)) + (0,314313 BEWÖLKTYP (2)) + (0 BEWÖLKTYP (3)) + (-0,6152587 [A_F=1,00] * [PETTYP=1,00]) + (-0,616591 [A_F=1,00] * [PETTYP=2,00]) + (-0,772573 [A_F=1,00] * [PETTYP=3,00]) + (-0,660745 [A_F=1,00] * [PETTYP=4,00]) + (-0,239951 [A_F=1,00] * [PETTYP=5,00])]) + (0,1220991 [A_F=1,00] * [PETTYP=6,00]) + (-0,042184 [A_F=1,00] * [PETTYP=7,00])]) + (0 [A_F=1,00] * [PETTYP=8,00])).

Figure 6: Formula for Predicting visitors attendance levels

Summarising, the day of the week has the greatest influence on the number of visitors. The Physiological Equivalent Temperature (PET) also has a major impact on the number of visitors per day, in particular on bikers and walkers. Precipitation and cloud cover have a moderate influence on the number of visitors. The current modeling experiments show that the weather over the previous 7 days does not play an important role on the number of visitors.

To evaluate the model, data records, not included in the model creation, were used to test these models. A control - using a linear regression - results in a determinacy of almost 90% for the model of the daily totals of all visitors.

DISCUSSION

The availability of the discussed data on visitor monitoring permits a statistical evaluation of the correlation between the total daily number of visitors, as well for specific user categories, and the day of the week, meteorological parameters and comfort indices. The fact that it is so difficult to calculate the daily number of visitors of a specific category, such as joggers, is partially due to the fact that different decision-making patterns are decisive in the considerations of whether to jog or not.

Another problem arises from the size of the sampling. One specific group - swimmers - was not dealt with in this article because the sample size was too small for use in an analysis using the univariate analysis of variance. In order to model low-frequency user groups it is necessary to incorporate sophisticated statistical methods such as regression trees (Ploner et al., 2002). Another possibility would be to increase the sample size by carrying out the survey over an extended period of time.

The demonstrative power of the model for days with peak loading is not yet satisfactory. Particular emphasis must, however, be placed on these days because they are of particular importance for the supervision of the park and its ecological system management.

A major foundation for the establishment of the model is the potential visitors' decision-making process, which results in their respective use of the research area. It can be assumed that the decision on whether, or not, to take advantage of the leisure time possibilities of the Lobau, which is used predominantly by residents, is made more-or-less spontaneously and not planned well in advance. Weather forecasts which, for example, play a role in the planning of short holidays (Ammer et al., 1991; Lozza,1996) are not relevant to decision making in this case. Rather, the individual activities which a person carries out in his leisure time depend on the current temperature. The weather values of the day in question and possibly of the previous days play an important role in the recreational use of the area under investigation (Harlfinger, 1978).

Extent of interference	LN Total number of visitors	LN Bikers	LN Hikers	LN Joggers	LN Dog Walkers
Workday, weekend and holiday	high	high	high	small	moderate
Precipitation	moderate	moderate	small	existent	existent
PET	high	high	moderate		existent
Cloud Cover	moderate	moderate	small		small
Interaction between weekday and PET	moderate		small		existent
Cloud coverage of the last 7 days			very small	existent	existent
Air Temperature of the last 7 days		moderate	very small		
Value of model	adj. R^2=.834	adj. R^2=.844	adj. R^2=.744	adj. R^2=.291	adj. R^2=.440

Table 2: Explanatory value of the total number of visitors per day and the user categories

Relevant, practice oriented and reproducible data is required to enable leisure and recreational planning. This data must: be easily interpretable, permit simple further digital processing; be principally quantitative and result from continuous and simple data collection. Meteorology provides unbiased data which, however, does not include any planning information (Höppe et al., 1987). The interpretation of this data or its linkage with additional data is necessary for reaching appropriate further decisions. If these data are available, the number and distribution of the expected visitors can be determined. The management of recreational and protected areas only needs to input the weather parameters and the appropriate date and the estimated number of visitors will be calculated automatically. The precision of this will depend on the complexity of the data available for the individual recreational area.

Last but not least the park management needs the prediction of attendance levels for: the preparation of employment plans for the personnel of the conservation area: e.g. personnel at information points, rangers, first aid helpers, ..., to know the type of information required and best way to convey it depending on the visitor types at various access points, to refined distribution zones: marking of rest or recreational areas in connection with a certain guidance of visitors in time and space and to know the kind of facilities needed in recreational areas at a certain time.

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Serial Experiences : Monitoring, Modelling and Visualising the Free Independent Traveller in New Zealand at Multiple Scales with GIS

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Abstract: This paper outlines a number of approaches and methodologies, based on utilising itinerary analysis and Geographic Information Systems, which have sought to explore tourism flows and their impacts at a range of temporal and spatial resolutions. As such its basic records are the sequential movement patterns of individual tourists, either from night to night or from stop to stop. It draws from a data base of some 50,000 journeys nationally, and three major regional surveys in Northland, the West Coast and Rotorua conducted between 1997 and 2001. The paper initially deals with analysis and integration issues relating to existing national data sets on international and domestic visitors and their overnight stays. It then describes and critiques the development of map-based sample surveys applied to detailed information on intra-regional flows, with reference to work in both Tai Tokerau (Northland) and the South Island's West Coast. These surveys record the 'informal' stopping behaviour of visitors in greater detail, and allow initial analysis of movement and positioning of tourists at various times of the day. Insights gained from these data are explored, and their relationship to other data sets such as attraction visitation and accommodation usage surveys are reviewed. Finally, the significance of the data for tourism (in areas such as development strategies and impact assessment) and for wider geo-demographic applications are discussed, as are new data collection opportunities for recording itineraries and flows.

NEW ZEALAND'S CONTEXT FOR FLOW RESEARCH

As a cluster of sizeable but isolated islands, blessed with sufficient attractions to attract substantial international visitor interest, New Zealand represents an almost ideal context for defining and researching tourist flows. With the nearest land mass three and a half hours flying time away, and with closely-monitored entry and exit points, few visits are incidental or casual trans-border excursions, and assessing gross patterns of visitation is straightforward. All visitors are recorded by entry and exit cards, and the great majority (well over 95%) arrive by plane at one of three sites: Auckland, Christchurch and Wellington. Auckland, with direct flights to Asia, the Americas and Pacific Islands, dominates traffic, while Wellington, with links only to a few Australian cities, plays a small but important role. Setting aside Australia, which is a significant but not dominant generator of visitors, most tourists either visit New Zealand as a solo destination (for 3 to 6 weeks typically) or combine New Zealand with a comprehensive tour including one or more of South East Asia, Australia or the Pacific Islands.

The International Visitor Survey

In terms of identifying the total number of international visitors, and thus having a robust sampling frame for surveying the composition of

Figure 1: New Zealand Context Map

visitor flows, New Zealand is thus in a highly favoured position. Since the late 1980s knowledge of gross flows has been used to collect additional information from international visitors through the *International Visitor Survey* (IVS). This has run annualy, initially with some 4,500 respondents each year and latterly with close to 5,500. This survey has evolved over the years, but the methodology has constantly used an exit survey drawn from known departure patterns, and which has featured the collection of detailed marketing information, trip purpose and respondent (and companion) profiles. It has also collected information on internal activities while in New Zealand, including a sequential record of places where overnight stops were made, and their duration. These data were largely used to record total nights spent at specific locations, but in 1993 the first re-casting of the data was undertaken to illustrate regional flows, which resulted in the publication of a national map of international tourist flows (NZTB 1994). Broken down by categories of visitor and by country of origin, it revealed quite clearly the different travel patterns of visitors originating from different countries in the 1992-1993 survey (Figure 2).

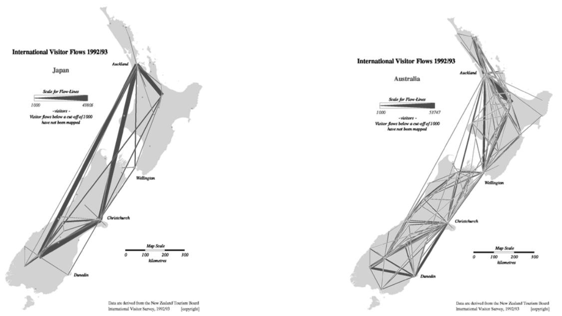

Figure 2: Comparative Flow Patterns, Japanese (left) and Australian (right) visitors. Source NZTB 1994

A knowledge of internal international visitor flows is important for understanding New Zealand tourism, partly because compared to many countries the free independent traveler, and the philosophy of touring holidays rather than single destination ones, are dominant aspects of tourist behaviour and impact. Touring by coach was once a major aspect of these flows (Forer and Pearce 1984), but increasingly car hire and independent and flexible travel behaviour have come to dominate in all but a few markets. The different behaviour of visitors from different markets, revealed by maps such as Figure 2, also gathers significance in terms of relating national marketing effort and focus to issues of regional development and involvement in tourism. For areas such as the West Coast of the South Island, growth in visitors from Australia or Germany, for instance, is worth considerably more than growth from Japan or Korea. These regional patterns also have significance in terms of influencing negative impact on New Zealand's natural assets, particularly the National Parks which have grown in number to fourteen and to constitute over 10% of the national land area. As international tourism numbers have grown consistently to over 1.5 mn in 2000, so concern with the potential impacts of tourism on national parks and other environmental attractions has increased, and answers are sought at the regional and local level rather than the national.

The Domestic Tourism Monitor

However, any significant understanding of impacts will also depend on domestic activity, which had been monitored infrequently from 1970 to 1998. In that year a pilot survey of the domestic sector was undertaken through Lincoln University, and in 1999 a full-fledged *Domestic Tourism Monitor* (DTM) was commenced surveying close to 17,000 people a year by telephone. This retrospectively recorded a single household member's travel patterns in the month prior, including day trips over 40 kms distant and overnight trips. The survey revealed that, in sum, the tourist activity from New Zealand's almost 4 mn residents generated slightly more economic turnover than the international sector, with a very different pattern of demand and trip duration. The DTM has been funded for further years, and it may become a more integrated exercise with the IVS through the design of questionnaires which use a compatible coding framework.

The initial mapping of IVS flows within New Zealand represented not simply a mapping exercise but also the substantial re-modelling of data into a compatible form for deployment within a Geographic Information System. Work by Forer and Oberdries (NZTB 1994) recast the sequential tabulation of destinations into the sectors of the intinerary followed by a particular respondent, largely to allow quick tabulation of flow levels between centres, and to automate flow representation. Researchers at the University of Auckland and Lincoln University extended this process by utilizing innovations in dynamic segmentation and routing that became available in the late 1990s to transform the itineraries into forms which could provide a much wider range of queries about flows and their constituent parts. This development also offered means to allocate tourist flows along specific highway routes (Figure 3), or simply link the itineraries by desire lines, as used in Figure 2.

These developments offered two new areas of enquiry. One was a better and more flexible approach to estimating regional demand as evidenced by tourist visitor numbers within local areas. The other was a greatly enhanced means of querying flows not just by composition but also by time elements, such as who was where on what day of their holiday or where people had been to prior to any specific place. While the limitations of sample size compromised drilling down too far, these data now provided a better means to identify local demand through parameters such as the origin or nature of the visitors. Combined with parallel data sets, such as the New Zealand Accommodation Survey (which records data on visitors in formal accommodation establishments) these data sets now provide a good initial estimate of regional patterns of visitation. They have formed significant inputs into ongoing work on environmental impacts and energy and material flows (Becken et al 2000), and provide a very useful national planning tool.

TOURISM FLOW DATA FOR EVALUATING IMPACT

The insights to be gained from the IVS and DTM have yet to be fully revealed, since there have historically been some technical issues in combining the two, and to date the surveys have been analysed only on an annual tabular basis. However, the two data sets provide a substantial framework for identifying gross patterns of demand and recreational activity. A real issue is whether spatially finer patterns of demand can be revealed either by analyzing these data sets in new ways or by combining them with other data sets.

This question is of relevance to work under way through the TRECC group at Lincoln University and Landcare Crown Research Institute, which is targeted at finding a framework to monitor and assess environmental impacts at various kinds of natural attractions. For specific sites, this work is seeking to develop key indicators of acceptable change for different kinds of attractions. Consequent from this, the research needs to identify the likelihood of unacceptable change in specific areas, which involves identifying specific critical usage levels for specific sites. It particularly requires the prediction of future use regimes so that, hopefully, negative impacts can be pre-empted.

One approach to modeling future impact on attractions is to use a three level model of probable activity levels. National patterns of tourism are now quite well documented, and a number of studies exist that offer predictions of the most volatile element in New Zealand tourism, namely future international demand. These predictions, usually aimed at market analysis, typically offer likely changes of visitor number over the medium term disaggregated by country of origin or some other significant categorization. If sufficient is known about the specific nature of regional activity, then these disaggregated predictions can be propagated through to the regions using the national data sets described above. Such a development gets us some way to forecasting use and impact levels of facilities in an area, but to link the management of local impact to the likely level of demand requires three extra steps. One is a finer level of robust demand measurement, so that smaller (sub)regions can be modeled, and the likely pool of visitors to a local system of attractions can be estimated. A second is a better understanding of the activity that occurs between accommodation stops, since this is typically the active periods in which impact occurs. The last, and most problematic, issue is to link local levels of visitor demand to specific behaviour within local systems of attractions (and thus specific impacts on specific attractions). This paper is concerned only with the first two issues, that centre on how to get a better local understanding of flow-generated local demand within a model that is operating at three spatial scales.

The research described here is experimenting with ways to extend our ability to describe, and to some degree forecast, local sub-regional tourism demand, and then identify its significance for specific categories of sites, and for this it is using small sub-regions on the West Coast of the South Island as a case study area. The West Coast contains large areas that are of high environmental value and sensitivity (including parts of five National Parks and one World Heritage Area). The strategy is to identify likely fluctuations in visitor numbers in sub regions by visitor type, using a recreational opportunity spectrum (ROS) classification, and then as a separate exercise to model within sub-regions how demand growth reflects in use of specific attractions. This structure will be elaborated on later on in this paper, but clearly the IVS and DTM are starting points in trying to identify sub-regional demand. They are also problematic for this purpose for several reasons.

LIMITATIONS WITH THE IVS AND DTM NATIONAL DATA SETS

While the national data sets form a powerful contribution to monitoring, and to some degree predicting, changes in tourist demand (both aggregated and to some degree disaggregated) they have several limitations in respect of being able to make links to actual impact on the ground, and especially to impacts in remote areas such as National Parks. These specifically relate to five aspects of the data sets: spatial resolution, sample size, absence of intervening corridors, absence of specific visitation data and limited local detail of movements.

Spatial Resolution

During its history the IVS has evolved a relatively coarse spatial coding, featuring some 130 points initially and closer to 180 in the 2000 survey. Furthermore the actual places coded have changed over time, so that some have disappeared while others have been amalgamated or added. The coding has generally been undertaken in the light of the respondent's recollection of stops visited, with major destinations such as Rotorua being recorded as a clear node, while unusual or infrequently visited locations have sometimes been amalgamated into somewhat ambiguous areas. By contrast the DTM uses free-response coding of named features at present involving a gazetteer of some 1800 places, all of which are punctiform.

Sample size

Although the surveys involve quite large numbers of respondents, the sample size for any year places limits upon many of the disaggregations that are actually desirable for reporting, whether by attribute classes or by regions. This is usually restricted to defining areas of substantial visitation or population, such as New Zealand's Regional Council areas.

Limited Knowledge of Corridors of Impact

Both the IVS and DTM surveys deal primarily with destinations, rather than routes. In the case of the IVS a destination is an overnight destination, while for the DTM it is that or the main activity centre of a day trip from home. Although the IVS has increasingly sought to capture some additional information on 'significant stops' or side trips from major centres (for instance day trips to Te Anau while based at Queenstown) , there is little explicitly recorded on where people are when they are not in their accommodation centre. Yet with Free Independent Tourists (FITs) the majority of their awake time, and a substantial component of their expenditure or impact, may occur between such stops. Furthermore, the impacts are likely to be close to the road route(s) between the two night stops.

Limited Knowledge of Stopping Patterns

Some of the great attractions of New Zealand, whether in National Parks or not, can be found well away from any accommodation centre. Examples include Cape Reinga, the Northernmost point of New Zealand, and Tane Mahuta, the largest surviving kauri tree, both of which attract large numbers of visitors but are some distance from significant accommodation. Many other more minor attractions influence visitors to stop and walk. Some major attractions, such as the Glaciers in the West Coast of the South Island, are visited by transient visitors while also attracting overnighters. Neither the IVS nor DTM reveals a great deal about such patterns.

Imperfect knowledge of specific route taken.

While knowing the overnight stops for any day may enable one to identify the likely corridor of impacts for a touring visitor, there are many cases where major or minor options may exist for route choice. A significant example is the option for tourists traversing the North Island of passing East or West of Lake Taupo, or similarly passing East or West of the Tongariro National Park. Without some intervening information it is problematic to get a more accurate idea of the likely zones of impact or of activity. This concern is likely to be addressed by better knowledge of where visitors stop, since this will provide key reference points on possible routes

EXTENDED SAMPLING BY SPECIALIST SURVEYS

This section briefly describes two aspects of work that seeks to address some of the shortcomings identified above, using examples from Tai Tokerau, and the West Coast study areas (Figure 1). The intention in both examples is to provide a better description of both where visitors actually travel, and where they can be found at transient stops during the day. The first, on its own, simply provides a better grasp of where potential visitors to natural attractions might be found, rather than any definite indication that they are actually present. The second indicates definite stopping points, and with refinement can even yield details of behaviour at that point (including the nature of any activity and its timing).

Tai Tokerau and the West Coast Surveys

Tai Tokerau (Figure 3) provides the first example, based on project work active in 1998 (SJHMRC 1998,), which was intended to provide better detail of movements in the Northland Peninsula. This area possesses several significant accommodation stops recognized by the IVS, notably Pahia, Russel and the Bay of Islands, but also Whangarei and Kaiataia. Typical IVS records for the area record dominant links from Auckland to the Bay of Island/Pahia/Russell centre, with a few trips to the smaller centres. Although the coding varies by year, it is generally true that few or no movements are recorded on the West side of Northland, if accommodation is used as a measure of movement. Yet the West, with its outstanding kauri forests, and to a lesser degree Cape Reinga in the North, are not only significant loci of tourist activities but are both fragile areas in terms of tourist experience and impact.

To broaden the picture, additional data were gathered to provide better indicators for actual patterns on the ground. These data comprised the outcome from a survey conducted over two 3 week periods of 780 car drivers on holiday. The respondents were approached at a number of parking sites between Whangarei and Pahia and asked about their trip or planned movement, including any night stops and 'significant day stops'. This was not a complete route specification, but the points for each survey could nevertheless be fed into a route building algorithm in ArcInfo to generate multiple itineraries that could then be questioned and aggregated. The points could also be analysed to show a surface of stopping points.

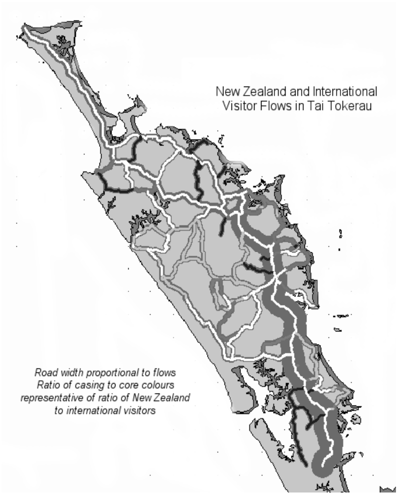

Figure 3a: Flows mapped to road network in Tai Tokerau.

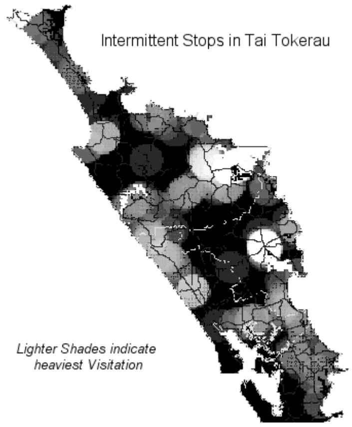

Figure 3b: Patterns of non-overnight stopping

Figure 3a) shows a sample of the route analysis, indicating the level of flows on the West and East Coast, and the nature of the tourists involved.

Figure 3b) shows an example visitation surface. Two useful additional insights to come from this analysis are the documentation of the balance of East versus West Coast flows, including some information on domestic and international visitor ratios, and the significance of totally different areas than overnight accommodation would reveal.

The Tai Tokerau study provided some enhanced information, and a better and more integrated description of spatial demand than the various alternative partial data sets available at the time. It also more than tripled the sample size of visitors available for analysis via the IVS (but closely mirrored its parameters when validated against country of origin from that survey). However, data were missing on the actual activities undertaken at significant stops (and any mention of short stops was also missing). Profile and attitudinal data on respondents was only partial, and timing and duration was not recorded.

The later West Coast study was developed to provide a richer augmentation of the IVS flow data, as well as to specifically address questions of the kind of visitors present and how they might behave, especially in a region where much of the attraction and experience lies in the travel and intermediate stops more than in the major accommodation sites. As figure 4 shows, the West Coast study area is long and thin. It fails to show two things important to understanding travel in the area, however. One is that the Southern Alps form a massive and rugged barrier between the West Coast and the rest of the island, which is breached for vehicular traffic in only three locations. The other is that while there are close to a million visits to the Coast each year, there are barely 30,000 residents, most of whom live in the mid-Northern quarter. Fuller details of this study can be found in Forer, Fairweather and Simmons (2000), but essentially it recorded the travel experience of some 2,700 visitors who holidayed on the West Coast between December 1999 and January 2001. Unlike the Northland exercise full itineraries were requested through either reflective or diary oriented survey instruments, and respondents were asked to record all stops of over 5 minutes including details of timing and the activity undertaken. The intention was to provide enhanced modeling options to augment the more generalized data from the IVS and DTM, and to provide sub-regional demand estimates by tourist category.

The West Coast survey was undertaken over five sample periods between early December 1999 and late January 2001, but the nature of the survey instruments (diary and retrospective) mean that the journeys recorded start as early as October 1999 and end as late as March 2001. During the nine weeks that survey teams were in the field tourists were sampled within the three entry zones to the West Coast, both going in and coming out. Those entering were invited to undertake a diary survey, while those leaving were asked to fill out a questionnaire on the spot. In the end, approximately equal numbers of each instrument were completed, and when compared appear to have performed with equal capabilities, in that comparison of the data from each shows a strong concurrence.

Both instruments collected data on visitor profiles, their attitudes, their overnight stops on the Coast, and intermediate (between accommodation) stops. For intermediate stops information was requested on the arrival time, the duration, the purpose, and food eaten or expenditure made, and any extra transport used (for instance helicopter transport onto ski-fields). While compliance with the request for time data was not complete, a significant amount was provided and considerably more could be inferred. For all stops, of course, location was also requested, both as a name or description and as a point on the A3 map provided with the survey. This process allowed the utmost flexibility in identifying stopping points, which are by nature often serendipitous decisions at various points within natural features such as the 25 km long Buller Gorge. In all some 27,000 stops were identified, over a total of approximately six hundred specific locations. Figure 4 shows the location of these stops with over 5 visits, the relative number of people stopping at each location, the extent of the study area and the location of the three main portals.

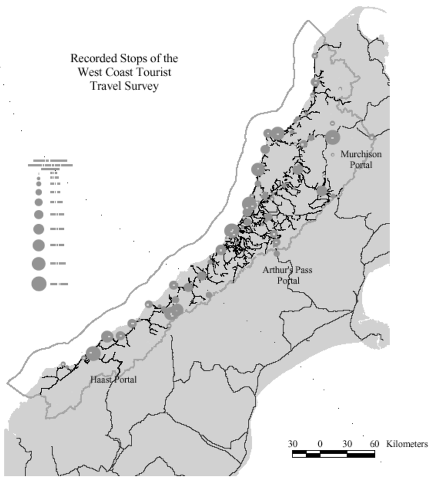

Figure 4: The West Coast Study Area and distribution of respondent's reported stops

What is striking, but hardly unexpected, is that the distribution of tourist stop events shows very limited relationship to the distribution of the population or available accommodation. The anomalous areas can be largely identified as those of outstanding beauty, particularly areas in, or close to, the National Parks. It is the development of better knowledge of the nature and degree of these visitations, in relationship to the trips in which they are embedded, which is a prime goal of the entire survey. It is hypothesized that, as visitors progress up or down the Coast, their stopping behaviour, and on-the-spot activities are very much conditioned by the duration of their total visit to the Coast and by the specific priorities they place on spending time at icon sites as opposed to meandering and diffuse visitations. To explore the influence of these possible factors the analysis of the data is focusing on identifying the way in which visitor patterns at specific locations reflect factors such as geographic position relative to entry point or previous night's accommodation, as well as the attractions at that site and the characteristics of the visitors. The significance of the direction of travel (North to South or vice versa) is also investigated.

The complexity and scope of this data base offers much room for analysis, and work is under way by Zhao to develop various flow-mapping techniques to visualize aspects of the flows and stopping behaviour at different scales of aggregation from the individual itinerary upwards. This is complemented by Chan and Chen's investigation of the influence of certain factors on revealed patterns of trips (Chan and Chen 2001). They have specifically reviewed ways in which length of trip, country of origin or entry point affect the pattern of stops, although as yet the interaction between these factors has not been investigated. One interesting finding however is the tendency for Northward travelers to stop less frequently and stay less long than South-bound ones. Whether this is due to the 'returning traveler' syndrome, i.e. most such trips represent the start of the journey to Auckland or Christchurch and then home, or due to timing issues is still to be clarified.

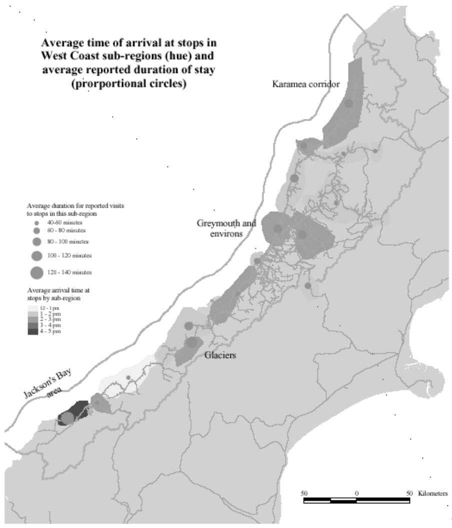

Figure 5: Temporal Aspects of West Coast Flows, showing proposed sub-regional demand zones

Investigations of individual movements using the most fine spatial scale available, however, are not directly useful for sub-regional forecasts, where more aggregate information is needed, particularly on how long tourists typically spend in an area, and incidentally when they arrive. Figure 5 shows some initial analysis of the full data set in terms of a set of sub-regions that are being considered for ongoing modeling. These divide the West Coast into 19 regions (not all are shown here) which include the main settlements and their immediate environment (such as Westport and Greymouth), icon sites (such as Punakaiki and the Glaciers), back country zones, and corridors (such as South Westland and the Buller Gorge). The map illustrates the average time of arrival at stops in these areas, but also the average time spent at sites within the areas (not including overnight stays). The role of Haast/Jackson's Bay as a significant stop, but also as an 'anchor' to people's days, is clear, as is the influence of Karamea's isolated position in the North.

When compared with figure 4, the prevalence of multiple, short stops in many of the less inhabited areas is quite clear. The next stage of work is targeted at mapping in more detail the patterns of stops relative to visitor and trip characteristics, and to assessing at what scale regions exist with adequate sample sizes to allow useful additional modeling.

The Tai Tokerau and West Coast surveys both represent relatively simple flow systems, largely linear and with limited access. It is hoped that they can yield more insights into basic flow behaviour governing intermittent stopping and route selection on a wider scale. Certain regularities, such as stopping frequency or propensity to stop after specific time lengths, may then be applicable to national movements and activities. More complex flow situations certainly exist, of which Rotorua is perhaps the best example. It is the major North Island tourist centre, with diverse markets amongst both domestic and international visitors, and it is position astride a wide web of flows that come to the area from all directions. A data set collected for Rotorua is to be the test bed for validating findings from the West Coast.

LIMITATIONS AND OPPORTUNITIES FOR LOCAL SURVEYS AS ADJUNCTS TO NATIONAL DATA SETS

This paper has discussed the IVS and DTM as national data sets which can be given added value by integration with surveys of finer detail, and it should also acknowledge the value of the national sets in validating the sampling of local surveys. While the IVS and DTM enjoy stable sampling frames, most local surveys are faced by well known practical problems of maintaining a constant sampling fractions with interviews, as well as weighting problems with establishing just what the extent is of the universe of flows which they are sampling. In New Zealand several additional sources useful for data validation exist. The national monthly census of accommodation usage was referred to earlier, and it assists with establishing total raw numbers of visitors as well as a quarterly breakdown by origin of them. Other data include traffic flow counts, car registration owner details, and attraction visitation numbers from the Department of Conservation, all of which provide an guides to the validity of sampled patterns. These different data sets have different spatial and temporal granularity, and different properties and precision, but together they provide a reasonable confirmatory web of cross references.

The other major issues with local surveys are compliance and cost. Concern for both restrict the information collected, and an additional aspect of the survey work to date is an analysis of the specific benefits accruing from specific questions and techniques relative to their cost of capture.

SIGNIFICANCE OF LOCAL FLOW SURVEYS AND FUTURE DIRECTIONS

The local flow surveys described here are part of a much wider research agenda in tourism flows, and in human movement and environmental interaction. They have been presented as a way to address the issues of calculating small area tourism demand, and the nature of places in regional tourist circuits. At a wider scale, they also offer a better insight into how active FITs allocate the substantial portion of their time, and significant portion of their expenditure, that is not spent in 'destination/ overnight' centres. There are substantial aspects of regional development, facility development and tourism demand management which are better understood when patterns of sequential flows are acknowledged. Related work has pointed out the potential value of a better understanding of issues in health and bio-security that can come from a knowledge of flows, and the work by Beken (2000) to link flows to energy and material impacts on the environment offers a topical perspective on how tourism affects the triple bottom line. Future work will address how flows can be interpreted into a classification of linear landscape experiences.

While the research agenda for flow analysis is attractive, at both micro, meso and national level, data capture remains a major barrier. Two trends offer hopes of cheaper and better ways to capture movement data. One is the growing interest in time geography, 'tracks' and the (x,y,t,a) trace (CSISS 2001), which might well offer new analytical tools and insights. The other is use of new technologies, specifically position aware devices (PADs), which are becoming far more commonplace, and intelligent map-server based Web questionnaires that ease the burden of personal data collection of space-time data (Glen, Huisman and Forer 2001).

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Deriving Artificial Models of Visitors From Dispersed Patterns of Use in Sierra Nevada Wilderness

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Abstract: Natural resource managers are faced with a complex problem of understanding human use patterns and associated impacts in dispersed recreation wilderness settings. This is further complicated by the subsequent synthesis and modeling of those behaviors that affect such patterns of use. While conventional approaches to modeling have limited use in acquiring and understanding such complex associations, spatial simulation models have been proposed as an alternative. The purpose of this paper is to describe a project whose focus is on a dispersed recreation context of backpacking trips and commercial packstock operations in the John Muir Wilderness in the Sierra Nevada Mountains in California. This paper will discuss the data collection and synthesis to derive agent profiles and rules as a precursor to the development of a dynamic, agent based model that represent the spatial distribution of visitation patterns.

INTRODUCTION

Backcountry use from both packstock outfitters and backpackers in the John Muir and Ansel Adams wilderness areas of the Inyo National Forest is an excellent example of how increasing human uses impact a sensitive, dynamic ecosystem and threaten to degrade the quality of experience of human visitors. Over 21,000 permits are granted every season to individuals and guides to travel through sections of the Inyo National Forest. While packstock trips have been a permitted use of the wilderness areas for many years, concerns over both the environmental and social impacts have been raised. More importantly to this study are the interactions of packstock with visitors. Packstock have been shown to influence a visitor's wilderness experience by introducing smells, sounds, and sights that conflict or accord with their wilderness values (McClaren et al., 1993).

Studies by (Lucus, 1980) have clearly demonstrated that the progress of individual trips is affected by interactions with packstock and other hiking parties, and there is a general assumption (based on early research) that encounters degrade the 'wilderness character' of the trip, and that they have adverse effects on the quality of experience for individual visitors.

In (McClaren et al., 1993) they conclude that not only monitoring and management should focus on impacts of packstock use, but that visitors should be informed of what to expect in specific areas, and where they might travel to avoid unsatisfactory experiences, such as packstock encounters. The problem is that very little is known about how to predict or control the numbers of encounters (except generally to limit the number of people/packstock parties along the trails), or whether all encounters are alike regardless of the types of parties involved, the locations on the trail and campsites and the contexts in which they occur. In addition, pressures from the public and from commercial outfitters are increasing; demand for more wilderness trips is very high. The effects of increasing trips or altering schedules are difficult to predict or evaluate due to the complexity of the variables involved, and the ambiguity about what factors affect the quality of the wilderness experience and/or the levels of adverse impacts on the wilderness environment. Environmental impacts at popular camping sites are already of great concern to the forest.

Backcountry use of the Inyo National Forest presents a number of complex human-environment interaction problems; large numbers of visitors and commercial operations seek activities and experiences that depend upon the unique environment of the Inyo National Forest; quality of the wilderness experience is affected by the participants' personal characteristics (abilities and intentions), by perceptions of and responses to features of the wilderness landscape, and by perception of and responses to encounters with other recreationists in the wilderness; and individual and cumulative impacts of recreation activities threaten the fragile forest environmentDecision makers and natural resource managers recognize the need for baseline visitor use data and more sophisticated tools to help them understand the human-environment interactions in the wilderness, and to effectively respond to their mandate to manage this unique environment and the highly valued human experiences it supports. While techniques have been available to managers to guide recreation management such as the Recreation Opportunity Spectrum (ROS) and Limits of Acceptable Change (LAC), limited use of computer simulation models have been employed to resolve such complex human/landscape problems. Studies such as those by (Hull & Stewart, 1992) have shown that time, and space (location), have a profound effect on levels of encounters, perceived crowding, and satisfaction and associated recreation impacts. It is surprising that computer simulation has not been more extensively used.

Computer simulation is not a new concept in studying natural processes and in particular recreation. Models such as the Wilderness Use Simulation Model (WSUM) (Shechter & Lucus 1978) have been available to assist natural resource managers in assessing wilderness use by recreationists. The simulator was developed and successfully tested in both Spanish Peaks Primitive Area in Montana (Smith et al., 1976) and the Desolution Wilderness in California (Smith et al., 1976) and subsequently modified for river recreation management for use on the Green and Yampa Rivers in Dinosaur National Monument (McCool, Lime and Anderson, 1977) and the Colorado River in the Grand Canyon (Underhill et al., 1986). This simulation tool provided a reliable way to examine both perceived and actual encounters along the trails and rivers. It seemed particularly useful as an aid to river recreation planning and management for conducting tests of a variety of alternative policies. These models while ahead of their time suffered from ease in interpreting outputs of the model and depended heavily on field observers to supply visitor use information as input into the model.

Work by (Wang and Manning, 1989) and others have used dynamic modeling frameworks such as Extend to model recreation use in national park settings with success. While these frameworks are useful in modeling relatively homogeneous and “lumped” phenomena, they are not so easily applied to highly variable spatial phenomena. In addition, this work heavily relies on observers, capturing data about perceived use and numbers of visitors in various settings.

To improve a manager’s ability to more effectively understand highly variable spatial phenomena such the distribution of visitors in a wilderness setting, researchers have been exploring the use of agent-based modeling. This contemporary approach to modeling moves away from the mix master universe of homogeneous populations down to modeling the individual. Although potentially computationally expensive, such flexibility provides a mechanism to represent many types of entities that embody variability within them selves. For example, such agents may represent individual visitors or vehicles. A predetermined set of rules, attributes and behaviors are applied to individual agents that motivate their desire to move through the landscape. Example personalities include backcountry hiker, motoring tourist or mountain biker. In order to provide input into agent-based models that attempts to mimic visitors and their associated behaviors in a local setting, studies must be conducted in the field to capture this baseline data.

Researchers such as (Daniel & Gimblett, 2000; Gimblett et al., 2000); Itami et al., 2000) and others have been exploring the use of agent simulations integrated with a Geographic Information System (GIS) that are designed to be used as a general management evaluation tools for any recreation setting. In these simulations, resource managers can explore the consequences of change to one or more variables so that the quality of visitor experience is maintained or improved. The simulation model generates statistical measures of visitor experience to document the performance of any given management scenario. Management scenarios are saved in a database so they can be reviewed and revised. All of these simulation efforts provide information on current and future conditions so park managers can identify points of over crowding, bottle necks in circulation systems, and conflicts between different user groups. All this with the hopes of more effective visitor management with the added benefit of improved monitoring and data collection methodologies.

While all of the simulation efforts mentioned above have been developed for a variety of purposes, all have resulted in varying degrees of success. In fact it can be said that because these models provide such sophisticated ways to model spatial phenomena, their utility is only inhibited by our ability to collect meaningful spatial/temporal data about visitors in complex wilderness landscapes. The challenge to researchers and resource managers alike is to develop methods to collect spatial/temporal data about visitor use patterns that is reliable, statistically valid and defensible. This information while providing resource managers with information critical to managing visitor use can alternatively be used as input to such models as described above. It is the challenge of valid, defensible data that is the impetus for this paper. Itami in these proceedings will describe the agent-modeling framework and it’s various measures and outputs.

This paper focuses on exploring a methodology for understanding the spatial and temporal patterns of dispersed recreation in the context of backpacking trips, and commercial packstock operations in the John Muir Wilderness in the Sierra Nevada Mountains in California. Herein is discussed the data collection and statistical synthesis to characterize wilderness visitors from which could be derived agent profiles and rules that will be used in the development of an agent-based model representing the spatial distribution of visitation patterns.

METHODS

Conventional survey and interview methodologies used to characterize the recreation experience have yielded useful information about the visitor. While this information is important to understanding the general profile of visitors to a region, it does little to enhance our understanding of the spatial/temporal distribution of a visitor and their associated social and ecological impacts in the landscape. Managers require information on the spatial nature of the visitor to adequately manage for both the experience and to protect the recreation setting. This information includes the destination, arrival and departure times, number of visitors in a party, type of activity, nights camping etc. These spatial dynamic parameters likewise are imperative for constructing models to represent current conditions and testing out future management scenarios to reduce social and ecological impacts in a setting.

Some have attempted over the years to collect such data in wilderness settings. Researchers such as (Lucus & Kovalilcky, 1981) conclude in their study that the most accurate wilderness use data come from a self-issued, mandatory permit systems. This method can be one of the most effective ways for understanding recreational use in most wilderness areas. While compliance varies from wilderness to wilderness (Lucus et al., 1981) found that mandatory permit systems far outweigh trail registers or other forms of data collection. While observing a sample of trailheads on sample days produces accurate estimates of those entering the wilderness, it is labor and time intensive and tends to lead to a limited sample. Other wilderness areas have gone to agency-issued permits. While having some disadvantages such as inconveniencing the visitor and expensive to manage, this system does provide a mechanism for ensuring the visitor comes in to the agency office to pick up the permit and provide information about where they plan to go. While each of these methods has its advantages and disadvantages, the sampling methodology in this study employs a combination of techniques for acquiring an accurate, representative sample of both spatial and temporal use patterns in wilderness settings.

This study utilizes a map diary approach that is distributed to each visitor when they pick up their agency-issued permit. The diary consists of a space to capture basic trip characteristic data, a map of trails and natural features, a brief set of questions on visitor satisfaction and instructions on how to record and denote a spatial location of the types of encounters, numbers of those encountered and nightly campsite locations (See Figures 1 & 2). Data that was essential to this study was duration of visit, number in party, type of activity and spatial location of trailhead, physical encounters with other parties, type and numbers and nightly destinations (ie. campsites). In addition to being given out to all permittees, the diary is distributed at each trailhead as part of a self-administered system and hand delivered to all commercial packstock operators with instructions on how to distribute to their clientele and return to the research team.

The map diary can be dropped off at the FS station upon completion of the trip, or mailed back in self-addressed envelopes provided. While compliance is an issue with this type of distribution method, issuing the map diary with the permit provides numbers on total distribution size and when comparing to those returned, a compliance rate can easily be computed.

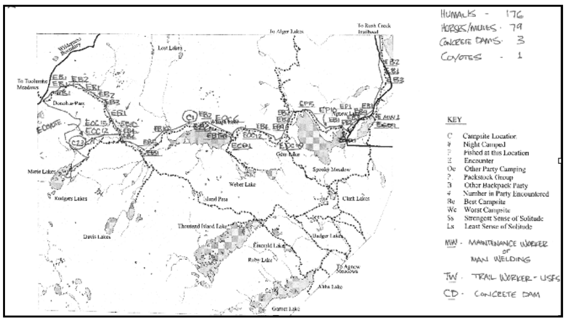

Figure 1 - An Example of the inside of the map diary used to capture overnight use

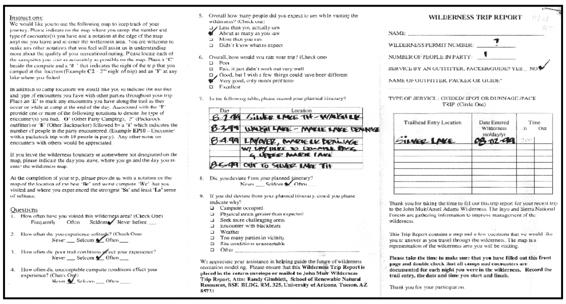

Figure 2 - An Example of the outside of the map diary used to capture overnight use

In addition, summer students randomly sampled each of the trailheads, spending days observing visitors entering the wilderness and stopping visitors to ensure they had a map diary in hand and urged others to deposit them in the return box or collected them directly from the visitor.

In May 1999, a study was undertaken to collect spatial/temporal data in nine different study areas in both the east and west sides of the Sierras. This included 3 areas of east/west complexity- Humphrey's basin, Mono Creek, and Silver Divide; and 6 areas of moderate use levels Ansel Adams West, Agnew Meadows, Cottonwood Lakes, North Fork Lone Pine, North Fork Big Pine and Rush Creek. The latter were of interest for understanding the extent of visitor use concentration in moderately used and complex areas. The primary driver of the study was the need to augment current use data for the management planning. Adequate data existed on levels of use by entry acquired by observation and permits, but assessments on distribution, congestion points, or patterns of use, encounters etc. were not confidently known, particularly the influences of east and west side entry into the large and topographically complex interior.

Secondarily, there was a desire to integrate resource data with patterns derived from the visitor use data as a mechanism for developing and evaluating management techniques. This also seemed to be a critical set of information in evaluating risks. Identifying areas of potential congestion in combination with visitor use impact data such as campsite conditions, trail use, or trail conditions, or relevant resource information on TEPS (threatened, endangered, petitioned or sensitive) species habitats, populations or potential habitats, provides decision makers with reasonable information for evaluating consequences of management actions.

Upon receiving the map diaries, all point locations denoting encounters etc. were entered into a spatial database for further analysis and all other data characterizing the party were entered into an electronic relational database. Both of these sets of data were interchangeable allowing both spatial and/or relational analysis of the data. ARC View 3.1 with the spatial analyst extension and Microsoft's database ACCESS was used in this study. Information entered into the database included:

RESULTS FROM VISITOR DATA COLLECTION

Figure 3 provides an illustration of the overall compliance rates in the nine wilderness areas studied in 1999. The highest return rate was from the Mono Creek wilderness area at 44.7% survey return. The lowest was from the Rush Creek area, with a survey return rate of only 16.1%. A the right hand side of Figure 3 can be seen a summary of the return rates as measured against the number of permits issued for the nine wilderness areas. Of the total permits issued (n=5467) for 1999 in the nine wilderness areas studied, (n=1371) or 25% complete and useful trip diaries were returned and entered into the database. While by conventional survey standards this may appear low, for wilderness areas and using this non-mandatory survey technique, 25% is considered a statistically representative sample.

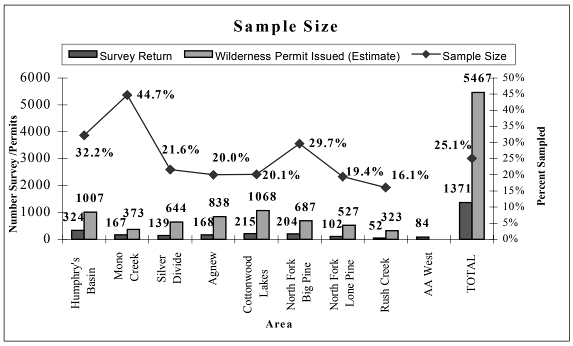

Figure 3 - Return Rate on Map Diary for all Wilderness Areas Studied

While the relational database does not provide information on the major destinations of each party, queries can be made to acquire a better understanding of the typical number of visitors per party entering and the total numbers in each of the wilderness areas. Table 1 describes the range of party sizes in each of the wilderness areas, the number of parties taking trips into each area, and the percentage of visitors visiting each area compared to the total number of visitors utilizing the wilderness in 1999.

Area	Mean # Party	# of Parties	% of Parties	Total # of Visit	% of Visits
Total	3	1455	----	4465	----
AA	4	84	5.8 %	331	7.4 %
Ag	3	168	11.5 %	538	12.0%
CL	3	215	14.8 %	646	14.5%
H	3	324	22.3 %	966	22.3%
MC	3	167	11.5 %	550	12.3 %
NFBP	3	204	14.0 %	549	12.3 %
NFLP	3	102	7.0 %	284	6.4 %
RC	3	52	3.6 %	173	3.9 %
SD	3	139	9.5 %	428	9.6 %

Table 1 – Visitors Utilizing the Nine Wilderness Areas in 1999.

The range of party size for all the areas was from (n=1 to n=15) visitors per party. In fact, there was only one area that did not have a maximum party number of (n=15). The North Fork Lone Pine recorded a maximum party size of nine. The largest mean party number came from the Ansel Adams West wilderness area with a value of four. However, this area only accounted for 5.8% of the total trips taken in 1999. There were a total of (n=4465) visitors entering all the wilderness areas that were captured in this study.

Humphrey's Basin was the most heavily used area during the 1999 season. Trips taken into the Humphrey's Basin area captured in this study totaled (n= 324) or (22.3% of the total). This, in turn, also made Humphrey's Basin the area that contributed the highest number of visitors (n=966) or 22.3% visiting all the wilderness areas in 1999. Figure 4 illustrates the tremendous increase in trips taken to the Humphrey's Basin wilderness area from mid-July to mid-September.

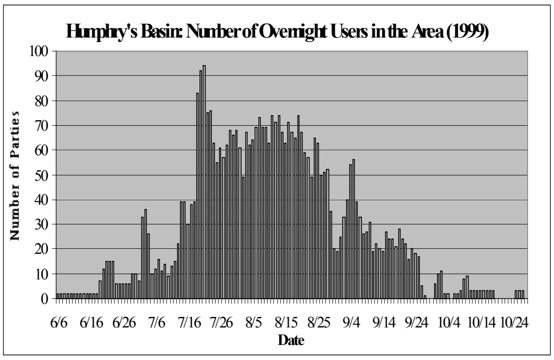

Figure 4 – Humphrey's Basin Visitor Statistics

Figure 4 provides some inside for Inyo National Forest managers are to the peak periods of use in the wilderness area. Snow pack usually limits access to the backcountry with the typical visitation periods ranging from Early June thru the beginning of October. The number of parties visiting the area increases from around 10 in early July to almost 100 toward the end of July. This number drops a little at the end of July, but is consistently above 60 parties through August when it drops through September and even more into October. Visitor information is particularly useful to managers as they can easily see that the season of visitation is short and intense in many areas. This information (percentage and intensity of use) coupled with the spatial data (destinations, duration of visit and encounter rates) provides needed information to focus management and construct policies to reduce impacts in each of the areas.

SPATIAL DATA INFORMATION ABOUT VISITOR DISTRIBUTION

One of the advantages of using a diary approach to acquire information on the spatial distribution of visitation is that once compiled the information can be visualized in many forms. For example, information about individual parties can be displayed, total number of parties summarized per locale or destination, the location of each night camped and in particular the spatial location, identity and number of reported encounters with other parties. Each trip can be dissected to observe not just the patterns of use, but assessed to identify and characterize typical types of trips that utilize the backcountry. Such as two party trips that camp in areas absent of others, typically seeking solitude and spend a minimum of five days in the backcountry. While this may seem logical, it provides valuable information to the manager as to the typical visitor that frequents specific locales and provides information that can be used in the agent-based simulations to develop virtual agents that are representative of their human counterparts.

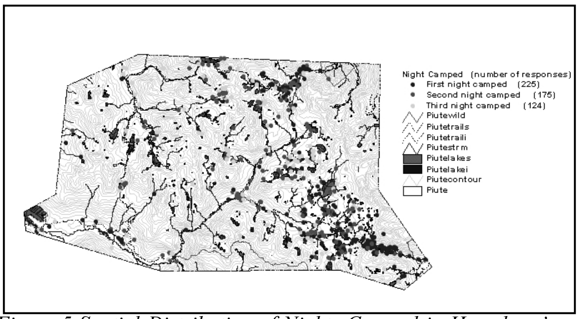

Figure 5 Spatial Distribution of Nights Camped in Humphrey's Basin

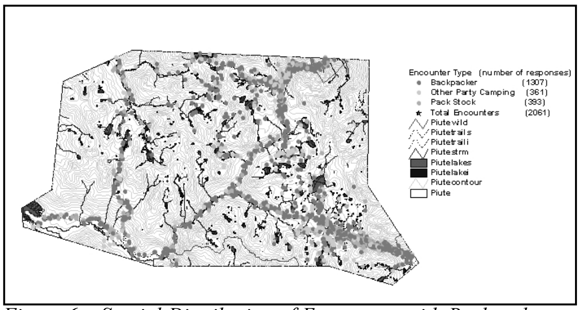

Figure 6 – Spatial Distribution of Encounters with Backpackers, Packstock and Other Parties Camping in Humphrey's Basin

Figure 1 seen previously is an example of a typical diary returned in 1999. As noted on the map, C1 indicates the location of first night camped followed by, C2, 3 where the party spent the second and third nights. The 'E' marking followed by 'B' and a number such as two indicates that this party had an encounter with another backpacking party that consisted of two. Four variables on the map serve as a measure the parties degree of satisfaction. These measures are documented on the map as Ss and Ls (Strong and Least sense of Solitude) and Bc and Wc (Best and Worst campsite). Once all diaries are compiled with this type of spatial information, areas of high concentrations of visitors can be discovered, potential conflicts between and within recreation use groups and correlated with recreation impact data can provide insight into opportunities for creative management. Figures 5 & 6 are examples of this type of output. For example, figure 5 illustrates the patterns of 1st, 2nd and 3rd nights camped in the Humphrey's basin. Aside from tight clustering of campsite nights this type of spatial information illustrates the age-old hypothesis that backcountry visitors typically camp near trails. Visitors in Humphrey's basin tend not to stray far from the trails and logically camp near high elevation lake destinations.

Trip Type	Responses	Tot.Responses
Guided	n=0	0%
Spot	n=15	1%
Dunnage	n=42	3%
pack trip	n=219	15%
backpackers	n=1179	81%
Total n for 1999	1455	
Party Size	**Responses**	
1-2 visitors	n=1032	71%
3-5 visitors	n=237	16%
6+ visitors	n=186	13%
Total n for 1999	1455	
Trip Duration	**Responses**	
1-2 days	n=961	66%
3-4 days	n=231	16%
5+ days	n=263	18%
Total n for 1999	**1455**	

Table 2 – Summary of Visitor in Cluster Analysis

Figure 6 illustrates the spatial distribution of encounters with backpackers, packstock and other parties camping in Humphrey's Basin. It is clear from the spatial information that there are considerable numbers of encounters with stock along the trails and at specific locations. As is true of other backpackers frequenting the backcountry. While this analysis says nothing about the quality of the encounters it does indicate the spatial patterns along the trails and at destinations where and how many per party intercept each other. This analysis provides three important sources of information to the manager. First it provides information on locations where one would expect to find varying degrees of use patterns in the backcountry. Second, it provides information on where more detailed monitoring should occur to examine both social and ecological conditions. This would include both conflicts between and within recreation activities and their associated impacts. Finally, the mapped information coupled with the information gathered about the typical trips provides a more accurately way to characterize the behaviors of visitors using the backcountry.

DERIVING VISITOR PROFILES FOR CHARACTERIZING AGENTS

The information provided by the diary has immediate value to the manager for understanding spatial use patterns of their management settings. In addition, this information is valuable in characterizing the visitor and their associate behavior. To do so this study utilized analytical procedures on the visitor information to determine statistically characterize and derive typical groups/visitor profiles. This information will be used in the future in agent-based models for simulation alternative management scenarios. A visitor profile is a combination of information, both categorical and quantitative, to describe the wilderness trip, visitor, and length of

trip. In other words, it is a way of simplifying a wilderness experience surveys into a few groups of similar features.

Data used for statistically deriving visitor profiles for characterizing agents were number in party, type of trip (commercial/non –commercial), and trip duration. Trip duration was not a direct question asked on the survey. It was calculated by computing the difference between the entry and exit dates logged on the surveys. Over the twelve-month survey in 1999, 1455 trips were sampled in the John Muir and Ansel Adams Wilderness areas. K-Means Cluster analysis was performed to combine the trips into groups of similar party size, trip type, and trip duration. In terms of party size, out of the (n=1455) trips surveyed, (n=1032), 71% were classified as 1-2 visitor parties. Out of the same number of surveys, (n=1179), 81% were classified as backpackers, and (n=961), 66% were trips of 1-2 days in length (See Table 2)

Summarized in Table 3 are the results of the K-Means Cluster analysis run on each of the nine wilderness areas in the Ansel Adams and John Muir Wilderness Areas. This analysis was undertaken to statistically aggregate trips according to party size, trip type, and trip duration. The cluster analysis for each of the wilderness areas were aggregated down to three statistically significant clusters that represent all trips documented in the data base. These clusters are represented in Table 3 and depicted are Group 1 thru 3. Each group consisted of a coding based on the three variable entered into the cluster analysis ie. number in party, trip type and duration of visit. For example, after running the cluster analysis for Humphrey's Basin and aggregated to three clusters or group types. The first statistically significant cluster consists of the numbers 2,5,2 which represents two visitors in the party, backpackers and spending a total of two nights in the backcountry.

Area	Mean # Party	# of Parties	% of Parties	Total # of Visit	% of Visits
Total	3	1455	----	4465	----
AA	4	84	5.8 %	331	7.4 %
Ag	3	168	11.5 %	538	12.0%
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RC	3	52	3.6 %	173	3.9 %
SD	3	139	9.5 %	428	9.6 %

Table 3 – K-Means Cluster Analysis Summary

Cluster 2 is represented by eight visitors per party, being serviced by a packstation, and on a four-day trip. Finally Cluster 3 is a three visitor party, backpackers and duration

An analysis of trips across all wilderness areas studied reveals that 65% of all visits to the wilderness areas can be accounted for by two person parties on backpack trips, typically spending two days. This is an interesting result considering the perceived need for increased commercial use in many wilderness settings.

From the cluster analysis it can clearly be seen that visitors can be aggregated into groups that share common trip characteristics in wilderness areas tested. Discussed earlier in this paper was the idea of using visitors as surrogates for agent-based simulations for developing and testing out management scenarios. While the simulations have not been discussed in this paper, Table 3 provides statistically significant information that could be used to characterize agents based on trip type, number in the party and trip duration. These three variables say little about visitor satisfaction or even preferences for recreation settings, but results of this study do suggest consistency in the patterns in which the backcountry is explored. More research obviously needs to be undertaken to tease out more salient factors that effect behavior in these settings from which rules could be develop for the agent-based simulations.

CONCLUSION

This purpose of this paper was to develop a methodology for acquiring data on dispersed recreation in the John Muir Wilderness in the Sierra Nevada Mountains. Results of this study clearly illustrate that reliable and valid sampling can be used to obtain representative information from visitors reporting information about their trips in the nine different wilderness areas in the Sierras. Further this paper has presented the case for collecting spatial/temporal data about visitor use patterns in wilderness settings. This information not only can aid managers to better understand both social and ecological impacts in their respective settings, it can alternatively be synthesized to characterize wilderness visitors as surrogates for agent-based simulations. Agent-based simulations are exploratory, but as discussed earlier in this paper have produced excellent results in evaluating management actions. Finally using spatial/temporal information collected in the field coupled with agent-based modeling techniques reveals where varying degrees of use patterns exist and can serve to direct managers to these areas resulting in more cost effective methods for long term monitoring of visitor use patterns.

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Simulating Visitors' Dispersion in a Nature Reserve based on a Friction Model

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Abstract: A friction model is used for predicting the risk of human penetration of fragile vegetation and bird breeding sites in a nature reserve in central Belgium. The basic components of the study are the terrain classification and the determination of friction values. Different sets of friction values are proposed: based on expert estimation, on walking speed, on energy consumption estimation and on willingness to trespass. The results are compared with spatial data derived from visitor's observations and interviews. The model is to be improved in a later stage by incorporating the effects of visitor's goals, and of attractors and detractors such as vistas, free roaming cattle or physical challenges. The outcome of this study will be used as basis for the evaluation, and eventually of the redesign, of the current management decisions provided in and around the reserve. Also it should help in following-up the effects of the rapidly changing vegetation and terrain conditions on the behaviour of visitors.

INTRODUCTION

The policy concerning nature conservation is rapidly changing in Flanders (northern region of Belgium). New reserves are being established, often in former extensive agricultural areas. More and more it is being realised that nature protection has to be backed by co-existing functions such as extensive recreation: nature conservation needs continuous and increased official and public support.

The "Demerbroeken" (marshes of the river Demer) is a typical example of a wetland area, formerly used for hay cultivation and later for poplar growing, now being reverted into a mosaic of restored wet hayfields, willow groves, extensive grazing fields, and ponds. The site is situated about 45 km east of Brussels. It retains a multifunctional character, since it not only is a nature reserve, but also a site popular for walking and a floodplain. Apart from a hill at one of the site corners, the whole site is flat. In this study a part of the site of 100 ha is being studied in detail.

The managers have great concern for maintaining an equilibrium between opening up the site for the general public and the protection of fragile parts such as quaking fen (floating organic mats) and bird breeding sites. The whole site is surrounded by habitation area and the general accessibility in the terrain is rather high.

Since it is not the intention to implement hard measures such as fencing off the reserve, which would detract from the overall site value, the central question is how to confine visits to the robust parts of the landscape through the layout of tracks and specific inconspicuous management practices such as selective mowing and discrete boarding.

The intensity of visits is too low and the site too complex and too large to develop on short time a map on visitor's distribution based on systematic observations or enquiries. Therefore an alternative approach is proposed, which uses a GIS based friction model that enables to calculate potential visit intensities at any part of the site, from specified site entrances. The method should terminate in a design and management tool, allowing among other to assess the impact of changes in the infrastructure, season effects or management practices on the distribution pattern of visitors.

This study was started up only a few months ago, and no final results, let alone validations and practical applications can be shown. Therefore, this paper will concentrate on the methodological aspects in the first place.

METHODS AND TECHNIQUES

There are essentially four methodological parts: the definition of a baseline terrain classification, the estimation of parameters concerning people's preferences and activities in the terrain, the selection of a movement model and the interpretation and validation of the results.

Baseline site information

Aerial orthophotographs from the systematic aerial recording over Flanders in the period 1997-2000 were used for demarcating the habitats of the study area. The term habitat is used here as a vegetation unit with homogeneous structural characteristics such as dominant species (e.g. reed) or species groups (e.g. grass and sedges) canopy height, density, soil conditions, microtopography

Figure 3. Study area: Demerbroeken (Zichem, Belgium). Habitats are depicted in a greyscale with increasing trespass resistance from pale grey to black. Circles symbolise entrances. This site fragment is about 1 km in W-E transect.

etc. These are the characteristics that are supposed to be the conspicuous determinants of people's behaviour and movement choices in the terrain. The air photo interpretation is followed by and corrected through field survey. In the field survey a careful mapping, supported by GPS, of all tracks and paths was made, as well as of ditches, fences, dams, information boards, benches and other elements that have an impact on movements in the site. The tracks are also classified in terms of width, vegetation cover, roughness of the surface, wetness conditions and lateral vegetation. All these elements are put into GIS format using ArcView and consequently gridded to 1m resolution. Care is given to preservation of object connectivity in the grid format, especially for linear objects such as tracks and fences.

Visitors observations and enquiries

This study aims at making an estimation of the trespassing probabilities in any part of the site. Unlike in city parks of urban forests, the density of visitors in the Demer marshes is rather low and irregularly distributed over the year. Therefore it is impossible to establish a visitors density map based on field observation alone. A more indirect approach is based on an enquiry of groups of people invited to visit the site. At the moment of the submission of this paper, 25 people have been requested to indicate on continuous scales a) their preference judgement concerning preselected sites, b) their preference concerning moving in certain directions, c) their estimation of effort needed to move along certain directions throughout certain types of terrain. In addition to visitors enquiries, the terrain managers themselves were asked to express the different terrain types in terms of walking resistance. These values have been used provisionally as reference.

Friction model

The whole site is being interpreted as a continuous area with varied penetrability. The perimeter of the site is considered as an impenetrable edge but for discrete entrances. An isotropic negative growth model is applied, based on the following formula:

$$N_{i+1} = N_i - U^*R_{i/i+1}$$

whereby Ni is a residual amount of "energy" in pixel i, U is a fixed unit "energy" that is lost in each transition from pixel i to pixel i+1 and $R_{i/i+1}$ is a resistance or friction factor that is taken into account in the transition from position i to i+1. The "energy" is given as a "start package" to selected objects, in this case the entrances of the site. This energy principle can be alternatively interpreted: effective energy, number of people, walking apparel quality, etc. The formula is being applied isotropically throughout the landscape until exhaust level. Each pixel of the landscape is being reached through a virtually unlimited set of pathways reaching the pixel from different possible orientations. The energy unit along the horizontal or vertical direction in the grid is fixed at 338 for calculation and memory economy in using integer values. The corresponding energy unit for the longer diagonal moves in the grid is 478. Using these two integers, a rounding error of only 0,004 is allowed in the calculations. The lowest resistance value is 1. The initial energy package set at the entrances of the site can be adjusted so as to correspond to the maximal reachable distance in case of overall resistances of 1. The set of friction values assigned to the different terrain classes should correspond to the effective resistances experienced, compared to the lowest resistance terrain conditions of 1, e.g. a flat asphalt road. The resistance values can be defined in different ways: physical walking energy consumption, traversing time, or willingness to traverse different terrain types. The programme used (CONNEC) is basically similar to cost-friction models in several commercial GIS packages, but has some additional possibilities, such as calculating cumulative accessibility, or calculating "walk-sheds" (areas of unique walking origin). The friction model was applied earlier in a project concerning biological connectivity in fragmented cultural landscapes for several species (Villalba et al., 1998; De Genst et al., 2001).

RESULTS

The establishment of resistance value series

Resistance values, defined according to the key expert, are put in a scale 1-100. 100 corresponds to the resistance of a thick reed vegetation. Fig. 2 compares the resistance values according to the key manager in the area and those obtained by measuring the passthrough time. The expert estimation and the timing were set to equal value. The other timing figures were rescaled accordingly.

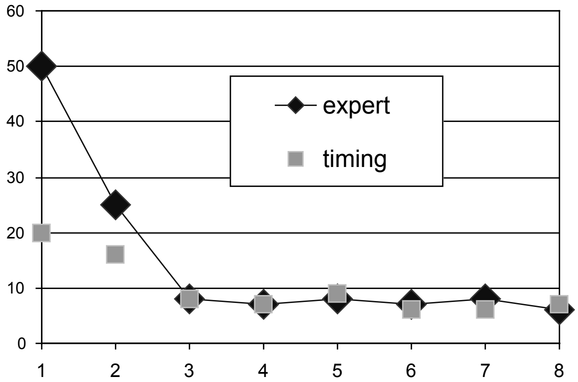
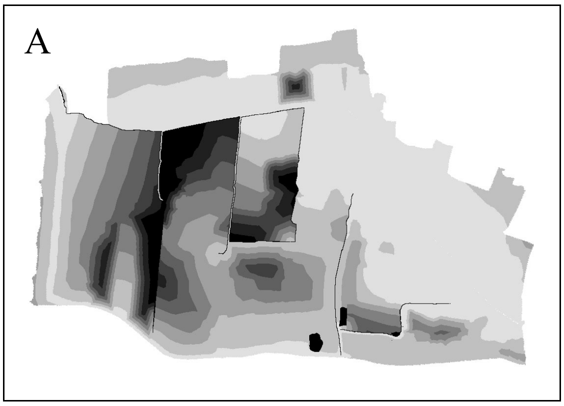


Fig. 2 Resistance scale 0-100. Comparison between expert estimation and measured passthrough speed (timing) for 8 land cover classes: 1= thick reed vegetation, 2 = woodland with thick understorey, 3= coniferous wood, 4=grazed terrain, 5=mowed quaking fen, 6=medium sized grass, 7= irregular track, 8=track though woodland

This comparative analysis and reciprocal recalibration is actually being completed by further field investigation. The provisional graph of fig. 1 suggests a similar trend whereby the expert model can be used as reference. The intuitive expert judgement likely is determined by perception of physical resistance and willingness to trespass rather than just attainable speed. Equal speed in sites of different roughness may hide different energy use levels. Therefore a third source of information is the use of effective human energy measurement in different terrain types, such as provided by Montoye et al. (1996). A fourth source is being investigated by enquiring psychological preferences/resistances for entering different terrain types.

Simulations of terrain access

Fig. 3 gives three simulations of access. The accessibility is the summation of the residual friction value from the dispersion starting at two entrances. (See fig. 1)



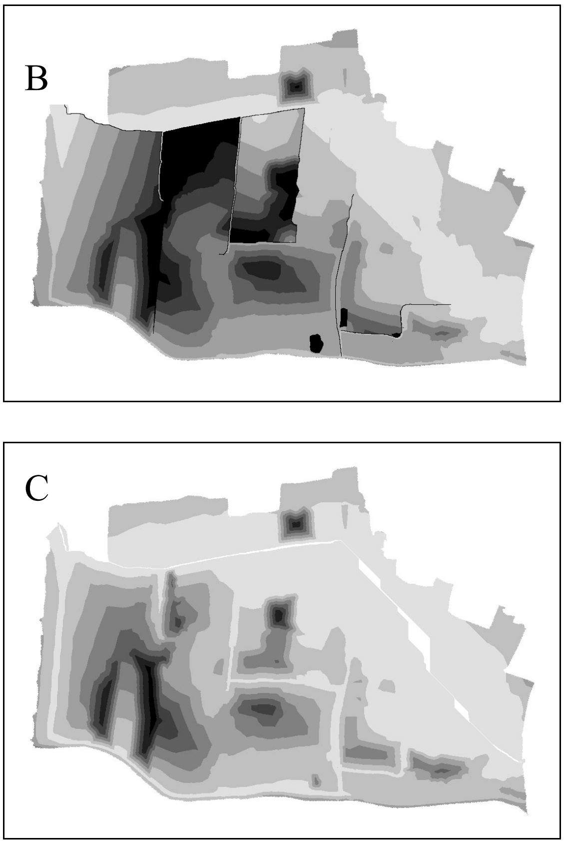


Fig. 3 Access models. A. With normal friction values for area units and standard friction value (6) for paths. B. Same as A but with differentiated path friction values. C. Same as A, but with friction values of ditches reduced to value 20. Grey shades vary from>80% residual growth value (pale grey) to 0% residual value (black).

The figures make clear that the friction model reacts sensibly to alternative scenarios. The differentiation of the pathway resistances according to width, surface roughness, wetness etc. changes considerably the overall accessability picture. Also the role of barriers such as ditches or metallic fences can be estimated very sensitively.

Provisional results of enquiries amongst invited people to the site suggest that this will result in well differentiated friction values for different road and surface types. Also, the impact of surrounding landscape characteristics, mystery effects etc. is likely very pronounced on the exact movement patterns. At the other hand, the statistical dispersion of values because of differences in personal characteristics should be taken strongly into consideration.

DISCUSSION AND OUTLOOKS

The accessability or penetrability model used in this paper has strong potentials for predicting risks of trampling according to the topological situation of fragile habitats. The model is non directional and will consider the whole site as a potential trespass area. Furthermore the model is based on an 'exhaust' principle that to a certain degree mimics human fatigue and preference for the easiest pathways. The model can be used easily for mapping the impacts of changes in the landscape. The model is very sensitive for apparently small changes such as a single footbridge over a stream or the effect of grass mowing, hence opening up more area for trespass. Likewise, the impacts of fencing off, broadening ditches etc. in order to control terrain visit can be easily simulated.

The exhaust principle however ignores possible 'refueling' e.g. by taking into consideration rest periods. The isotropy of the method furthermore does not consider directional factors such as terrain slope, visual attractivity and other goal elements in the landscape. It should be further clarified what exactly such models are capable of simulating: the displacement behaviour of individuals, the average roaming behaviour of groups, the probability of a certain site to be visited etc. Likely this modeling endeavour could be completed by linking several types of models: dispersion models, path finding models (Jöhnsson s.d.), landscape preference models and other.

The resistance or friction values as used in the model can be defined and measured according to different methods. Further comparison of the outcomes of these methods is necessary in order to obtain a useful ranked set of terrain types. An important question is the relation between physical resistances and psychological resistances. It is expected that this research will be able to contribute to this question in a later stage. The seasonal and atmospheric effects are also important factors of variation for the resistance values.

The next research steps will be the comparison of the dispersion calculations with further visitor's behaviour in the site. The low density of visitors however impedes a direct validation. Special emphasis will be given therefore to more indirect validation through enquiries and interviews with groups invited to the site and with local witnesses such as site managers, hunters and frequent visitors.

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RBSim 2: Simulating the Complex Interactions between Human Movement and the Outdoor Recreation Environment

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Abstract: This paper describes advancements in recreation management using new technology that couples Geographic Information Systems (GIS) with Intelligent Agents to simulate recreation behaviour in real world settings. RBSim 2 (Recreation Behaviour Simulator) is a computer simulation program that enables recreation managers to explore the consequences of change to any one or more variables so that the goal of accommodating increasing visitor use is achieved while maintaining the quality of visitor experience. RBSim provides both a qualitative understanding of management scenarios by the use of map graphics from a GIS as well as a quantitative understanding of management consequences by generating statistics during the simulation. Managers are able to identify points of over crowding, bottlenecks in circulation systems, and conflicts between different user groups.

RBSim 2 is a tool designed specifically for the purposes of simulating human recreation behaviour in outdoor environments. The software is designed to allow recreation researchers and managers to simulate any recreation environment where visitors are restricted to movement on a network (roads, trails, rivers, etc.). The software architecture is comprised of the following components:

- GIS module to enter travel network, facilities, and elevation data
- Agent module to specify tourist personality types, travel modes, and agent rules
- Typical Trip planner to specify trips as an aggregation of entry/exit nodes, arrival curves, destinations and agents
- Scenario designer to specify combinations of travel networks, and typical trip plans
- Statistical module to specify outputs and summarize simulation results.

This paper describes the RBSim software architecture with specific reference to the trip planning algorithms used by the recreation agents.

RBSIM – RECREATION BEHAVIOUR SIMULATOR

The purpose of the Recreation Behaviour Simulator Version 2 (RBSim 2) is to simulate the consequences of management decisions on visitor flows and encounters within a defined road and trail network within an outdoor recreation setting. RBSim 2 is a computer simulation tool, integrated with a Geographic Information System (GIS) that is designed to be used as a general management evaluation tool for any visitor and recreation facility management problem on linear networks. This capability is achieved by providing a user interface that imports park information required for the simulation from either MapInfo or ESRI ArcView geographic information systems. Once the geographic data is imported into RBSim, the park manager may then build alternative management scenarios (Itami et al. 1999).

Some of the factors the manager can change include the number and kind of vehicles, the number and arrival rates of visitors, and facilities such as the number of parking spaces, road and trail widths and the total capacity of facilities.

Statistical measures of visitor experience are generated by the simulation model to document the performance of any given management scenario. Management scenarios are saved in a database so they can be reviewed and revised. In addition, the results of a simulation are stored in a database for further statistical analysis. The software provides tables and graphs from the simulation data so park managers can identify points of over crowding, bottlenecks in circulation systems, and conflicts between different user groups.

Park managers can use RBSim 2 to compare alternatives by experimenting with different policy levers that can operate within the software. Such levers may activate or deactivate rules which agents in the RBSim environment will follow as they move through the environment of the Park.

RBSim uses concepts from recreation research and artificial intelligence (AI) and combines them in a GIS to produce an integrated system for exploring the complex interactions between humans (recreation groups) and the environment (geographic space) (Gimblett et al. 1996a; Gimblett et al. 1996b, Gimblett and Itami 1997, Gimblett 1998). RBSim joins two computer technologies:

- Geographic Information Systems to represent the environment
- Autonomous human agents to simulate human behaviour within geographic space.

WHAT IS AN AUTONOMOUS AGENT?

RBSim uses autonomous agents to simulate recreator behaviour. An autonomous agent is a computer simulation that is based on concepts from Artificial Life research. Franklin as Graesser (1996) define an autonomous agent as follows:

"An Autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to affect what it senses (and acts on) in the future."

Agent simulations are built using object oriented programming technology. The agents are autonomous because once they are programmed they can move about their environment, gathering information and using it to make decisions and alter their behaviour according to specific environmental circumstances generated by the simulation. Each individual agent has its own physical mobility,

sensory, and cognitive capabilities. This results in actions that echo the behaviour of real animals (in this case, human) in the environment.

What is compelling about this type of simulation is that it is impossible to predict the behaviour of any single agent in the simulation and by observing the interactions between agents it is possible to draw conclusions that are impossible using any other analytical process.

WHY RBSIM IS IMPORTANT TO RECREATION MANAGERS

RBSim 2 is important because until recently, there have been no tools for recreation managers and researchers to comprehensively investigate different recreation management options. Much of the recreation research is based on interviews or surveys, but this information fails to inform the manager/researcher how different management options might affect the overall experience of the user. For example a new trail may be introduced to alleviate crowding or conflicts between different user groups. How does this change increase or decrease the potential conflicts? How many more users can be accommodated and for how long? What is the impact on other facilities in the same park? Questions like these cannot be answered using conventional user survey tools. These questions all pivot around issues such as time and space as well as more complex issues such as inter-visibility between two locations. By combining human agent simulations with geographic information systems it is possible to study all these issues simultaneously and with relative simplicity.

RBSIM 2 COMPONENT ARCHITECTURE

Figure 1 shows the relationship of the major components of the RBSim 2 object hierarchy. An RBSim 2 simulation model is comprised of the following components:

Road/Trail network

The Road and Trail network is imported either from ArcView Shape files or MapInfo Tab files. On import standard fields required by the simulator are added to the associated attribute tables. Once the network has been edited and attributed it is written to a topologically structured network of Links and nodes.

Links are a series of line segments defined by a series of x,y,z coordinates that describe the alignment of the road or trail between two nodes. Link attributes include Label, Link Type, Link Category, number of lanes, maximum speed, length and slope. Links also may have access restrictions assigned to a scenario, such as open and closure times for different travel modes

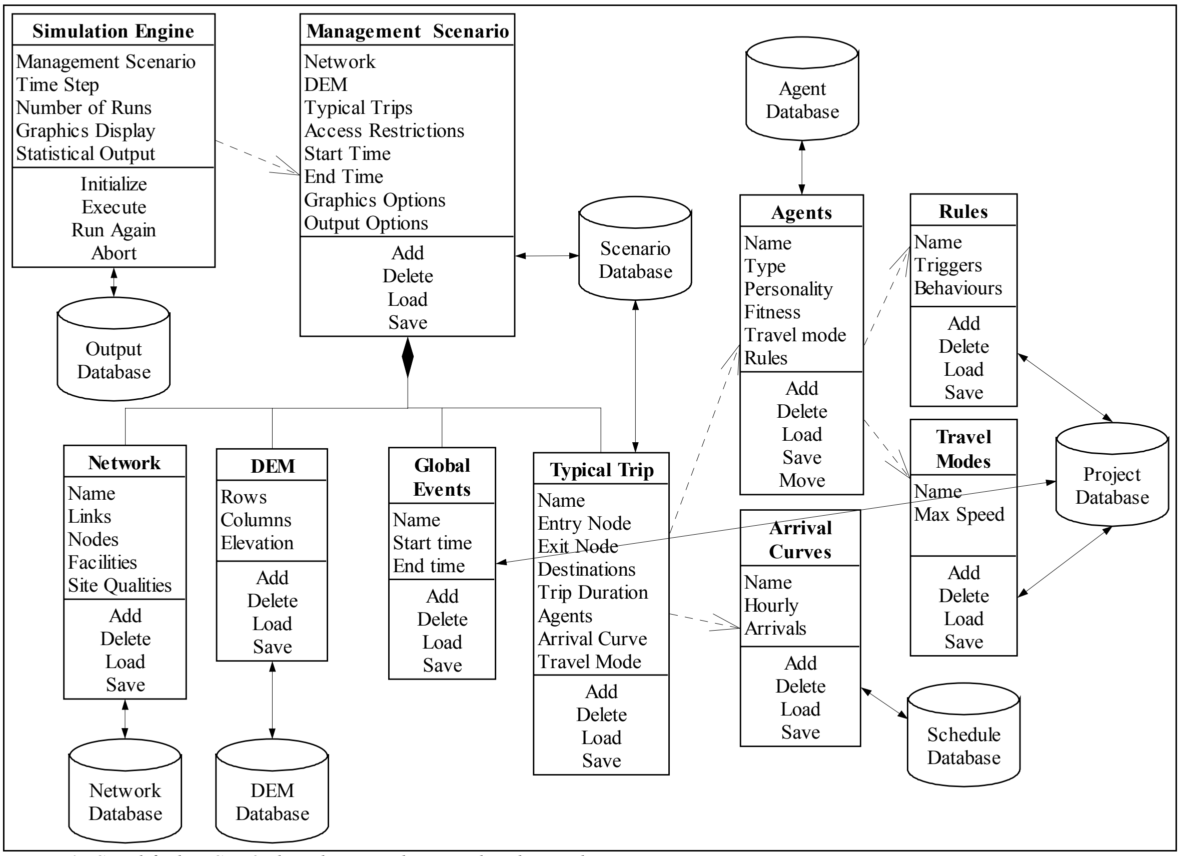

Figure 1. Simplified RBSim 2 class diagram showing class hierarchy.

A node is a point in the network representing a particular physical location at an intersection between links or where one or more facilities are located. Nodes are joined to the network by one or more links.

In addition to X,Y,Z coordinates, nodes have attributes including label, park entry, park exit, locale, facilities, and site qualities. Facilities are user defined destinations such as a visitor centre or picnic area that have a capacity and a typical duration of visit assigned to them. Site qualities, are user defined values such as scenery, history, or environment,education that are attributed to a node. A locale is a collection of one or more *nodes* with associated facilities that have a shared identity and can be grouped based on proximity to each other or common access.

Digital Elevation Model (DEM)

Elevation data is represented in a regular grid of elevations. They are used to assign elevations to the network and in calculating intervisibility between agents. DEM's are imported into RBSim from ESRI binary export files.

Global Events

Global events are user defined events that are raised during a simulation. Events have a start time and an end time and are controlled by the simulation engine. An example might be a rain storm, nightfall, temperature change, or any other event that affects the entire simulation.

Arrival Curves

Arrival Curves indicate the number of visitors arriving per hour over a 24 hour day. Arrival curves may be derived from traffic count data or estimated by managers familiar with the arrival patterns. Arrival Curves are used as part of the description of a typical trip, described later.

Agents

Agents have a number of standard attributes including fitness level, travel mode, travel speed, and preferences. Preferences are a list of values that correspond to site qualities that are attributes of network nodes. Values are weighted using Saaty's (1995) Analytical Hierarchy Process[1]. Preferences are used in the agent's logic for way-finding in locales which is described later in this paper.

Agents also have visual abilities. They can do line of site calculations to other agents at run time to count the number of other agents visible within a user defined radius.

Agent Rules

Agent rules are a set of user defined behaviours that are defined using a stimulus/response or event/action framework. RBSim 2 exposes runtime properties of the network, agent, and global events. Each of these properties will have a state or value

[1] For a more detailed explanation of the use of AHP in agent reasoning see Itami and Gimblett, 2001

which can be defined as a stimulus or event. Boolean logic can be used to combine two or more stimuli to create complex conditions for behaviour.

Behaviour is defined as a directive to search for a location or facility. An example of a complex rule is:

If (TravelMode = 'Car' AND Locale='12 Apostles' AND LocaleEntry = True) THEN Find Carpark

Agent rules are assigned to agents in the management scenario builder. The order rules are executed can change behaviour, so the user can specify the order of execution of rules. For instance, an agent should always park a car before going to a visitor centre.

Typical Trips

A Typical trip is described by an entry node and exit node to the network, an arrival curve, and probability distribution of agent types, a list of destinations (locales), and a trip duration. The concept of a typical trip is based on the premise that visitors have common patterns of use. For example day use visitors arriving during weekdays will have a different arrival pattern, a different duration of stay, and perhaps a different pattern of destinations than a traveller arriving on a weekend or an overnight visitor. Typical trips can be derived from field data or based on the experience and expertise of managers on-site.

Management Scenarios

A management scenario is an aggregation of a network, a DEM, one or more typical trips, a set of ordered agent rules assigned to one or more agents, zero or more global events, a set of access restrictions, and a set of runtime simulation conditions (see Simulation Engine).

Access restrictions (or gates) allow the manager to open and close parts of the road and trail network to different travel modes. Access restrictions are scheduled with a start time and end time. They may be hourly closures or seasonal closures.

Agent rules are assigned to each class of agent defined. Individual rules can be turned on and off for each agent, and the order that rules are executed may be uniquely defined for each agent class.

Simulation Engine

The simulation engine executes the management scenario. For each simulation run, the user defines the start date and time of the simulation, the end date and time of the simulation, and enables or disables the graphics display, statistical outputs, and agent inter-visibility.

Once these simulation conditions are defined, the user then runs the simulation. The simulation engine initialises the simulation in the following steps.

1. The network is loaded and validated
2. Each typical trip is loaded and the arrival schedule is interpolated for the duration of the simulation. All arrivals are then aggregated and sorted by arrival time.
3. Global events are scheduled
4. Network access restrictions are scheduled
5. Locales are sub-setted from the network.
6. For each locale, for each travel mode, a travel time matrix is calculated for all origin-destination pairs.
7. If output statistics are requested, the output databases are initialised.
8. If runtime graphics are requested, the graphic windows are initialised.
9. The simulation run is then commenced. The simulation engine starts the simulation clock and for each time step, reads from the arrival schedule to find all agents entering the simulation for that time step. For each agent, the simulation agent creates an instance of the agent, assigns it a personality preference profile, a set of rules, a fitness level, a travel mode, arrival mode, and a trip duration. The simulation engine then calculates a "Global trip" from the typical trip destination list. The global trip begins at the entry node for the trip and ends at the exit node. The path to intermediate destinations is generated based on least travel time algorithm. The global trip is saved as a trip itinerary and passed to the agent. Each agent then responds to a single method "Move" for each time step of the simulation. Once the agent is created, the simulation engine only issues the move method to each agent. The agent uses its own internal logic and rules to navigate through the network, selecting destinations, and determining duration of stay for each destination.

THE WAYFINDING LOGIC OF AGENTS

All agents follow a plan a global trip plan as described earlier, however these plans provide only a general trip itinerary. Once the agent begins its trip, changing conditions of the network (facilities becoming full), global events (rain storms), agent states (agent fitness, running short on time), can all act together to change the behaviour of the agent according to rules and the internal way-finding logic of the agent.

The way-finding reasoning of an agent is influenced by the following factors:

- Available time (defined by time elapsed subtracted from total trip duration).
- Travel mode as it affects travel time.
- Agent preferences
- List of rules and their order
- Currently executing rules
- Internal state of the agent
- Current location of the agent
- Condition of the network including availability of facilities, access restrictions,

and travel time to destinations on the network

- Previously visited destinations

As the typical trip defines the entry and exit node and a series of locales and durations, the simulation engine then uses travel time algorithms to find the most efficient route between destinations. However once an agent reaches a locale, it must use its internal way-finding logic to find destinations, generate a path that links these destinations, and simultaneously take into account the factors in the above list.

When an agent arrives at a locale, it checks to see if there is a duration set for this locale in the global trip itinerary. If the duration is >0 then the agent checks to see if there is enough time left in its total trip duration by subtracting the time elapsed since the beginning of the trip and the time to travel to the exit node. If the remainder is positive and greater or equal to the duration set for this locale, the agent enters the locale and performs the following initialisation procedures:

1. Loads the subset locale network for the agent's current travel mode.
2. Generates weights for the site qualities for each node in the locale by multiplying the node site quality with the corresponding personality preference value (unique to the agent)
3. Marks any nodes that have already been visited as "visited" and sets their site qualities to zero.
4. Sets its internal state to "entering locale"
5. Loads its rule list.
6. Generates a locale trip plan.
7. Executes its move behaviour for the locale.

The way-finding logic is encapsulated in step 6, generating the locale trip plan. The locale network is a topologically structured network containing the links and nodes, access restrictions, facilities, and site qualities for the locale.

Once the locale network has been initialised, the agent then evaluates all possible combinations of destinations from its current node location. These paths were pre-calculated when the simulation was initialised to enhance performance. The agent then evaluates each path and rejects any path that exceeds the available locale visit duration. The remaining paths are then ranked to maximize the site preferences and contain facilities that are on the agent's current rule list. A gravity model is used to weight the paths so paths with high priority facilities are ranked higher for facilities close to the agent's current location.

Once the preferred path is selected, the agent loads it as its current trip itinerary. The agent then traverses this itinerary as far as it can in the current time step. If the agent encounters a node that contains facilities that are on its current rule list, the agent changes its internal state to "visiting facility" and generates a visit duration for that facility. If the facility at the node has no available capacity (e.g. the parking lot is full), the agent "looks ahead" on its itinerary to see if a facility of the same class is available, if there is, the agent then continues its trip toward that node. If there is no other facility of the same class, the agent will then change its state to "queuing" and waits until the facility becomes available.

At each iteration of the simulation the agent must check its available trip time, its current travel mode, its current rule list, and its current state. Any of these can trigger a change in behaviour. The agent may abandon its current trip and calculate a path back to its car, or to the exit. If the conditions have not changed, then the agent continues to execute its current behaviour.

Though there are a lot more details to this behaviour, the above reflects the overall logic behind the agent's way-finding logic. When implemented, the logic produces behaviour that appears "smart" in that the agents generate logical paths and exhibit behaviour that is human-like.

12 APOSTLES MASTER PLAN PORT CAMPBELL NATIONAL PARK VICTORIA, AUSTRALIA

Port Campbell National Park is managed by Parks Victoria, Australia. The park is typified by spectacular coastal scenery with limestone cliffs and sea stacks against the backdrop of the forceful waves of the Southern Ocean. The park's popularity is enhanced by its proximity to Melbourne and the large number of tour buses that visit the site daily. These factors contribute to the heavy visitor use, and the inevitable crowding and decline of visitor satisfaction and environmental quality. RBSim 2 was used to examine the impact of changes in park infrastructure and increasing visitor rates over a 10 year period on the Twelve Apostles site. This site has recently been upgraded with a new parking lot and visitors centre. All parking south of the Great Ocean Road has been removed and visitors must now park in an improved parking lot north of the Great Ocean Road (see figure 2).

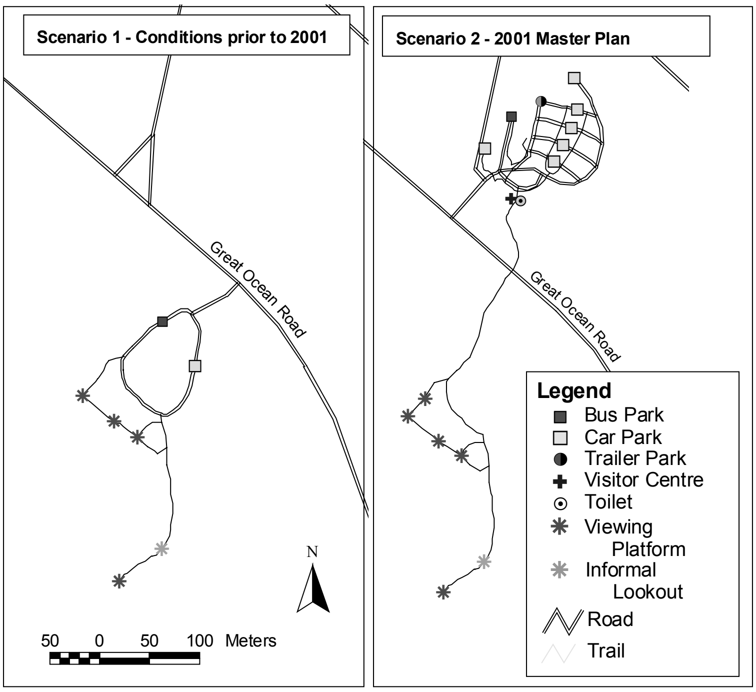

Figure 2: Network layout and facilities for Scenario 1 and Scenario 2. Limited parking to the south side of Great Ocean Road in Scenario 1 encourages illegal parking, visual impacts, and crowding. Scenario 2 shows all vehicular traffic has been moved north of the Great Ocean Road with an enlarged parking area, a new Visitor Centre, new public toilets and a pedestrian walkway that goes under the Great Ocean Road to the viewing platforms facing the 12 Apostles.

Some 701,000 people visited the site in 2001/2 and by 2006/7 this is expected to be 864,000. The new visitor centre which includes new toilet facilities and an interpretive centre provides a gateway to the site via a pedestrian tunnel that leads visitors under the Great Ocean Road along a path to the viewing platforms along the cliff edge of the spectacular views of the 12 Apostles. Traffic counts before and after the construction of the new facilities were taken to provide baseline and calibration data for the RBSim model. Simulation results are examined to answer a set of five management questions of key interest to the rangers of Port Campbell National Park.

Table 1 shows the before (scenario 1) and after (scenario 2) layouts of the 12 Apostles site.

Facility	Scenario 1	Scenario 2
Viewing Platform	345 People	345 People
Informal Lookout	5 People	30 People
Bus Park	6 Buses	12 Buses
Car Park	30 Cars	245 Cars
Visitor Centre	None	100 People
Toilet	None	29 People
Trailer Park	None	12 Cars

Table 1: Comparison of facilities at the 12 Apostles locale before (scenario 1) and after (scenario 2) the implementation of the new master plan.

Table 2 shows the arrival rates for cars over a 24 hour period for three time periods. The projections for 2006 and 2011 are based on a projected 3.55% growth rate per annum.

These figures were used for both scenarios. Rbsim 2 generates a standard set of statistical outputs these include:

Time	2001	2006	2011
5:00	2	2	3
6:00	19	23	27
7:00	6	7	8
8:00	20	24	28
9:00	54	64	76
10:00	114	136	161
11:00	153	182	216
Noon	203	241	286
13:00	230	273	325
14:00	213	253	301
15:00	235	279	332
16:00	193	229	272
17:00	90	107	127
18:00	37	44	52
19:00	10	12	14
20:00	2	2	3
21:00	7	8	10
22:00	1	1	1
Totals	3590	3893	4253

Table 2: Arrival rate for cars entering the 12 Apostles site for three time periods. These rates were used for both Scenario 1 and scenario 2.

- Car park and bus park capacity
- Trip completion rates.
- Visual Encounters. This is a measure of crowding at a particular attraction[1].
- Queuing time at parking facilities
- Length of stay

Each of the measures were analysed according to the original management questions. Space limitations do not allow discussion of the statistical methods used to analyse the results, however these are fully reported in Itami, Zanon and Chladek (2001).[2] Only results for Scenario 2 are reported here.

How well will the new facilities at 12 Apostles cope with growing visitor loads?

Results show bus parking will be inadequate during the busiest time of the day between 2:00 and 4:00 pm by the year 2006. This shortage is exacerbated by the year 2011 as bus parking is inadequate for the whole period from 3:00 pm to 5:00 pm

By 2006 the car park is full from 1:00 pm to 4:00 pm by 2011 the car park is full from 12:00 pm to 5:00 pm.

How is length of stay affected by the new configuration of the 12 Apostles site?

The longer walk from the new parking facilities to the viewing platforms extends the average length of stay an average of 6 to 7 minutes. Predictions by RBSim in this regard are confirmed by measurements on-site.

How crowded will the site get in the future?

As the number of visitors increase, there is increasing pressure on viewing platforms and lookouts. Crowding increases because of the increased duration of stay and the increased capacity of car parks.

How will visitor satisfaction be affected by the new facilities and growing visitor numbers?

It is expected that visitor satisfaction will decrease with an increase in visitors. This is caused by increased queuing times at parking lots, an increase in the length of stay, the number of visual encounters, especially at viewing platforms, and the number of visits that fail because of lack of parking at peak periods. This can partially be resolved by increasing the capacity of viewing platforms, but the long-term solution will require redistributing the visitors to other sites, especially at peak periods.

Management Recommendations

- Bus parking will need to be managed between 3:00 pm to 5:00 pm within 5 years (eg. use informal spaces near the visitor centre).
- Limit car arrivals after 1:00 pm in 10 years or build an extension to the car park.
- Viewing platforms will have to be increased in capacity in the 5 to 10 year time horizon if the overflow car park is used or if the car park is extended further.

CONCLUSIONS

RBSim 2 is a general agent-based model for simulating the behaviour of visitors in recreation environments where movement is constrained by linear networks. The open architecture allows recreation managers to build simulation models for any park and recreation area. Because RBSim 2 is designed as a management tool, managers can examine a broad range of management options and compare and contrast different strategies. By interacting with the simulation model, managers can evaluate the effectiveness of alternative facilities management plans to determine the performance on visitor flows and visitor satisfaction under different visitor loads.

RBSim is under continuous development to generalise it for a broader range of recreation environments. This development is linked to behaviour research (see paper by Gimblett et al. in this conference) in the U.S. and Australia. We are now in the process of developing simulations for a broad range of environments and recreation management problems.

The component architecture described in this paper allows us to build additional agents as new components and integrate them with RBSim using "plug and play" technology. In this regard, we are in the process of designing "shuttle bus" agents and "animal" agents such as grizzly bears. There is considerable interest in integrating the behavioural modelling of RBSim2 with traditional GIS ecosystem models to develop temporal environmental impact models.

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A Concept for Coupling Empirical Data and Microscopic Simulation of Pedestrian Flows

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Abstract: In this paper we present a concept for coupling empirical data and a microscopic simulation of pedestrian motion. Since there is no automatic detection method available for this task up to now the main focus is on developing such a system.
A review of the different detection methods is presented and the requirements are given an automatic system has to fulfil. Additionally, a possible realisation of such a detector is described. Experiences with such a system for vehicular traffic are reviewed.

INTRODUCTION

The simulation of pedestrian motion has reached a high interest in many fields of human live. There are two major directions of pedestrian flow simulation: One is the investigation of basic phenomena encountered in human motion like the formation of trails with opposite walking directions [14, and references therein] or the formation of temporary roundabout traffic [13]. The other field is the application of these simulations to optimise pedestrian flows in complex geometries for various intentions.

Our simulation was originally developed for the simulation of evacuation processes onboard passenger ships [7]. But due to its high flexibility it can also be used to simulate pedestrian flows within football stadiums or shopping malls.

Since our model provides a high simulation speed it is possible to perform calculations faster than real time for a large number of pedestrians. Combining this high calculation speed with an automatic detection system for pedestrian flows will enable medium term predictions for the distribution of people from detected initial conditions.

The outline of this papers is as follows: In the next section we present the basic elements of our model. The following section gives an overview over the available empirical data and problems that occur during the collection. Next, an overview over the currently available systems for the detection of pedestrians is given. A short discussion of the usability of these methods for our concept follows. From this we develop the requirements for an automatic detection system which is described in the next section. The last section gives an idea for a coupled detector/simulation system and its probable use.

MODEL DESCRIPTION

For the simulation of pedestrian flows a Cellular Automaton (CA) model is used [7]. Contrary to macroscopic models which pay no attention to individual behaviour of pedestrians our microscopic model simulates individuals.

The floor plan is divided into quadratic cells with a size of 0.4m by 0.4m. Each of these cells can be occupied by at most one pedestrian. The people are allowed to move from one cell to each neighbouring unoccupied cell. That means the coordination number is 8.

Walls, furniture and other obstacles are represented as inaccessible cells (see figure 1). The orientation of the pedestrians towards a certain target is done by a potential field. Walking in the direction of the gradient is the shortest way to a given target that is the source of the potential. The values for the potential field are subject to a metric that generalises the "Manhattan metric". The distance to the target is coded in the grey shade of the cells. The lighter the grey the shorter the distance.

The update of the pedestrians is done in a random order. The order is set at the beginning of each time step. Moved pedestrians are deleted from the order. Because of that each pedestrian is moved only once in a time step.

Individual characteristics of the pedestrians are given by a set of parameters. These parameters are assigned according to a normal distribution between given limits. The parameter sets include the walking speed which is given in cells per time step, a swaying probability to describe a variation from the shortest path, a dawdle probability to describe the speed reduction due to orientation, a patience to give the ability to search for a new way when the currently chosen way is jammed, and a maximum vision range.

To reach higher walking speeds than one cell per time step (e.g., 0.4m/s) each time step is divided into sub time steps (see figure 2). In each sub time step a pedestrian can move from one cell to a neighbouring cell. By filling in as much sub time steps as the required maximum velocity is we can simulate higher walking speeds. In this context, lengths are measured in cells and speeds in cells per time step.

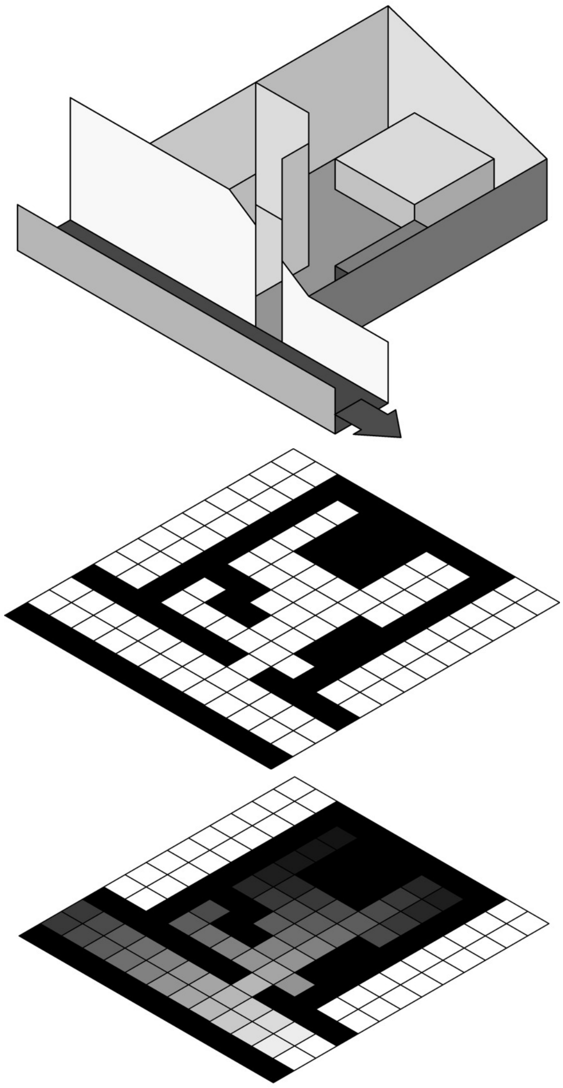

Figure 1: Discretisation of the floor plan. Inaccessible areas are marked as black cells. Accessible cells are white. The grey cells represent the potential field which leads to the exit.

The interactions between the individuals are repulsive. If a cell is occupied by a pedestrian no other pedestrian can use this cell in the particular time step. In this way accidents are prevented.

The outcome of the simulation is the total evacuation time. This is the time until the last person has left the facility. Since decisions of pedestrians are made by drawing random numbers a single simulation run can produce an arbitrary result. So we repeat each simulation a couple of times with different random numbers to make a statistical statement about the evacuation time (Monte Carlo simulation). Additionally, for each person the starting point and the exit coordinates are recorded together with some statistical information (e.g. which speed for how many time steps). In the upcoming version a density and occupancy plot will be available. These plots provide information on which cells are most frequently used during the evacuation.

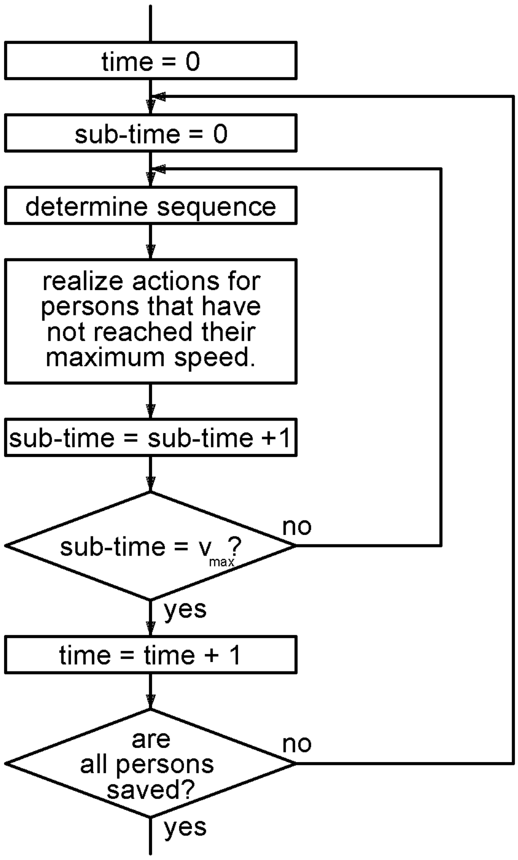

Figure 2: Algorithm of the microscopic simulation. The update sequence of the persons is random. The number of sub time steps equals the maximum walking speed.

EMPIRICAL DATA

For our simulation we use a small set of parameters. Nevertheless it is highly recommended to adjust these parameters for our simulation as well as for other simulations dealing with pedestrian motion. This is done either by extracting them from the literature [3], from observations, or by trial and error [10].

In the end there is always the need for observations since the outcome of the simulation is an evacuation time which has to be compared with full scale tests (unless the results are trustworthy).

To compare the simulation with full scale tests we have observed some evacuation drills in schools and on ships and we have undertaken some own experiments.

These observed drills, especially in the schools, showed some critical points of the simulation we did not pay much attention to before. For example, while the real exercise in a primary school [6] was done in about 85 seconds the simulation predicted about 160 seconds. This gap occurred because we did not consider the special circumstances that our observation produced: The exercise was done in a primary school with pupils of the age of 6 to 10 years (first to fourth grade). Our observation equipment (cameras, staff) produced a high grade of nervousness so that the pupils tried to make their job very good what means that they moved very fast. In the first simulation runs we did not consider this fact and worked with pupils which were too slow. By fitting the walking speeds to recorded values the simulated time dropped down to about 100 s.

By comparing the simulation to another evacuation exercise in a secondary school a second necessary point occurred. It showed up that neglecting furniture in the class rooms leads to a difference in evacuation time. Our first idea was that the class rooms basically serve as a reservoir for the pupils and when the alarm is given they just move out. It occurred that the furniture (tables) in the class rooms lead to a guidance of the pupils within the class room. This resulted in a better outflow through the door and not to the jam which appeared without tables. This increased the outflow and led to a simulated evacuation time which better fit to the measured time.

Phenomena like the influence of furniture are qualitative. They can be analysed by simply watching the recorded video films. But if we want to extract data like walking speeds from such drills we have to examine the films frame by frame. This is a very time consuming work.

From this fact the idea arose to use an automatic detection system. Looking at what is currently available for human detection we found nothing sufficient and we formulated some essential requirements. From these requirements we derived an idea for such a detector.

If such a detector would be available there is a wide field of applications for the detector itself as well as for a coupled detector/simulation system.

CURRENT DETECTION METHODS

In this section we give an overview of the detection methods which are currently available for human beings. Most of these detectors can only detect the presence of people but no individual data like walking speed and direction.

Detectors can be differentiated by several criteria. One differentiation can be done by the categories *active* or *passive* detectors. This differentiation is based on the measurement principles the detectors use. Active detectors are working on a sender/receiver basis. A sender emits some kind of radiation (in most cases electromagnetic radiation). Either the reflected signal is detected or it is detected that the signal is blocked by an obstacle (e.g., for light barriers). By measuring the travel time of the radiation the distance to the target can be computed. Microwave detectors, active infrared detectors, ultrasonic detectors, and laser scanners belong to this category.

Passive detectors do not emit any radiation but detect the environmental radiation field and react on changes therein. Typical passive detectors are passive infrared detectors and video cameras.

A second approach for the differentiation of sensors is the type of application they were developed for. In this case the detectors can be divided in the categories *static* and *dynamic* sensors. Dynamic sensors are only able to detected moving objects while static sensors can only detect fixed objects.

In the following a short description of the different sensors is given. For a more detailed view on the different detectors, see [2].

Active Infrared Sensors

Active infrared sensors emit infrared light with a wavelength close to the visible spectrum and detect the reflected part or the transmitted one. They are capable of detecting non moving objects. A special case of these sensors is the infrared light barrier. The light barrier is triggered when a beam of infrared light is interrupted. The need for an interrupted light beam enforces a special mounting position for light barriers which is not always possible.

Passive Infrared Sensors

Passive infrared sensors are frequently used as motion detector for automatic illumination, alarm plants, or automatic doors. They consist of a pyro-electric element which produces an electric current when infrared radiation acts on the element.

They react on rapid changes in the environmental infrared radiation field. Because of that they are only able to detect moving objects. The detected wave length is above 10 μm.

Microwave Detectors

By emitting and receiving electromagnetic waves with a wavelength of 1 to 10 cm microwave detectors belong to the group of active detectors. Sending and receiving is done with a single antenna. By measuring the travel time of the wave the distance to a target can be computed and by using the Doppler-Effect the velocity of a target can be measured.

A measure beam is emitted by the antenna and the mixed signal of all reflections is received. Because of that only the strongest signal is analysed.

By using the Doppler-Effect, microwave detectors are capable of detecting the velocity and moving direction of a target. This enables microwave detectors to measure only pedestrians who are walking in a certain direction. But it also produces problems when a detected person who fits detection criteria is superimposed by a signal of a person who does not match the criteria. Then there will be no person detected.

Ultrasonic Sensors

Some animals orientate by using ultrasonic (e.g., bats). The detection is done by emission of silent sonic impulses and receiving of echo.

While this technique is sufficient for animals it is not reliable for person detection. The strength of the reflected ultrasonic impulses depends on the clothing of the persons. A weak reflection leads to non-detection of persons. Additionally, for a strong reflection the impulse has to impinge vertically as the reflection has to.

An advantage of ultrasonic detectors is the ability to detect unmoving objects for infinite time periods.

Mat Detectors

Some materials change their behaviour under pressure. This effect is used in mat detectors. Mat detectors are placed instead of sidewalk slabs or beneath them.

There are two different systems of pressure sensitive mats available. One system consists of a piezo-electric coaxial cable which is embedded in rubber mats. When the cable is exposed to pressure like from a person standing on the mat an electric voltage is produced.

The other system measures and analyses the change in the optical properties of glass fibres.

In this configuration mat detectors are only useable to detect the presence of persons. To count persons the mats have to be divided in smaller elements and then arrays of these elements have to be installed.

Laser Scanners, Radar Scanners

The measuring principle of scanners is the computing of travel time of various electromagnetic radiation. Either infrared light (for Laser scanners) or microwaves (for Radar scanners) is used. The narrow bundled radiation is emitted by a moving emitter and reflected by the target. By computing the travel time or the phasing, the distance to the target can be detected.

Originally, scanners had been developed for the differentiation and counting of different road users. They are also used for the detection of persons in secured areas. Since the scanners are mounted overhead a use for the collection of pedestrian data is in principle possible but has not yet been tested.

Video Analysis

Currently, video analysis is used for data collection of cars. The video images are analysed by a grey scale analysis in pre-defined windows. For cars this technique works sufficiently good but does not satisfy the needs for pedestrians. The main problem is the definition of windows which fit to pedestrians anywhere in the plane.

A new system from the University of Minnesota [1] is able to track pedestrians in real time. This system works for single pedestrians with a frame rate of 30 frames per second but the frame rate drops down with an increasing number of pedestrians. The number given is 25 frames per second for 6 pedestrians. This drop down depends on the available computer power. Since the computational possibilities increase very fast it will be only a question of time since a larger number of pedestrians can be tracked in real time.

Thinking of a long term observation using video analysis the question of data security has to be addressed. Taking videos of persons is often not allowed unless they do not give their explicit permission.

DISCUSSION OF THE DETECTORS

Since most of the above mentioned systems have been developed for the detection of pedestrians waiting at crossings they are not able to extract any motion data of the pedestrians. Furthermore, some of the systems are not able to detect how many pedestrians are there. For example, infrared detectors give a signal independent of the total number of pedestrians. If there is at least one pedestrian they trigger the crossing light.

This limitation is not hindering if the detectors are used for presence detection at crossings. But it makes them unusable for collecting data like walking speed and direction.

Another disadvantage is the ”loss” of pedestrians due to occlusion. This is the main problem of the optical systems like video analysis or radar scanners since they are usually not mounted overhead. But it is essential that pedestrians do not simply disappear or suddenly appear for the collection of data.

The great advantage of a video analysing system is variable size of the observed area. By simply changing the zoom of the camera a higher resolution can be reached.

IDEA FOR A NEW DETECTION METHOD

From the above mentioned points we can derive requirements for a detection system which can be coupled to our or any other microscopic simulation. The main requirement is the robustness against occlusion. The system must be able to detect the presence, walking speed, and walking direction independently from the level of occlusion to give a full set of data to the simulation. Since this can only be reached by mounting cameras or scanners overhead (what is not always possible) this is the main problem.

Another possibility to prevent occlusion is the detection from beneath. This idea is based on the inductive loops which are used for traffic detection [8]. Inductive loops are common in collecting data from moving cars. The metal parts of the cars trigger an inductive loop and this signal is analysed by a computer.

Since humans are (at least in the beginning) not metallic the use of inductive loops is impossible. The idea for the detection system is the use of footprints of the walking pedestrians on the above mentioned pressure sensitive mats (figure 3).

In the current configuration the mats are only able to give a signal when something exerts a pressure on the mat. A spatial resolution is not given. But by dividing a mat in small quadratic elements of 10cm by 10cm it would be possible to detect where a footprint is made. By measuring the distance of the footprint from the edges of the array it is possible to predict where a person enters the array. From the shape and orientation of the footprint a prediction for the walking direction can be made (see figure 3).

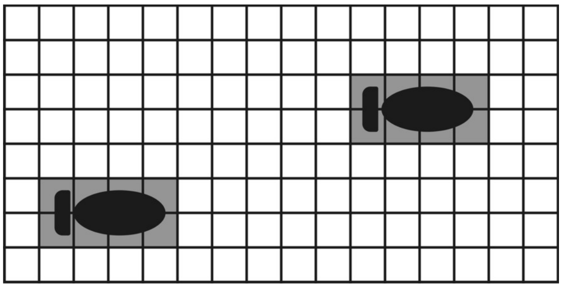

Figure 3: A possible situation on a spanned mat detector. The footprints (black) trigger the underlying elements (grey). Because of the closeness to the left edge of the array the next footprint is estimated near the right edge.

The analysis of the position and orientation of the first footprint starts the system to wait for the second footprint in walking direction. From the temporal and spatial distance between the footprints the walking speed and direction can be computed. By counting the footprints the number of pedestrians can be obtained to get the density on the detector.

It will have to be shown that this approach is feasible. However, up to now we do not know of any facts that make this generally impossible.

Details

To explain the above mentioned mat array approach in more detail we now give an explanation of the assumptions made.

To find a good balance between costs and benefits we estimate that a size of 10cm by 10cm for the elements is sufficient. A better spatial resolution would be given with smaller elements but the increase in elements (half the size means four times the number) will possibly slow down the data extraction.

From this starting point we can derive the other requirements like detection speed. The estimated mean velocity of the detected persons is about 1.3m/s and the step length is about 0.6m/s (see [3]). This means that the time delay between the first and the second footprint is about 0.5s. When we require a measured accuracy of 0.1m/s for the velocity and (due to the cell size) take a variation of 0.1m for the step length, the upper limit for the deviation in the time measurement is 0.08s.

The total length of a mat array must not be less than 2m. This is because of the required direction detection. To decide where the first footprint is made we need the first footprint to be made near one edge of the array. With a length of 2m the first footprint is in any case made closer to one edge than to the other.

The width of the mat can vary depending on how many persons should be able to walk side by side. The lower limit for the width is the width of one person, e.g., about 0.5m.

Every single element is then connected to a computer which is triggered by the first footprint. The orientation of the activated elements determine in which direction the next footprint is estimated and the time measurement starts. When the second footprint activates the underlying elements the time measurement is stopped. From the distance between the activated elements the step length is calculated and together with the measured time the velocity can be computed.

This has, of course, not to be done online, but the data can be recorded and stored and analysed later on.

COUPLING TO THE SIMULATION

The collected data are fed into the simulation as the initial entrance rate and velocity in the simulated area. This area can be all kind of route network. From that source the simulated pedestrians spread over the network and walk through it according to the algorithm mentioned above. At some points within the network additional detectors can be attached to adapt the simulated amount, velocity, and direction of persons to reality. This makes a complete surveillance of the area unnecessary while the simulation fills the gaps where no surveillance can be done. Additionally is it possible to get data on the occupation of unmonitored areas. A similar system is applied successfully to city [16] and highway traffic [17].

Furthermore, a prediction of jammed areas would be possible because of the high simulation speed. This enables for the specific positioning of staff to resolve such congestions. Especially in the case of protected areas it is necessary to prevent such congestions as people are impatient. If they have to wait at a waypoint (e.g., a bottleneck on a way) they will soon try to shortcut trough the woods. To prevent this, a staff member can be positioned there to hinder the pedestrians in taking a shortcut and to speed up the other pedestrians in the bottleneck. This increases the effectiveness of the staff.

This coupling of empirical data and micro simulations is done with great success for highway networks in Germany ([4,5] and references therein).

CONCLUSION AND OUTLOOK

The presented concept for a coupled system of detectors and a microscopic simulation offers a wide range of possible applications. Not only in the field of data collection an automatic detection system would provide great benefits but also in the field of simulation and prediction of pedestrian flows. This enables the optimisation of route networks as well as the optimal positioning of staff members. Through a combined system of a microscopic simulation and a couple of detectors a complete surveillance of large areas becomes unnecessary.

The next steps will be the transfer of the theoretical data of the detector into a working system. After a detailed analysis of the capabilities the coupling to the simulation can be done.

Even though at the present state this is only a concept, there are three strong arguments for pursuing this approach:

- It has been done successfully for vehicular traffic.
- The basic technologies are available.
- There is a plethora of potential applications.

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Using Simulation Modeling to Facilitate Proactive Monitoring and Adaptive Management of Social Carrying Capacity in Arches National Park, Utah, USA

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Abstract: Recent research and management experience has led to several frameworks for defining and managing carrying capacity of national parks and protected areas. The process outlined in contemporary carrying capacity frameworks embodies the principles of adaptive management. That is, management decisions are guided and adapted within these frameworks by monitoring indicator variables to ensure that standards of quality are maintained. The objective of this study was to develop a computer simulation model to estimate the relationships between total park use and the condition of indicator variables. In this way, simulation modeling might facilitate proactive monitoring and adaptive management of social carrying capacity of parks and protected areas.

INTRODUCTION

Public visits to parks and protected areas continue to increase and may threaten the integrity of natural and cultural resources and the quality of the visitor experience. For example, annual visits to the U.S. national park system are approaching 300 million, and this level of use may disturb fragile soils, vegetation and wildlife, and may cause unacceptable crowding and visitor conflicts. Starting as early as the 1960's, outdoor recreation research has adapted and developed the concept of carrying capacity to address these issues related to visitor use (Manning, 1999). In the context of outdoor recreation, social carrying capacity refers to the amount of visitor use that can ultimately be accommodated in parks and outdoor recreation areas without diminishing the quality of the visitor experience beyond an acceptable level.

This study addresses the application of computer simulation modeling to defining and managing social carrying capacity in Arches National Park, Utah. Previous research has led to establishment of selected indicators and standards of quality for major attractions within the park (National Park Service, 1995; Manning et al., 1995; Manning et al., 1996a; Manning et al., 1996b). For example, to avoid unacceptable levels of crowding, the number of people-at-one-time (PAOT) at Delicate Arch should not exceed 30 more than 10 percent of the time. But how many visitors can be allowed to hike to Delicate Arch before this standard of quality is violated? Moreover, how many visitors can be allowed in the park before standards of quality are violated at this and other attraction sites? A computer simulation model of visitor use was developed to help answer these and other carrying-capacity related questions.

CARRYING CAPACITY AND ADAPTIVE MANAGEMENT

A number of frameworks have been developed to provide managers with a basis for making decisions about the carrying capacity of parks and protected areas, including Limits of Acceptable Change (LAC) (Stankey et al., 1985), Visitor Impact Management (VIM) (Graefe et al., 1990), and Visitor Experience and Resource Protection (VERP) (National Park Service, 1997). Common to all of these frameworks is formulation of management objectives concerning the degree of resource protection and the type of recreation experience desired. Management objectives are made operational through a set of indicators and standards of quality (Manning, 1999). Indicators of quality are defined as measurable, manageable variables that reflect the essence or meaning of management objectives. Standards of quality are defined as the minimum acceptable condition of indicator variables. Indicator variables are monitored over time, and management actions are applied as needed to ensure that standards of quality are maintained.

The process outlined in contemporary carrying capacity frameworks embodies the principles of adaptive management. Adaptive management has been characterized as a form of experimentation and learning in which a team of managers, planners, and experts formulate hypotheses concerning the relationship between management actions and corresponding outcomes (Lee, 1993). A management "experiment" is carried out by taking management actions, monitoring the outcomes of the actions, and comparing the monitoring data to hypothesized outcomes. Managers adapt to differences among expected and actual outcomes of management actions by reformulating their hypotheses and implementing new management actions. Management outcomes are monitored to test revised hypotheses, and additional learning about the system under management takes place. This process continues in an incremental cycle of experimentation and learning. For example, consider a park or related area where crowding-related indicators of quality (e.g., the number of people seen at one time at popular attraction sites) have been monitored and are not within standards of quality. Managers of the area may hypothesize that these indicators of quality can be brought within standards of quality by limiting the number of people who enter the park or by implementing a permit system that controls the temporal and/or spatial distribution of visitors to the area. In order to test these hypotheses, visitor use limits or a permit system are implemented for the park. Monitoring is conducted to test the hypothesis that crowding-related indicators of quality are within standards of quality given the new management action. Through this process the manager learns about the effectiveness of management actions and adapts future management decisions accordingly.

While carrying capacity frameworks such as LAC, VIM, and VERP have been successfully applied in a number of park and recreation areas, a potential weakness of this approach to carrying capacity in particular, and adaptive management in general, is their arguably reactive nature. That is, they rely on a monitoring program to determine when standards of quality are violated, or are in danger of being violated. A more proactive approach to managing carrying capacity would be to estimate the level of visitor use that will cause standards of quality to be violated, and to ensure that such levels of visitor use are not allowed. Computer simulation modeling has the potential to facilitate a more proactive approach to defining and managing social carrying capacity. Specifically, simulation modeling provides managers with a tool to experiment with and predict the outcomes of a range of management actions that might otherwise be too costly to consider and/or may lead to potentially undesirable consequences. In this way, outdoor recreation managers can capitalize on the strengths of adaptive management, decision-making guided by experimentation and learning, while avoiding potential constraints associated with such an approach.

OVERVIEW OF SIMULATION MODELING AND APPLICATIONS TO OUTDOOR RECREATION

Simulation modeling is the imitation of the operation of a real-world process or system over time. It involves the generation of an artificial history of a system, and the observation of that artificial history to draw inferences concerning the operating characteristics of the real system. Simulation modeling enables the study of, and experimentation with, the internal interactions of a complex system. The approach is especially suited to those tasks that are too complex for direct observation, manipulation, or even analytical mathematical analysis (Banks & Carson, 1984; Law & Kelton, 1991; Pidd, 1992).

The most appropriate approach for simulating outdoor recreation is dynamic, stochastic, and discrete-event, since most recreation systems share these traits. Models that represent systems as they change over time are *dynamic* models, differing from static models that represent a system at a particular point in time. Complex and highly variable systems are often modeled using *stochastic* simulation. A stochastic simulation model contains probabilistic components and takes into account the random variation of systems over time. *Discrete-event* simulation models are dynamic models that imitate systems where the variables change instantaneously at separated points in time. This contrasts with continuous systems where variables change continuously over time. A mountain stream is usually modeled as a continuous system, where variables such as stream flow change continuously over time. An example of a discrete-event system is a campground: variables, such as the number of campers, change only when there are campers arriving or departing.

From the mid-1970's to the early-1980's, researchers explored computer simulation modeling as a tool to assist recreation managers and researchers (Manning & Potter, 1984; McCool et al., 1977; Potter & Manning, 1984; Schechter & Lucas, 1978; Smith & Headly, 1975; Smith & Krutilla, 1976). The main goal of the Wilderness Travel Simulation Model, as it came to be known, was to estimate the number of encounters that occurred between recreation groups in a park or wilderness area. The model required input variables such as typical travel routes and times, arrival patterns, and total use levels. Outputs included the number of encounters between visitor groups of various types and the date and location of encounters. Initial tests established the validity of the model, but the model soon fell into disuse. Computers were relatively inaccessible at the time, and the evaluative component of carrying capacity research had not yet produced defensible numerical standards of quality.

Recent changes in computing power complemented advances in evaluative research to provide the context and impetus for the present study to revisit computer simulation for recreation research and management. Simulation-capable computers have become "smaller, cheaper, more powerful and easier to use by non-specialists" (Pidd, 1992). Exponential growth in the power of personal computers has facilitated the use of graphic user interface and visual interactive modeling technologies to make the simulation process accessible (Pidd, 1992). These advances have led to wide proliferation of simulation in the fields of business management and manufacturing.

In recent years there has been renewed interest in applying simulation modeling to outdoor recreation management, resulting in the development of two related approaches. Research at Grand Canyon National Park (Daniel & Gimblett, 2000) and Broken Arrow Canyon near Sedona, Arizona (Gimblett, Daniel, & Meitner, 2000; Gimblett, Richards, & Itami, 2001) combined simulation modeling with artificial intelligence technologies and geographic information systems (GIS) to address social carrying capacity-related issues at the study areas. Studies at Acadia National Park (Wang & Manning, 1999), Yosemite National Park (Manning et al., 1998b, Manning et al., 1999), Yellowstone National Park (Borrie et al., 1999), and Alcatraz Island (Manning et al., 1998a) used a simulation approach similar to the Wilderness Travel Simulation Model. These studies involved building models of specific sites or specific activities to determine social carrying capacities within these National Park areas. This paper presents an application of the latter approach to simulation modeling at Arches National Park. Specifically, a computer simulation model of visitor use of Arches National Park was developed to estimate the maximum use level that can be accommodated at Delicate Arch and within the park more generally without violating standards of quality for a crowding-related indicator of quality (PAOT at Delicate Arch). The results provide numerical estimates of social carrying capacity of Delicate Arch and Arches National Park.

METHODS

Data Collection

A variety of methods were employed to gather the baseline data used to build the simulation model of visitor travel in Arches National Park, including vehicle counts with traffic counters, on-site visitor surveys, field visits, and map analysis. In addition, parking lot counts were conducted to validate model outputs. The following paragraphs describe the data collection methods in more detail.

A traffic counter placed at the entrance to Arches National Park was used to record the number of vehicles entering the park and the time each vehicle entered. These traffic data were collected during a seven-day period from August 19 - August 25, 1997. Total daily vehicle entries for these seven days averaged to 1,346 vehicles.

Data concerning visitor characteristics and their travel patterns within Arches National Park were collected through a series of on-site surveys administered to park visitors during the summers of 1997 and 1998. During the summer of 1997, vehicle travel route questionnaires were administered to 426 visitor groups as they were exiting the park. One visitor from each group was asked to report their group's size, the total amount of time they had spent traveling on the park roads, and where and how long they paused during the visit. Finally, with the aid of the interviewer, they were asked to retrace the route of their trip on a map of the park. The vehicle travel route questionnaires were administered on 6 days during the period from August 14 – August, 30, starting at 7:00 a.m. and ending at dusk. Safety concerns pre-empted stopping cars and surveying visitors after dark.

A second questionnaire was administered during the summer of 1997 to a total of 180 visitor groups returning from their hikes to Delicate Arch. One visitor from each group was asked to report the group's size, the total amount of time they had spent on the trail to Delicate Arch and at the Arch, and where and how long they paused during the hike. The Delicate Arch hiking questionnaires were administered on 3 days during the period from August 15 – August, 24, starting at 7:00 a.m. and ending at 10:00 p.m..

During the summer of 1998, 160 questionnaires were administered to tour bus drivers on 42 days between July 9 and October 22. Bus drivers were asked to provide the same type of information that was collected in the vehicle travel route survey the previous summer. Tour bus travel route data were collected during the daylight hours from 7:00 a.m. to dusk.

Hiking questionnaires were administered during the summer of 1998 at The Windows and Devil's Garden sections of the park. Similar to the hiking questionnaire administered at Delicate Arch during the previous summer, visitor groups at The Windows and Devil's Garden areas were asked to report information about their group size, the route they hiked, and the places and amount of time they paused during the hike. A total of 245 questionnaires were completed by visitors returning from their hikes around The Windows on 5 days during the period from July 18 - August 3, and 320 questionnaires were administered to hikers returning from their hikes in the Devil's Garden section of the park on 5 days during the period from July 5 - August 6. Surveys in both locations started at 7:00 a.m. and ended at 10:00 p.m..

Additional data needed to construct the model were gathered through analysis of park maps. Specifically, the lengths of road and trail sections between intersections were calculated from maps provided by the park.

Data needed to validate the output of the simulation model were gathered through a series of vehicle counts conducted at selected parking lots in the park. The number of vehicles in the Wolf Ranch (Delicate Arch), The Windows, and Devil's Garden parking lots were counted 11 times a day between 6:00 a.m. and 10:00 p.m. on four days during the period from August 19 – 25, 1997. The total number of vehicles entering the park was recorded with traffic counters on each of the days that parking lot counts were conducted. The parking lot count data were compared to parking lot values output by the simulation model run at total use levels equivalent to the number of vehicles entering the park on the days validation data were collected.

Model Algorithm and Programming

The Arches National Park travel simulation model was built using the object-oriented dynamic simulation package, Extend (1996). The structure of the model was built with hierarchical blocks that represent specific parts of the park's road and trail systems. The simulation model is comprised of three main types of hierarchical blocks, including entrance/exit blocks, intersection blocks, and road and trail section blocks.

Entrance/exit blocks were built to generate simulated visitor parties. Visitor parties are generated by the simulation model based on an exponential distribution varying around mean values calculated from the park entrance counts recorded by the traffic counter. The exponential distribution has been demonstrated to accurately simulate arrival rates at park areas with random arrival patterns (Wang & Manning, 1999). Within the entrance/exit block, newly generated visitor parties are assigned values for a set of attributes designed to direct their travel through the simulated park visit. First, visitor parties are randomly assigned travel modes (automobile or bus) and group size, both according to probability distributions derived from the visitor surveys. Next, travel speeds are assigned to visitor parties according to a lognormal distribution. The mean travel speed and standard deviation of the distribution were calculated from the travel times reported by survey respondents and the lengths of their travel routes. The lognormal distribution has been demonstrated to accurately simulate different travel speeds in parks (Wang & Manning, 1999). Lastly, the visitor parties are randomly assigned a route identification number that directs groups through their simulated park visit. Travel route identification numbers are assigned to visitor parties according to frequency distributions of actual routes reported in the visitor surveys.

Intersection blocks were designed to direct simulated visitor parties in the right direction when they arrive at road and trail intersections. Lookup tables unique for each intersection direct visitor parties to the next park feature (e.g., road section, trail section, parking lot, attraction site) selected from the set of alternatives at the intersection. The direction of travel selected for a visitor party at each intersection is based on the value of the group's route identification number and the number of previous times, if any, the group has been through the intersection.

Road section blocks were built to simulate travel along park roads. Simulated visitor parties are delayed within each road section they enter for a length of time determined by their assigned travel speeds and the length of the road section. Similar to road section blocks, parking lot and attraction site blocks were designed to hold simulated visitor parties for periods of time based on data collected from the visitor surveys. Parking lots were also designed to output the number of visitor parties parked at each parking lot throughout the simulated day. Attraction site blocks were designed to output PAOT at selected attraction sites throughout the simulated day.

Model runs

A series of model runs were conducted to achieve three purposes; 1) to estimate the maximum number of visitors that can be allowed to hike to Delicate Arch between the hours of 5:00 a.m. and 4:00 p.m. without violating the standard of quality for PAOT at Delicate Arch (i.e., to estimate a social carrying capacity of Delicate Arch); 2) to estimate the maximum number of vehicles that can be allowed to enter Arches National Park between the hours of 5:00 a.m. and 4:00 p.m. without violating the standard of quality for PAOT at Delicate Arch (i.e., to estimate a social carrying capacity of Arches National Park); and 3) to validate the simulation model by comparing actual parking lot counts with parking lot data generated by the simulation model. Each run simulated park use from 5:00 a.m. to 4:00 p.m. As noted earlier, safety concerns (i.e., stopping vehicles after dark) prevented vehicle and tour bus travel route surveys from being administered after dark. Therefore, the model does not simulate visitor use during the evening hours.

For the first objective, estimating a social carrying capacity of Delicate Arch, the model was run at a range of total use levels representing the number of visitors hiking to the Arch. Twelve runs were made for each use level to capture stochastic variation. The average percent of time that PAOT at Delicate Arch exceeded 30 (i.e., the maximum acceptable level of PAOT at Delicate Arch) was recorded for each total use level modeled. This process was repeated to estimate a social carrying capacity of Arches National Park, except that the total number of vehicles entering the park was modeled.

To achieve the third objective, validating the simulation model output, a series of 48 model runs were conducted. Model runs were conducted for each of the total park use levels recorded during the four days that parking lot counts were recorded. The model runs were repeated twelve times for each of the four simulated days to capture stochastic variation. The number of vehicles in selected parking lots was tracked through each simulated day. For each of the total use levels modeled, the average number of vehicles in the selected parking lots was calculated at time intervals that matched the actual parking lot count times and compared to observed data.

RESULTS

Social Carrying Capacity of Delicate Arch and Arches National Park

Numerical estimates of social carrying capacity of Delicate Arch and Arches National Park are reported in Table 1. The figure in the first column of Table 1 indicates that the estimated social carrying capacity of Delicate Arch is 315 hikers. That is, the model estimates that a maximum of 315 people can be allowed to hike to Delicate Arch between the hours of 5:00 a.m. and 4:00 p.m. without violating the standard of quality for PAOT at Delicate Arch. The social carrying capacity of Arches National Park is estimated to be 750 vehicles. In other words, the model results suggest that a maximum of 750 vehicles can be allowed to enter the park between the hours of 5:00 a.m. and 4:00 p.m. without having PAOT at Delicate Arch exceed 30 more than 10 percent of the time.

Delicate Arch	Arches National Park
315 hikers (5:00 a.m. - 4:00 p.m.)	750 vehicles (5:00 a.m. - 4:00 p.m.)

Table 1. Numerical Estimates of Social Carrying Capacity

	T statistic
Windows parking lot counts	-3.00*
Delicate Arch parking lot counts	1.46
Devil's Garden parking lot counts	-0.28
Park-wide parking lot counts	-0.40

Table 2. Parking Lot Validation Statistics

Model Validation

Table 2 presents validation results based on comparisons between actual parking lot counts and model outputs. The four days of counts were combined and a set of four t-tests were performed to test for statistically significant differences among observed data and model outputs at each of the three parking lots and park-wide. There was a statistical difference found among observed data and model outputs only at the Windows parking lot.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Study findings suggest that it is feasible to develop a park wide model of visitor use encompassing both vehicle and pedestrian travel. Moreover, such a model can be used to develop relationships between use (e.g., the number of vehicles entering the park each day and the number of visitors hiking to Delicate Arch each day) and the condition of indicator variables (e.g., PAOT at Delicate Arch). Such a model can be used to provide numerical estimates of social carrying capacity of an attraction within a park or protected area. Further, as this study demonstrates, a travel simulation model can be used to estimate a park-wide social carrying capacity.

While monitoring is incorporated as an important element of contemporary carrying capacity frameworks, constraints on human and financial resources often limit the ability of park and protected area staff to conduct comprehensive monitoring of crowding-related indicators of quality. Further, due to the dispersed nature of visitor use of parks and protected areas it is often difficult to conduct monitoring through conventional means such as field observations. The application of computer simulation modeling to defining and managing social carrying capacity of parks and protected areas facilitates a proactive approach to monitoring. Specifically, rather than monitoring the field conditions of indicator variables as they change in response to expanding visitor use, simulation modeling can estimate the condition of indicator variables under a range of visitor use levels. While simulation modeling does not eliminate the need for on the ground monitoring of indicator variables, it has the potential to reduce the costs, time, and related challenges associated with monitoring crowding-related conditions of parks and protected areas. In this way, simulation modeling makes it more feasible for park and protected area staff to engage in the process of experimentation and learning that is characteristic of adaptive management.

Findings from this study suggest that managers at Arches National Park can use the simulation model to inform decisions about how to manage social carrying capacity. Among the options available for managing social carrying capacity at the park is the alternative to regulate the amount of visitor use at specific attraction sites within the park. As mentioned previously in this paper, the simulation model provides managers with numerical estimates of social carrying capacity at Delicate Arch. Managers could use this information to guide decisions concerning the appropriate number of visitors to allow to hike to Delicate Arch. However, in some cases, regulating where visitors are allowed to travel within a park or protected area may limit visitors' choices to an undesirable extent and may be difficult for managers to implement. An alternative approach would be to regulate the amount of visitor use at the park-wide level. That is, it may be preferable to visitors and easier for managers if the number of people allowed to enter the park is regulated, rather than limiting where visitors may go once they are in the park. Decisions about how to regulate the total number of visitors entering Arches National Park can be informed by the numerical estimates of park-wide carrying capacity generated by the simulation model in this study.

Visitor use limits should be considered a last resort for managing social carrying capacity in national parks and related areas. Other forms of management, such as public transportation, permit systems, and site design may provide adequate solutions to social carrying capacity issues without having to limit use. Further research should explore the use of simulation models to estimate the effectiveness of alternative visitor management practices. For example, to what degree does redistribution of spatial and temporal visitor use patterns through a permit system affect PAOT at attraction sites and/or the number of encounters among hiking groups? To what extent are crowding-related conditions of national parks and related areas affected by the use and design of public transportation systems? Additional research should assess the capacity of simulation modeling to address these and related questions.

As noted earlier in this paper, statistical tests used to validate the simulation model indicated a significant difference between actual and model vehicle counts for the Windows parking lot. However, statistical tests supported the validity of model output based on parking lot counts at Delicate Arch, Devil's Garden, and all three parking lots combined. While these results are encouraging, further efforts to validate the model are warranted. Specifically, additional parking lot counts, as well as PAOT counts at selected park locations, would provide the basis for further comparisons with simulation model output and strengthen conclusions about the validity of the model output.

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A Spatial Model of Overnight Visitor Behavior in a Wilderness Area in Eastern Sierra Nevada

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Abstract: This paper documents an attempt to simulate spatially the behavior of a group of sampled overnight visitors in a dispersed recreation setting – the Humphrey's Basin region of the John Muir Wilderness in the eastern Sierra Nevada Mountains. This study utilizes spatial data depicting the behavior of backcountry visitors in Humphrey's Basin to formulate a model based on cost surface techniques in a geographic information system (GIS) to develop a measure of visitor effort expenditure as a way of describing factors influencing spatial distribution of camping behavior. This hiking effort index model (HEI) measures the accumulative cost hikers expended to traverse varying distances between campsite locations in the study area. The cost grid input for the HEI model consisted of a) a slope factor derived from digital elevation models (DEM), b) the measured hiking times of backpackers at various slopes, and c) the relative cost of traveling either on or off trail. The model measures relative travel cost in units of hiking minutes. The model was tested using a subsample of the actual spatial data of visitor behavior not used in the running of the HEI model. Results indicate that the HEI model does accurately simulate the spatial distribution of visitors. This study thus suggests that human behavior in a dispersed recreation setting can be successfully modeled as well as pointing to ways of further improving simulation techniques
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INTRODUCTION

Social scientists recognize that human spatial patterns are more than just background to or expressions of social action. They understand that spatial patterns are instrumental to the formation and reproduction of human behavior (Penn and Dalton, 1994). Yet, little research exists that describes how people distribute themselves within recreation systems (Wang and Manning, 1999). This means that significant aspects of the character of encounters, conflicts, experience opportunities and benefits in recreation are not well understood (Gimblett et al., 2001).

Much of the research about recreation in wildernesses and other protected areas during the last forty years has concentrated on adapting the concept of carrying capacity to recreation use (Stokowski, 2000). The carrying capacity work, and its theoretical complement, normative theory, have produced useful findings (Shelby et al., 1996; Cole and Hammitt, 2000). Yet, researchers have debated the applicability of the carrying capacity concept to human recreation issues for years (Wagar, 1974; Manning and Lime, 2000).

One critical deficiency of human dimensions research is the lack of data that captures actual patterns of human use of natural resources (Ewert, 1996). Managers in heavily used wilderness areas have been found to rely for the most part on personal opinion in their decision-making (Cole, et al., 1997). Basic information on human use in protected areas is patchy (Manning, 2000). The low frequency of monitoring of human use belies its importance to wilderness management (McClaran and Cole, 1993). Recreation use is still inadequately measured and described (Watson, et al. 2000). Without better data better models of human use patterns can't be produced (Machlis and McKendry, 1996). The data that needs collecting should be of the type, and only of the type, that is actually needed by managers and other decision makers (Williams, 1998).

A stated objective of new recreation models is to empower land managers to make better-informed decisions while reducing the negative consequences of policy decisions. Models have been defined as simplified copies of complex entities or systems, copies that allow otherwise impossible or impractical study of the most important aspects of those systems (Gilbert and Troitzch, 1999). In the case of a recreation model of a wilderness area, an effective spatial/temporal model of a backcountry area could enable managers to comprehensively map human use and preview the implementation of policies and their consequences (Gimblett et al. 2000). In contrast to human use pattern models that are derived from spatial/temporal data, policy decisions based solely on experience and intuition and tested through trial and error tend to be costly, time-consuming and harmful to visitor relations (Shechter and Lucas, 1978).

A spatial model is particularly appropriate in a recreation context because how visitors perceive impacts and the quality of their experience is predicated to a significant degree upon where exactly encounters and conflicts occur. A significant problem in simulating human use patterns is the complexity of human behavior. An outstanding feature of models such as the wilderness use simulation model (WUSM) was their capacity to handle complexity. Therefore, the objectives of this study were to simulate the character of human behavior by isolating some of the contributing factors into that behavior.

STUDY AREA

This study was conducted in the Humphrey's Basin area of the John Muir Wilderness. Humphrey's Basin is an alpine lakes basin located in the Inyo and Sierra National Forests in California. It is located about 32 km. west of the town of Bishop, which is approximately 480 km. east-southeast of San Francisco and 440 km. north of Los Angeles. For the purposes of this study, Humphrey's Basin is defined by Lake Italy to the north, the Pacific Crest Trail to the west, the Kings Canyon National Park boundary along the Glacier Divide to the south, and by North Lake to the east. This defined area is 145,763 acres or 590 sq. km. Practically speaking though, the actual boundary of the study area was defined by the map provided for participants upon which they recorded their information. Any visitor behavior that occurred within the confines of the map provided as part of the data collection was deemed to have taken place within the study area itself.

Humphrey's Basin is ideally suited for studying complex recreation behavior. Being a large wilderness area it offers varied settings in which visitors can travel on- and off-trail, and can choose destinations from innumerable suitable locations. Although permits are required by the Forest Service for overnight use in the John Muir Wilderness, backpackers are free to camp wherever they please, as long as they camp the stipulated distance away from water sources. The basin is accessible to and used by dayhikers, overnight backpackers, packstock trips (trips using pack animals -- horses and mules) and guided mountaineering trips.

UNIVERSITY OF ARIZONA STUDY

The data used to build the HEI model was collected as part of a larger study conducted cooperatively by the Forest Service and the University of Arizona. The Forest Service contracted with the university for two seasons of data collection on backpacker, packstock outfitter and mountain guide use in nine study areas during one season and in three of the same areas the following season. Humphrey's Basin was one of those areas studied both years. The Forest Service has used data drawn from the study in the completion of a general management plan for the John Muir and Ansel Adams wilderness areas. Their use of the data is not related to this study in any way.

Data from the Arizona/Forest Service study were collected during two seasons, 1999 and 2000, of permitted overnight backcountry use in the nine study areas. Dayhikers were not asked to participate. Data was collected for a total of eight months spread over the two seasons. In both study seasons, data collection forms were first distributed on or just before the fourth of July and were continuously available until the end of the backcountry season. The end of the season varies yearly, depending on the arrival of snow. In 1999 and 2000, season's end occurred sometime in late October.

Data was collected through the use of a type of trip diary or, as they were referred to for the purpose of this study, trip reports. The traditional recreation data collection mechanisms, interviews and surveys, were not used for this study. Those methodologies don't capture situational effects well, while visitors may have no conscious strategy in their spatial behavior and might not be able to articulate it even if they did (Stewart, 1998; Gilbert and Troitzch, 1999).

Some research indicates that observing a sample of trails and trailheads on sample days produces optimal data on visitor behavior. This method wasn't feasible in this study, given the cost that would be involved and the size of the study areas. Using self-administered methods, as in the case of mandatory permit systems, generally has been found to produce adequate results (Lucas and Kovalicky, 1981).

Each trip report consisted of three sections. The first solicited general information about visitors and their trips. This information included what trailhead each party left from. Section two was a series of questions regarding visitor satisfaction with different features of the wilderness experience. The section's data had no bearing on the development of the spatial models that concern this discussion.

The final section of the trip report asked wilderness visitors to record where they went on their trip, whom they encountered there, and how long they spent at each campsite. Each separate study area contained a different map. Like the satisfaction information, the encounter information isn't relevant to this model. The data that does concern this model was where visitors camped and for how long. Visitors denoted the location of each camping incident by marking a dot on a map included in the trip reports. Alongside each dot visitors wrote on the map the night or nights they spent at that campsite. Only camping occurrences that took place in Humphrey's Basin were counted and analyzed for this model. Accordingly, information from visitors who began their trips outside of the basin but spent part of their stay within the area was included in this study.

Trip reports were distributed to visitors through a number of outlets. Trip report stations that allowed the reports to be self-administered by visitors were set up at feeder trailheads that provide access to Humphrey's Basin. In 2000, the Forest Service sent trip reports to all visitors who received their permit by mail. This wasn't possible in 1999. The trip reports came with a self-addressed postage-paid envelope. Visitors were instructed to take a trip report with them during their visit, complete it as they went along, and then seal the finished report in the envelope and drop it in the mail. Reports were mailed to the University of Arizona in Tucson, AZ.

The data collection methods used in this study acted as a limitation to the precision of the eventual modeling results. The backcountry visitors who participated in this study were not selected in a strictly random manner. Not all visitors had an equal chance of receiving a trip report and there was some degree of bias in what portion of the population of visitors returned completed trip reports. An overwhelming majority of returned trip reports came from people who took them at trailheads. Only an insignificant portion came from those administered through the other distribution methods. Therefore the sample used in this study can't be said to be strictly representative of visitors to Humphrey's Basin. Also, visitor use studies have concluded that visitors often misreport where they go in the backcountry. Ideally, observers would record visitor behavior (Cole et al. 1997).

MEASURING DISTANCE BY A COST SURFACE

Once the data was collected from the wilderness study area, the next step was to find the principle on which to build the model. Rossmo argues that the most fundamental analytic device in geography is the nearness principle, also known as the least-effort principle. Rossmo defines the least-effort principle as: given his choice, a person will select a route that requires the least expenditure of effort. This suggests that all other factors being equal, hikers will always chose the closest destination (Rossmo, 2000). Tests of animal behavior demonstrates that animals do use least-cost pathways (Ganskopp and Johnson, 1999). But how does one define closest? Does it involve more than just distance? Rossmo argues that the perception of distance is influenced by the relative attractiveness of destinations, the number and types of barriers along the route, the traveler's familiarity with the route, the actual physical distance, and the attractiveness of the route.

The nature of the data collected in the Sierra excluded consideration of all but two of the influences Rossmo cites. The data from Humphrey's Basin meant a spatial model would have to be constructed from the distance traveled by hikers and the barriers they faced on their trips. DeMers states that the way to show the functional distance covered by travelers is to calculate an impedance value for their trip. This impedance value is the accumulative cost incurred as distance is crossed (Demers, 1997). Accumulative cost assigns a distance value to a route that counts some associated measurement besides feet or meters. For example, the accumulative cost of the flow of water runoff might measure impedance by the degree of slope of the terrain and the density of vegetation screens along the route. Thus, for hikers in the Sierra, the accumulative cost of hiking would be the total expenditure of effort, however that is measured, they expend to negotiate the landscape.

Raster-based GIS calculate the accumulative cost of a route in the form of a cost surface. To produce a cost surface, which is represented by a tessellated grid, one selects a starting point, or source cell, which has an accumulated cost of zero. As the GIS window moves across the cells adjoining the source cell, the GIS adds the cost of traversing each cell to the total already counted. For example, crossing a cell adjacent to the source that has an associated cost of 1 would leave the journey with an accumulated cost of 1. If the next cell crossed has an associated cost of 2, the accumulated cost to that point of the route would be 3, and so on until the terminus is reached. So, a cost surface is the representation of the value associated with the difficulty of traveling to each point on the surface from the starting point. Accordingly, locations on the cost surface that are remote from the source cell will have much greater values than cells proximate to the starting point.

ASSIGNMENT OF ROUTE COST

The topography of Humphrey's Basin was represented by a digital elevation model (DEM). This DEM was constructed by reformatting eight DEMs into grids using the ArcInfo GIS and then combining them. The eight 1:24,000-scale (7.5 minute) digital elevation models (DEMs) used to represent the study area were obtained from the US Geological Survey. The DEMs used in this study were of Florence Lake, Mt. Darwin, Mt. Henry, Mt. Hilgard, Mt. Thompson, Mt. Tom, Tungsten Hills and Ward Mountain. These DEMs were combined by the *mosiac* command in ArcInfo. GIS allow reprocessing of DEMs into maps representing various features latent in topography. One determinant of cost in the HEI model would be the degree of slope of the cells hikers traversed in the cost surface. ArcInfo was used to reclassify the combined DEM into a grid representing slope values for the area.

The degree of slope had to be translated into some unit of measurement to depict the relative cost of each cell. Time was chosen as the measurement unit. Wagtendonk and Benedict conducted a study of travel time variation among backpackers on trails of different slope in Yosemite National Park (Wagtendonk and Benedict, 1980). They timed backpacking parties as they hiked a mile on a trail of gentle rise (.75%), a trail of moderate rise (5.0%), and a trail of severe rise (12.5%). They considered trails of this slope to be the only pertinent routes in Yosemite. They did extrapolate these measurements later to obtain travel times for trails of steeper slopes. A c*on* state- ment in ArcInfo was used to reclassify the slope grid using the travel times in the Yosemite study and thus obtain a cost grid of hiking times for each cell in the study area. Cells having a gentle slope were assigned a value of .019, those with a moderate slope were assigned a value of .023, and those cells with steep slopes were assigned a value of .025. These values were reached by taking the averaged slope class values that represented number of minutes needed to hike a mile. These values were then converted for travel times needed to cross a one-meter cell.

Hiking cross-country is almost always more difficult than doing so on established trails. To account for this increased difficulty for hiking cross-country, each cell in the study not associated with a hiking trail in Humphrey's Basin was assigned double the impedance value. This doubling of difficulty values was chosen to reflect the increase in difficulty that hiking off-trail involves without inordinately skewing the influence of this factor on the model's results as a whole. Therefore the range of values in the cost grid to be used in the production of the cost surface were from .019 minutes for cells on a gentle slope and trail to .051 minutes for cells on a severe slope without a trail.

RUNNING THE HEI MODEL

The cost spent in time hiking was then calculated for each applicable segment of travel between campsites used during backcountry visits in Humphrey's Basin. This derivation of hiking effort times, which does not correspond to the actual time elapsed between campsites, but rather the cost of travel as expressed in hiking times, was done in two sections: first nights and last nights. The first night section comprised segments where the travel was between the Piute Pass trailhead and a first night's camping. A grid was made with just the Piute Pass trailhead. This source grid and the cost grid were the inputs to the c*ostdistance* function in ArcInfo. Only first nights of trips that originated at the Piute Pass trailhead were used. There were 229 reported first nights of this type in the database. Of these, 10% were not used in the model. These 23 would be used to test the model later. The 10% figure was chosen because it provided the best compromise between the conflicting needs to have a large enough sample to run the model and still have a sufficiently large reserve sample set aside to test the model with.

Section two, last nights, used all final nights of any trip that terminated at the Piute Pass trailhead. The source grid was again the Piute Pass grid. Any camping incident was used as long as it was the last night of a trip and it ended at this trailhead. Also, the concluding night's campsites of trips beginning outside the study area were included in this section as long as the final night occurred within Humphrey's Basin and the trip ended at the Piute Pass trailhead. There were 233 total nights in this section. Setting aside 10% for model verification, left 210 for running the model.

TESTING THE HEI MODEL

To test the accuracy of the hiking effort index model, a cost surface with the Piute Pass trailhead as the source point was produced. This surface was then reclassified into zones corresponding to the 20%, 40%, 60%, 80% and 100% percentiles of the First Night and Last Night sections. The procedure for testing was to overlay the 10% sample of camping incidents set aside from the two sections on the zones created from the model. If the model has any validity the 10% subset, randomly chosen through the SPSS statistics software, would fall within the zones in the same percentages as occurred in the larger set. For instance, for first nights, 20% of campsites had a HEI figure of 88.8 or less. Therefore one would expect 20% of the 10% subsample or 4.6 incidents to fall within that first zone. Likewise, 40% of the 23 or 9 should fall within the zone delimited by zone two, which had a zone boundary denoted by the HEI number of 124.4.

RETURN RATES FOR TRIP REPORTS

521 trip reports were returned from the Humphrey's Basin study area, 324 from 1999 and 197 from 2000. There are several ways to judge the success of this return. One way is to compare the number of returned reports with the number of reports actually put into the hands of overnight visitors. Because of the logistical difficulties of administering this study, such a comparison can only be broadly estimated. Given the numerous distribution points – pack stations, mountaineering centers, ranger stations, visitor centers, etc. – and the length of the study periods, no census of the actual number of trip reports given to visitors has been conducted. A general estimate is that between 6,000-7,000 were handed out for all areas in 1999. 1455 trip reports were returned from all areas that same year. No figures are available for Humphrey's Basin alone. For 2000, around 2,000 reports were probably handed out in the three areas. Of those 397 total were mailed back. So, 1999 had a return rate (using 6,500 as the number given out) of 22.3%. 2000 had a rate of 19.8%. This is a rough measure of the percentage of permitted parties who knew of the study and participated.

Another way of judging the participation rate is to compare the number of returned reports with the number of permits issued. This analysis can be done on the study areas separately. 1007 permits were issued for Humphrey's Basin trailheads in 1999. That is a return rate of 32.2%. This was the second highest rate return rate of the nine study areas. 644 permits were issued for use in the Mono Creek study area, which is located directly to the north of Humphrey's Basin. 139 trip reports were returned from there, a 44.7% rate. The lowest return rate, 16.1%, was in the Rush Creek area. 323 permits were issued for there and 52 trip reports returned. The percentage of reports returned against permits issued for all nine areas was 25.1%, 1371 against 5467 (one study area had no figures for permits issued). No figures were available for permits issued for 2000. This analysis begs the question of whether in this kind of study returns rates are of the same significance as they are in studies of visitor satisfaction. In those traditional recreation research studies consensus on the quality of experience is sought after. This study seeks to uncover use patterns, and for that there is no precedence established for how much data is needed to accurately establish those patterns.

RESULTS OF THE HEI MODEL

The presentation of the model results is done for all results, first nights, and last nights, as defined above. The table of the frequency statistics of the hiking time segments lists the results of the HEI analysis (table 1). The mean figure of 209.2 for all segments represents the cost in minutes of hiking effort that sampled backpackers expended on the average segment for all trips included in this survey. Histograms for all results and each of the two sections of analysis graphically present the distribution of hiking times (figure 1).

Segments	All	First	Last
n	460	228	232
Mean	209.20	178.57	239.31
Median	199.01	138.79	233.56
s	107.61	100.61	105.96
Minimum	4.74	4.74	22.24
Maximum	662.54	457.92	662.54
Range	657.79	453.18	640.30
20th percentile	116.49	88.80	135.18
40th percentile	179.82	124.44	202.46
60th percentile	231.22	188.19	265.10
80th percentile	295.85	278.96	302.50

Table 1: Results of HEI model, in minutes of hiking effort.

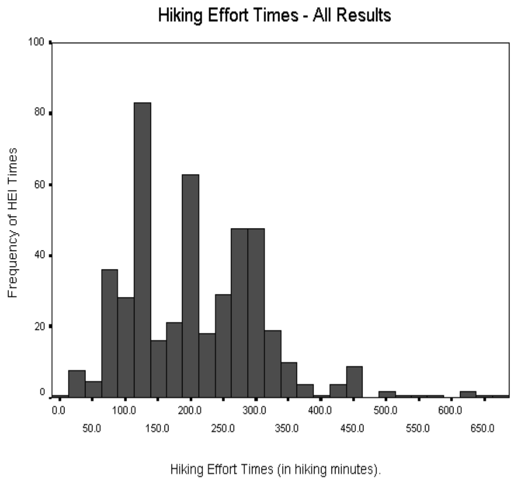

Figure 1: Histogram of hiking effort times for all segments run in the HEI model, n = 460.

TEST RESULTS OF HTI MODEL

The models of first and last nights both performed well. All 23 values of the test sample for both models fell within the study zones. As a whole, the first night model slightly underestimated the values, while the last night section slightly overestimated the values. For the 20th percentile, first nights were 35% under the expected value. Last nights were 35% over. First nights were within 2.2% of the expected value at the 40th percentile. Last nights were 23.3% over there. At the 60th percentile, first night values came within 1.4%. Last nights improved to being only 8% over the value. First nights stalled at the 80th percentile, and fell to being 24% under. Last nights held steady at 7.4%, this time being under. On average, the first nights section was 12.5% under the expected value. The mean of the discrepancy figure for last nights was 14.7%. The average accuracy for both sections was therefore 13.6% within the expected value. Chi-square tests on both sets of results confirm the accuracy of the model. With 4 degrees of freedom, the 95% chi-square statistic is 9.488. If the first and last nights sections were accurate one would expect to get chi-square results below 9.488. The first nights chi-square result was 1.609. The last nights result was 2.314.

DISCUSSION

The results of the hiking time analysis were not normally distributed. Both the first nights and last nights sections evidence multi-modal distributions. Both sections are positively skewed as well. Due to the presence of an obviously anomalous outlier, the range of all the results was inflated. This outlier, the maximum value of all results, was from the first nights section and represented a result so large that it was almost definitely the product of an error. Removing that value from the database reduces the range of results by 160 minutes of hiking time. Still there was great variance in the times recorded.

Removing the outlying values from the high end and some from the very low end in each section produces much more tightly grouped results. Once this is done it's clear that most segments took between 75 and 325 minutes of hiking time. The most frequently recorded times were 125 minutes and 200 minutes. The last nights had a larger corrected range than did the first nights. Both the last nights and the first nights had strong multi-modal distributions. Though there was a range of values in the percentiles listed in the table of results, that range wasn't that great. This supports the findings that there was a strong tendency of the results to cohere around the mean values. Not surprisingly the values for each of the percentiles grew larger as nights got later in the represented trips.

Despite the presumed diversity in personality types, levels of experience, goals and expectations of visitors to the study area, the hiking effort index results reveal some significant trends about hiking behavior taking place there. As the frequency statistics show, an average hiking segment in Humphrey's Basin took about 3 ½ hours of hiking time. The bias of the results to the positive side indicates that there are some hikers who, for at least part of their visit, hike for a much longer time than the average. This was to be expected. Still, contrary to expectations, these extreme hikers represented a relatively small percentage of the entire population of backcountry visitors. First night hikes, those from the trailhead to the first campsite, on average were the shorter of the two sections. Last nights were on average more than an hour of hiking effort longer. One can infer that visitors covered less ground early in their trips, increased distances as they went along, and did their longest hikes to return to the trailhead from their last campsite.

The spatial significance of the distributions of hiking times in all sections was marked. Most important is that these distributions show that campers preferred some areas to others, and that that preference had a very definite spatial aspect. The peaks in the histograms of hiking times correspond to those areas in Humphrey's Basin where visitors camped most often. For the results from all incidents, the most popular areas were those that correspond spatially to the hiking times of first, 125 minutes, and second, 200 minutes. The third most popular locations are those that correspond spatially to the hiking times grouped from 250 minutes to 300 minutes.

Another revealing occurrence is that the contrast of these popular times from the times next to them is so great. The 120-minute section in the histogram of all results had a frequency of 84. The sections on either side of it had frequencies of only 16 and 28. That means the 120-minute time, and destination, were much, much more frequented than those right next to it.

Thus, visitors repeatedly chose to camp at destinations that corresponded to very specific and narrow hiking times, and chose to pass over areas that were just around it. Thus the model demonstrated a very fine level of resolution to the spatial aspects of visitor behavior in the study area.

CONCLUSION

The results of this study strongly suggest that accurate spatial modeling of human behavior in dispersed recreation settings is possible. Limitations of the data collection methodology notwithstanding, the HEI model accurately simulated where backcountry visitors would camp. Additionally, the model characterized the differences in hiking behavior between the different portions of visitor trips. These attributes of the HEI model could assist recreation managers in understanding the spatial and temporal aspects of use in their protected areas. All human hiking behavior is a combination of "push and pull" influences, i.e. effort and attraction. This model concentrated on the "push" factors. Further study should entail modeling the complementary facets of the relative influence of landscape attractions – the "pull" of prime camping locations, scenic vistas and peaks for climbers – on visitor distribution.

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Cyclical Visitor-Behavior Patterns of Urban Forest Recreation Environments and their Determinants – A Statistical View

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Abstract: Urban forest recreation environments have their particular rhythms, not only natural periodicities, but also periodicites of their human members (vistors, rangers,...). A human forest ecosystem as a basic unit of analysis can be defined as an interaction between the population, the organization of forest and the technology in response to the environment. In order to manage such forest ecosystems information about the recreation demand of visitors is needed, particularly about the rhythms of the visitor flow. A scientific project in Stuttgart, a town in South-Germay, provides for an example. The central objective of this paper is to detect periodicities in a time series of frequencies of certain groups of visitors, observed by a fix video camera over one year (March 1999-March 2000) (n=1421 measurements). A not widespreaded statistical method, the spectral analysis, will be applied on the data. Certain periodicities can be found, especially a day-cycle, week-cycles and year-cycles for the various groups of visitors. Impacts of weather (sunny, cloudy, rainy) and weekday (weekend or not) have significant influence on the visitor flow. A simulation illustrates the shape of the cycles, which are detected.

INTRODUCTION

Urban forests as human ecosystems have their particular rhythms, and member of Homo sapiens – vistors, residents, rangers – are part of them. To manage this forests without a sense of these rhythms is unrelastic, myopic and not sensible. The concept of „human ecology“ proposed by Hawley (1950, 1986) can serve as theoretical framework for both urban forest management and urban forest research. The human ecosystem as a basic unit of analysis is defined „by the interaction of *population*, *social organization*, and *technology* in response to *environment*“ (Machlis, 1989, p.158). This interaction can be recognised as a mutual adaption of this four components in a biological sense

In Germany there is a lack of detailed knowledge not specially of the biological ecosystem or of the social organization but of the visitor behavior and of its rhythms. Therefore the focus of this paper lies on the research of visitor behavior and its periodicities in a forest recreation environment. A forest science project in the forest of Stuttgart provides for the database. The research issues of this statistical-method orientated paper are:

1. Are there any periodicities in the visitor flow over one year?
2. Differ various groups of visitors as walker, jogger, cyclist in their periodicities?
3. Are there any impacts of weather or week-day on the frequencies of visitor?
4. Is it possible to simulate the visitor flow over one year?

THEORY

The concepts of forest recreation environment in Germany differ widely form the concepts in the USA. In the USA this theme is discussed under the heading of park and wilderness management. That means ecosystems f.ex. forests are diveded in one part, the park, which is easy accessible for visitors and in another part, the wilderness, which is not accessible for visitors, because there is a lack of clear path, roads... and in the whole a lack of safety. Due to the ecological micro structures of German forest ecosystems there is no park culture in Germany. The forest have to fullfill simultaneously multiple demands: recreational needs, nature protection and natural ressources (wood...).

Although the views of forest recreation environment in USA and Germany don`t accord, the theoretical concepts of park management, f.ex. suggested by Agee & Johnson (1988) can be used by German forest scientists and environment psychologists for research and design of forest recreation environments, particularly the theory of human ecology. The roots of human ecology lie primarily in general ecology, sociology, and anthropology. It is faced with the relation between physical environment and behavior. The two key assumptions of human ecology for Machlis (1989, p.161) are: „Assumption 1. Homo sapiens is both biological and cultural. A significant portion of human social behavior is biologically determined... Assumption 2. Homo sapiens is ecologically interdependent with the natural world." Support for the first assumption comes strongly from the discipline of socialbiology (Wilson, 1975). Johnson & Agge (1988, p.6) stress on four elements of biological and social systems:

(1) „Ecological systems are continually changing.
(2) There may be substantial spatial heterogeneity in impacts from particular action.
(3) Systems may exhibit several levels of stable behavior.
(4) There is an organized connection between parts, but everything is not connected to everything else".

The temporal and spatial properties of both parts the biological part and the human part seem to be essential for the consideration of forest (human) ecological systems. Marlies (1989) asks the question, what we need to understand an ecological recreation area in order to mange it wisely. Beside the knowledge about the physical environment, information of the various groups of human populations, that use the park and their visit flows is needed.

This brings us to the viewpoint of this paper: to look on the temporal properties of visitor flows in recreation areas. Form a statistical perspective you have a time series of observed behavior frequencies of different kinds of visitors f.ex. walker (Möbus & Nagel, 1983; Schmitz, 1989). You can analyze time series in the time domain or as here suggested in the frequency-domain, which is up till now not widespreaded in the social sciences and particularly in the environmental psychology (Larsen, 1987; Mc Burnett, 1997). In its most general form, spectral analysis involves decomposing a time series into several periodic functions. It is somewhat like a regression analysis in that the objective is to account for variance in the data by fitting a model, whereby the model is nonlinear. Brigola (1997) and Butz (2000) offer introductions in fourier-transformation, an other word for spectral analysis. The harmony in music or the moon cycle can be helpful to understand the basic ideas of spectral analysis.

Suppose a periodic oscillatory wave as the tone „a" of a violin, which can be made visible by an oscillator. This observed wave as a kind of time series y_t will be understood as a combination of certain pure waves (sinus tone in music). Such a wave can be characterized primarily by a **periode P** or a **wave length**, that is the time, in which a cycle once recurs. The moon cycle has a period about P=26 days. 1/P is the **frequency f**, the proportion of the cycle, which is realized in one time unit. For example 1/26 of the moon cycle is realized in 1 day. The **amplitude A** describe the height of the wave. If you take the unit-circle with the circumference of 2π , than you can get the **circle frequency** $\boldsymbol{\omega}$=2πf. You can move the whole wave on the time axis. This was called **phase** $\boldsymbol{\theta}$. The cosinus- and sinus-functions have periodic properties. Therefore this function will be used for the following function (1) with k different harmonic waves:

$$(1) \qquad y_t = \sum_{j=1}^{k} A_j \cos(\omega_j t + \theta_j) + e_t$$

where e_t is a stationary random series and t is the time. Using the trigonometric identity $\cos(\omega+\theta) = \cos(\omega t)\ \cos(\theta) - \sin(\omega t)\ \sin(\theta)$. Equation 1 can be written as

$$(2) \quad y_t = \sum_{j=1}^{k} a_j \cos(\omega_j t) + b_j \sin(\omega_j t) + e_t$$

where $a_j = A_j \cos\theta_j$ and $b_j = -A_j \sin\theta_j$.
The function f in equation (2) is periodic in t in the sense, that

$$(3) \quad f(t+P) = f(t), \qquad (-\infty < t < \infty)$$

To estimate the parameters, the Fourier coefficients a_j und b_j, the Least-Squares method can be applied. The sum of quadratic errors e_t is thereby to be minimized.

As mentioned before the variance of the time series can be decomposed into the variances for each fourier-frequency f_k. This is called **periodogram**:

The sum of $I(f_k)$ over all f_k is the total variance of the time series σ^2_y. As in regression you can express each periodic function with its variance components as proportion to the total variance. In regression analysis this proportion is called coefficient of determination. The function I_k can also be used for **white-noise-testing** (Fisher's Kappa). If the time series consists only out of white noise, than the normalized y-coordinates of the periodogram $I(f_k)/2\ \sigma^2_y$ has a χ^2-distribution with 2 degress of freedom (Schlittgen, 2001, p.88). If there is some periodicity in the data, one period of the periodogram must show a big value. Therefore the maximum of $I(f_k)/2\ \sigma^2_y$ will be used as empirical test-value Z. The probability of H_0 „White noise" is:

$$(4) \quad I(f_k) = n \cdot (a_k^2 + b_k^2)/2$$

$$(5) \quad P(Z > z) = 1 - (1 - e^{-z})^{(N-1)/2}$$

whereby z is the observed maximum of the periodogram and N is the number of timepoints. For a periodogram-interpretation the following issues must be taken into account:

(1) Alising: Only periods P till 2*time units can be observed. To detect a two-week-cycle for instance one measurement per week on two weeks is at least necessary. If there is a cycle with lower frequency it cannot be detected, but it appears hidden as long wave. Therefore it is

important to choose a adaequate decomposition of the observed time series.

(2) Leakage: If the time series is short, there is not only a great peak in the periodogram in the main frequency, but also in the nearby frequencies. This effect decreases with increasing n.

(3) Missing-Values: To detect periodicities in a time series it is necessary to have a series without missing values.

For the last problem Schlittgen (2001, p.183f) offers several solutions. One is to replace the missing values with the average over all data. Another method takes into consideration the specific autocorrelation structure of the values nearby the missing value. At first the p-order autoregressive process AR(p) is estimated. At second the predicted values which replace the missing values are estimated by minimizing the following sums of squares of errors e_t (SS) with known autoregressive parameters α:

$$(6) \quad SS = \sum_{t=p}^{N} e_t^2 = \sum_{t=p}^{N} (y_t - \hat{a}_1 y_{t-1} - \ldots - \hat{a}_p y_{t-p})^2$$

If the partial derivatives of (6) $\delta SS/\delta y_t$ for each missing value is set to zero the predicted values are the solution of a linear equation system.

Up till now only one series is observed. If you consider simultaneously more than one time series, the multivariate spectral analysis offers you many possibilities for the analysis (Priestley, 1996, p.660). One of them is the **coherence-diagramm**, which shows for each frequency, how much the two time series are correlated. The coherence-coefficient varies between 0 and 1.

To test the influence of weather and weekday on the visitor flow a regression analysis will be used, which take into account the specific autocorrelation structure of the data, f. ex. a regression with an AR(2)-process of the random component e_t (Mutz, 1998, Becker et al. 1998) and x_j as the predictors:

$$(7) \quad y_t = \sum_{j=1}^{m} ß_j x_{jt} + \varepsilon_t$$

$$u_t - \alpha_1 u_{t-1} - \alpha_2 u_{t-2} = \varepsilon_t$$

After the presentation of the mathematical-statistical background we return to central question of this paper. Within the scope of one year several cycles (day, week, month, year) are expected to recur. The cycles of different visitor groups don't differ very much, only such between jogger and walker. The joggers start earlier in the morning or later in the evening with their forest-visits than the walker. In will be supposed, that at weekend and at sunny days the frequencies of visitors rize at maximum.

METHODS

The data are taken from a forest-science project of Janowsky (2002). The central objective of this project was to work out a forest-paths-concept for the forest of Stuttgart, a town in South-Germany, which fullfill not only the economic, but also the leisure demands for this forest. In one part of this study the visitor flow over 1 year should be observed. The data are collected by an observation-study which took place one year each day from 6 a.m. to 10 p.m. (March 1999 - March 2000), whereby the monitoring was done by a motion-sensitive fixed video camera. The data for the statistical analysis are generated by counting the behavioral events on the videotapes, aggregated for 8 time-units of 2 hours per day. Not only the total visitors are counted, but also different groups of visitors: walker, jogger, cyclist and others (cars...). The last one are not included in the statistical analysis due to its low frequencies. Additionally the weather is categorized in three groups: sunny, cloudy and rainy. For the regression analysis the categories are transformed by effect coding into dummy-variables (Cohen & Cohen, 1983). For a detailed discussion of the design and sampling see Janowsky (2001).

Because of breakdowns of the video camera only n=191 days out of 366 days can be analyzed. In order to apply the spectral analysis, the above mentioned method was used to replace the missing values with estimated values. Additionally a cubic polynomial week-trend was assumed. To estimate these values very precisely, for each month a model was fitted. The *proc autoreg*-procedure of the statistic software-program SAS was used with a slightly different algorithm as described above. Figure 1 and Figure 2 show the time series without and with replacement.

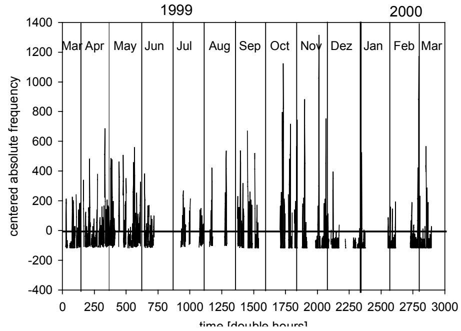

Figure 1.: Raw time series without missing value replacement

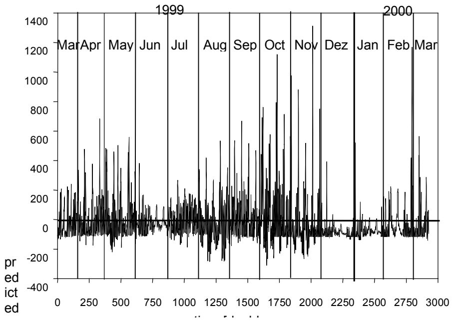

Figure 2.: Time series with missing value replacement

The total structure of the time series can be maintained by the replacement. In June 1999 or in Januar 2000 there is lack of data. Therefore the estimations are rather poor. But without substitutions spectral analysis generates misleading results. At the end 2928 double hours from 53 weeks with 5-7 days and 8 double hours per day build up the database for the spectral analysis, which is outperformed by the *proc spectra*-procedure of SAS.

RESULTS

First, descriptive statistics are calculated to describe the distribution of the frequencies. Table 1 shows the essential statistics of the distribution of frequencies over one year, seperated for the visitor groups, and total.

	M	STD	MIN	MAX	CV
walker	84.0	143.9	0	1372	171.3
jogger	27.4	34.7	0	399	126.6
cyclist	4.3	7.4	0	51	172.5
total	115.6	165.5	0	1428	143.1

Table 1.: Descriptive statistics of the raw frequencies over the whole year March 1999-March 2000 (n=1421 double hours).

As expected the walkers has the main proportion to total with a mean value of 84 per double hour and day. Than it follows the group of the joggers with a mean frequency of 27.4 and the cyclists with 4.3. The distribution is strongly asymmetric with few very high values f.ex. a maximum of 1428 visitor in double hour. To avoid biased estimates in spectral analysis these few outliers (>99% of the distribution) are replaced by the mean value. Additionally the time series was centered before the spectral analysis takes place.

Second, it was tested whether the time series is white-noise (random fluctuation). Fisher's Kappa was calculated for each visitor category (total, walker, jogger, cyclist): $T_{total}=251.88$ $p<0.01$, $T_{walker}=158.87$ $p<0.01$, $T_{jogger}=96.12$ $p<0.01$, $T_{cyclist}=300.35$ $p<0.01$. All four time series show significant periodicities. But it must be taken into account that the high sample size makes it difficult, to maintain the statistical hypothesis H_0. Other white-noise-tests as Bartlett`s Kolmogorov-Smirnov Statistic however show similiar results.

Third, the periodogram will be estimated for each visitor group and for total. Figure 3a,b show the periodograms for total and for the group of the walker. Instead of the fourier-frequency f=1/P the period P is used.

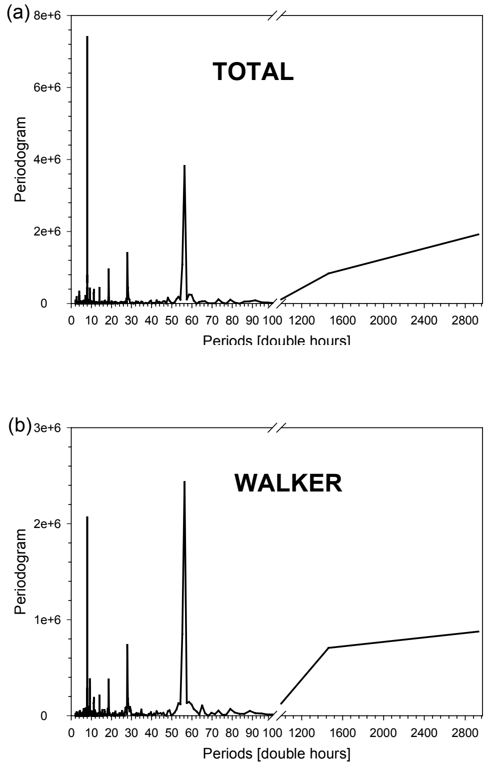

Figure 3.: (a) periodogram for the total time series (b) periodogram for the time series of the walker

The similiarity of the periodogram of figure 3a and 3b is obvious. The peaks in figure 3a indicate important cycles: at period 8 a day-cycle, at period 18.65 a 1/3week cycle, at period 27.5 a 1/2week cycle and at period 56 a week cycle (=7 days * 8 hours per day). Additionally a 1/2year-cycle at period 1464 and a year-cycle at period 2928 recur. 17.2% of the total variance of the total time series is accounted by the day cycle, 8.9% by the week cycle, 4.5% by the year cycle and 1.9% by the 1/2year-cycle. Similiar results can be found for the walker.

Therefore the day- and week-periodicity are more important than the year-cycles. Significant month-rhythms are not observed. The time structure of the visitor flow is mainly influenced by the group of the walkers. Nearby the big peaks you can find many small peaks, which probably indicate a leakage effect. Due to the high importance of the day cycles, the time series needs at this time area more differentiation. Random fluctuation in the data can be another cause for this phenomena.

In figure 4a,b you can find the periodogram of the groups of the joggers and the cyclists.

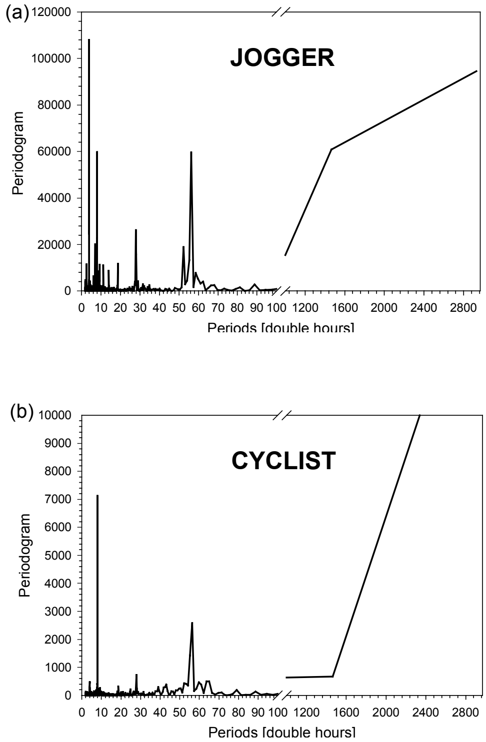

Figure 4.: (a) periodogram for the time series of the group of the jogger (b) periodogram for the time series of the cyclist

If you compare figure 3a/3b with figure 4a/4b the similiarity between this figures is apparent. The peaks in figure 4 at period 8, 18.65, 28 and at period 56 indicate a day-, 1/3week-, 1/2week- and week-cycle. A 1/2year- and year-periodicity is also found, particularly for the jogger. But there are also differences. Concerning the joggers it can be found at period 4 a 1/2day-cycle, which has the greatest explained variance-portion. It follows the 1/2year and the year-cycle in explaining the total variance of the time series at second best. While for the joggers the day-/year-periodicities play a central role, the year-cycle is essential for the cyclists. This frequency explains about 20.5% of the total variance in the time series of the cyclists. Riding a bike or jogging depends heavily on the season (warm/cold). Jogging is a sport, which takes place almost early in the morning or later in the evening, which explains the half-day-cycle.

Fourth, coherence-diagrams can illustrate, how much the time series of a special visitor group is connected to the time series of another group for certain frequencies. In Figure 5a, 5b, 5c the coherence-diagrams for the correlations between each of the time series of the three visitor groups are shown. Instead of the periods the circle frequency 2πf was used. Walker and jogger, walker and cyclist show high correlations (>.60) rather in the higher frequency domain with circle frequencies smaller than 1.0 or periods beginning at 6 (3/4day) ending at 2928 (year).

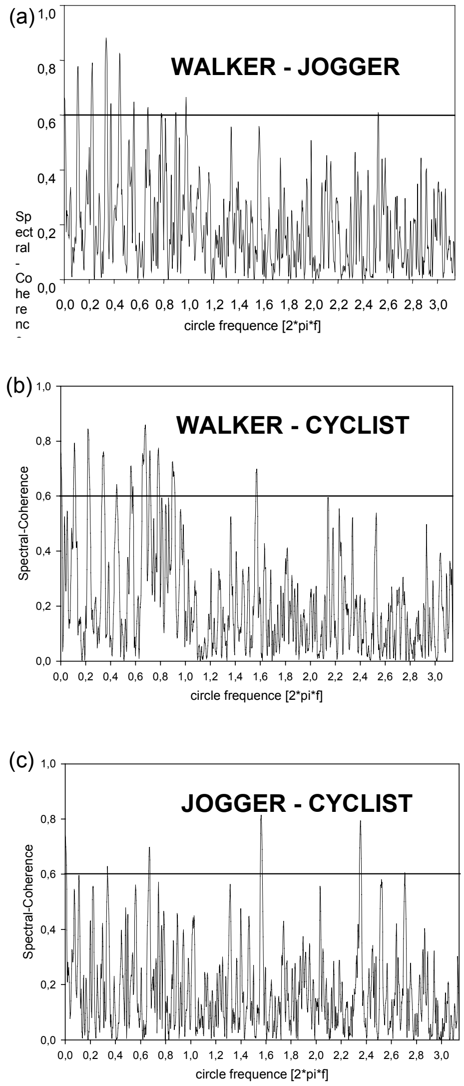

Figure 5.: spectral coherence diagram for the time series of (a) walker-jogger (b) of walker-cyclist (c) jogger-cyclist, seperated for each circle frequency. (vertical line=correlation of .60).

In the coherence diagram *jogger-cyclist* (figure 5c) the correlation for the circle frequency under 1.0 are not so high as in the in the latter one, but there are single peaks at circle frequency at 1.57 and at 2.6, which indicate a high correlation of the 1/2day-cycle and 1/3day-cycle of the two time series. While for joggers and cyclists intraday cycles are strongly joined together, for walkers and cyclists, walkers and joggers week-cycles are strongly related. In spite of differences between the three visitor flows this result claims some support for the strong relation of the three time series, particularly concerning the week- and year-cycles.

Fifth, a regression with an AR(3)-process was calculated to prove, whether weekday and weather has an impact on the total visitor flow. This analysis is only outperformed for the month of april, because for this month over 80% of the data have non-missing values in all variables. 74.3% of the frequency-variance can be accounted by the model. As expected a significant effect of the weather was found. Sunny weather simultaneously increases the frequency about 39 persons, rainy weather decreases the frequency about the same number of persons. Cloudy weather has no effect. But also when the weather is nice at one time, two hours later, but not four hours later, the frequency of visitors increases. For the weekend the flow of visitors increases too. If the weather is nice and it is weekend, then four –not two– hours later the flow of visitors is strongly raised. This results are only valid for the month of april.

Sixth, a simulation is done to illustrate the shape of the cycles which are detected. Figure 6 shows the predicted mean-centered time series from a 1-day-, 1/3week-, 1/2week-, 1/2year-, year-cycle using the estimated fourier coefficients a_j and b_j and equation (2).

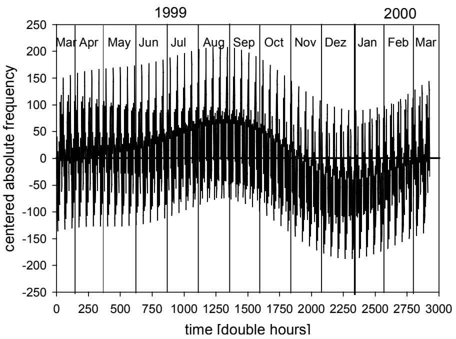

Figure 6.: Simulated time series over 1 year

In figure 6 you can well recognize the day-periodicity and the year-cycle, beginning in march, increasing till august and decreasing heavily in november and december.

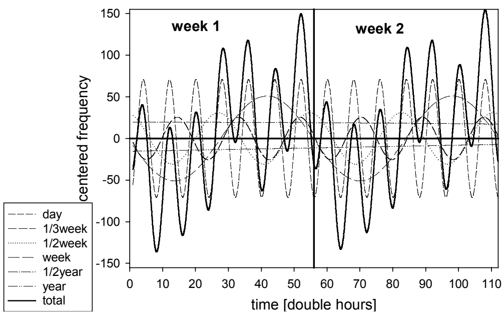

Figure 7.: Simulated time series for two weeks in march 1999

Figure 7 decomposes the simulated time series of figure 6 into its components or basic waves for two weeks in March 1999. The strong influence of the day periodicity on the total periodicity can be demonstrated. This day-cycle is overlayed by certain week cycles, which bring about the chacteristic shape of the total frequencies in one week.

CONCLUSIONS

Urban forests as human ecosystems have their particular rhythms, and member of Homo sapiens – vistors, residents, rangers – are part of them. To manage this forests without a sense of these rhythms is unrealistic. Therefore special methods of data gathering and data analysis must be choosen to find such periodicities. The data are taken from a forest-science project of Janowsky (2002). The central objective of this project was to work out a forest-paths-net-concept for the forest of Stuttgart, a town in South-Germany, which fullfill not only the economic, but also the leisure demands. One area of questions emphasizes the visitor flows at a important position in this forest.

The study should *at first* prove, whether there are any periodicities in the visitor flow over one year. Certain periodicties can be found. Particularly a day-cycle, but also week and year-cycles play an important role in explaining the whole time series. Month periodicities are not detected. The coherence diagramms claim some support, that this result can be generalized over all visitor groups (walker, jogger, cyclists).

Secondly, the study should give an answer to the question, whether the weekday (weekend or not) or the weather at certain hours have a strong impact on the visitor flow. Such influences can be found, especially lagged influences of weather.

Thirdly, the estimated fourier coefficient allows us to simulate the time series of the total visitor flow. The peaks of high visitor frequencies in summer (july, august, september) and rather low frequencies in winter (november, december) were obvious.

This paper should introduce in a statistical method, not very widespreaded in the social sciences and the forest science using an empirical example. The problems of this methos as alising, leakage, missing value are discussed. New perspectives as the multivariate version of spectral analysis was outlined. This method allows to connect under an ecosystem or human ecology perspective natural periodicities of forests with the periodicities of humans, particularly their utilization behavior f.ex. walking, jogging...

The next generation of statistical analysis of periodicities has just started in the psychology and social sciences under the title of „chaos theory“. But the proponents of this movement recommend in a first step the application of spectral analysis (Robertson & Coombs, 1995; Kiel & Elliott, 1997; Alisch, 2001). A detailed discussion of this new, very sophisticated, but not yet established methods would go beyond the scope of this paper.

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Modelling the Dependency between Visitor Numbers and Meteorological Variables via Regression Trees

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Abstract: We propose using regression trees as a flexible and intuitive tool for modelling the relationship between weather conditions and day to day changes of the visitor load in outdoor recreation areas. Regression trees offer a number of advantages when compared e.g. to linear models, specifically by outlining different seasonal and meteorological scenarios. When applied to video monitoring data from the Lobau, an Austrian nature conservation area, good regression tree models for the total number of visitors and the counts for some visitor categories (bikers, hikers, swimmers) were found, while other categories could not be adequately represented (dog walkers, joggers). The regression trees indicate a strong relationship between weather and total visitor numbers, as well as weather and the number of bikes and swimmers, respectively. The relationship to weather was found to be only slight for hikers and dog walkers, and completely absent for joggers.

In general, the use of derived meteorological quantities in form of thermic comfort indices for characterizing weather conditions results in better models than the use of directly observable meteorological quantities.

INTRODUCTION

It has been shown (Brandenburg, 2001, Brandenburg and Ploner, 2002) that the number of visitors to the Lobau can be predicted with good results by using a combination of meteorological variables and derived thermic comfort indices which are used to describe human perception of weather conditions. These predictions were based on linear regression models for the logarithmised visitor numbers.

Regression trees are an attractive alternative for prediction because they handle nonlinearity and interactions between variables implicitly. Additionally, they offer a hierarchy of importance of the predictors involved, a classification of the data based on both predictors and the predicted variable, and an intuitive graphical representation of the model.

In this article, we hope to address three basic questions:

1. the basic suitability of regression trees in modelling visitor loads,
2. the possible improvement of model quality when including meteorological information,
3. the relative merits of directly observable meteorological variables like temperature as opposed to derived comfort indices.

MATERIAL & METHODS

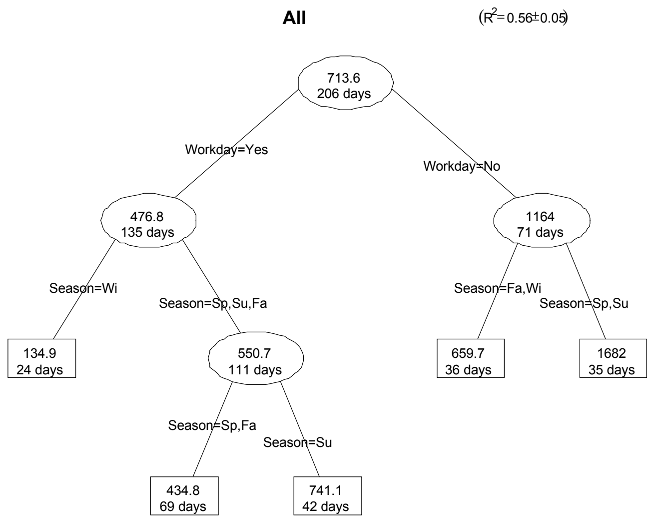
Data Collection

Visitor numbers were gathered using video material collected between August 1998 and September 1999. Cameras were located at five main entrance points to the Lobau. Visitors were counted and assigned to one of several user groups (hikers, dog walkers, joggers etc.). Due to practical problems with camera maintenance, specifically during the initial phase of the project, complete data from all five video stations was available for 206 days (out of 426) only. While we were able to interpolate missing visitors numbers quite well by using the results of the non-compromised stations, we have followed the decision of Brandenburg, 2001, to use only the 206 complete days for modelling. In order to take into account obvious fluctuations in visitor numbers, these days are classified as either 'workdays' (working days) or "holidays' (i.e. either weekend or a public holiday).

Meteorological data were obtained from a nearby weather station. The technical details of the data collection are described in Brandenburg and Ploner, 2002.

We have modelled both total visitor numbers per day and the counts for five user categories:

Figure 1.Regression tree for the total visitor number per day, using only seasonal information.



- Bikers and hikers make up the main part of visitors to the Lobau.
- Dog walkers and joggers are comparatively smaller user groups, but with potentially high impact on the local wildlife.
- Swimmers also represent a smaller visitor group, though through the typically longer duration of their stay, they tend to have high ecological impact.

Numerous meteorological variables have been considered for their relevance in recreation behaviour (Brandenburg and Ploner, 2002). For use as independent variables in the regression trees, we have found it sufficient to work with ambient air temperature, relative humidity, wind velocity, precipitation, vapor pressure, and solar radiation, each observed at 2 pm.

The meteorological elements listed above were use to calculate a number of *comfort indices.* These indices are combinations meteorological variables that are designed to measure the subjective perception of weather on a one-dimensional scale corresponding to the everyday use of 'good' and 'bad' weather as opposites on a fairly continuos scale. For our current work, we have considered four parameters:

- Equivalent Temperature (Auer et al., 1990),
- Effective Temperature (Auer et al., 1990),
- Chill Factor (Becker, 1972),
- Physiologic Equivalent Temperature (Matzarakis et al., 2000).

Definitions and some background information on these indices is given in Brandenburg, 2001.

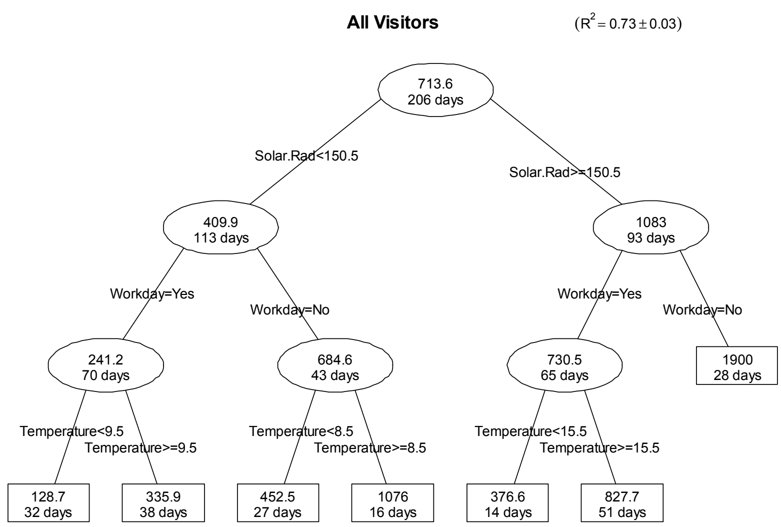
Working with regression trees, we have found the Equivalent Temperature (T_{eq}) to be the most useful comfort index: it gave persistently better results than the others, and was the only one that offered high quality models for visitor numbers on its own, without including either one of the other comfort indices or some meteorological variable.

Classification and Regression Trees (CART)

Regression trees describe the relationship between a response variable and a set of independent variables by recursively partitioning the data set at hand. The methods and terminology described in the following are due to Breiman et al., 1984.

Starting with the full set of observations, the current set is divided in two so as to make the two new subsets as homogenous as possible in regard to the response variable. This process is repeated until all subsets appear to be sufficiently homogenous. The resulting partition of the data set can be described by a binary tree, where each terminal node represents a subset of the observations, and each interior node represents one of the splitting rules. The value predicted by the model for each of the terminal nodes is then an appropriate summary function of the response variable within that node, usually the mean. Figure 1 shows the graphical representation of such a tree for the daily total number of visitors to the Lobau: internal nodes are shown as ovals, terminal nodes as rectangles, and

Figure 2. Regression tree for the total visitor number per day, using seasonal information and meteorological data.



the corresponding splitting criterion as edges; each node contains the average visitor load for the corresponding subset (first line), and the number of days in the subset (second line). Starting from the topmost (or *root*) node, which stands for the complete set of observations, we see that the set contains 206 days with 713.6 visitors on average. In the first step, these observations are split up according to whether they were made on a workday (left branch) or on a holiday (right branch). The corresponding nodes show that there are 135 workdays and 71 holidays, with average visitor loads of 476.8 and 1164 respectively. The left node is then split up again, this time according to the season the observation occurred in: winter workdays go to the right, all others to the left. The right node, with 24 observations averaging 134.9 visitors, is a rectangular terminal node that is not split up any further, unlike the 111 days in the left node. In this way, the 206 daily visitor counts are split up into five subsets (terminal nodes) according to workday and season, with visitor loads ranging from 134.9 on winter workdays to 1682 on spring and summer holidays.

In our approach, splitting rules involve only one independent variable at a time: a simple threshold value for intervalscaled or ordinal variables, and a partition of the observed values for a nominal variable. Starting from the root, all possible splits for all variables within a node are considered, and the one which produces the greatest homogeneity is chosen; the process is then repeated for both subnodes, until all nodes within the tree are sufficiently homogenous. While this stepwise procedure does not guarantee that the resulting tree is optimal overall, it assures that important splits happen before less important ones ('further up' the tree).

Regression trees that are grown only with regard to the homogeneity of the terminal nodes are well known to overfit the data badly, resulting in needless and irreproducible complexity of the model. This is avoided by balancing the size of the tree against its cross-validated predictive power: the initially grown maximally homogenous tree is cut back progressively by removing terminal branches, resulting in a sequence of trees of decreasing complexity and increasing cost (in terms of loss of predictive power). Among these trees, the most parsimonious one is chosen. This process is known as *cost-complexity pruning*.

It has the added advantage that the tree model comes together with a crossvalidated estimate of the model quality. This estimate is calculated by splitting up the data set randomly in ten subsets and refitting the tree ten times, while leaving out each one of the subsets in turn. The trees grown on ninety percent of the data are then used to predict the average for the left-out ten percent. The combined mean squared predictions errors of the crossvalidation runs, divided by the sample variance, is called *relative error* (*RE*) by Breiman et al. (1984, chapter 8.3). In this article, we use the equivalent *coefficient of determination*, which we write in a slight abuse of notation as

$$R^2 = 1 - RE .$$

As Breiman et al. (op.cit.) note, R^2 as defined above is not really the same as in linear regression, specifically it is neither the square of a correlation coefficient nor can it be properly interpreted as the amount of variance explained. Still, it is a measure of model quality, with values close to one implying good predictive power, and with values close to zero implying a poor model. We feel that this is not only more familiar for most researchers, it also makes comparisons with linear models as described e.g. in Brandenburg and Ploner, 2002, much easier for the reader than the relative error.

The R software package we used in our analysis (Ihaka and Gentleman, 1996) relies on the approach described in Clark and Pregibon, 1993, the specific model that we employed (Poisson deviance for counting data) on the implementation described in Therneau and Atkinson, 1997.

Modelling Strategy

We have used regression trees to model visitor numbers in several different user categories under three different assumptions:

1. that apart from the visitor numbers, only seasonal data is available, i.e. in which season a visitor count was observed, and whether on a workday or holiday,
2. that in addition to the seasonal information, we have meteorological variables like ambient air temperature, humidity,etc.,
3. that we have T_{eq} values in addition to the seasonal information.

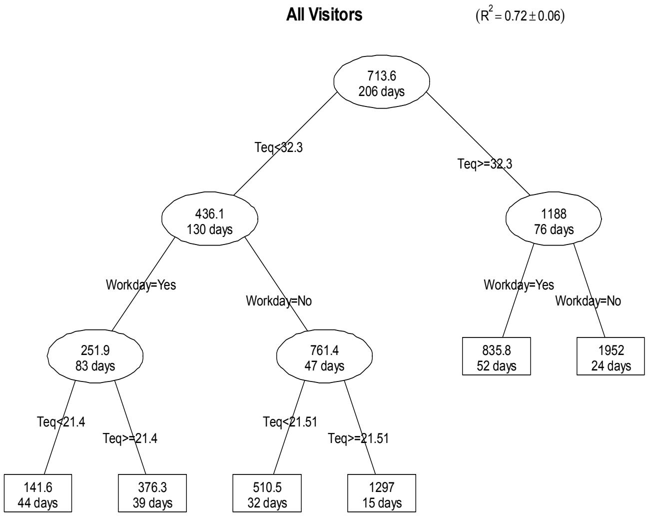
The first class of models serves as a baseline result, telling us how well we can expect to do in predicting visitor loads *without* using meteorological information at all. A comparison of these results with the second and third class hopefully shows the possible improvement in model quality and predictive power when incorporating weather information, and a comparison of the models in the second and third class highlights the respective advantages of directly observed and derived meteorological variables.

RESULTS

Total Number of Visitors

Figure 1 shows the regression tree using only seasonal information. The first split is according to whether a day is a workday or not, and the following splits are according to season: for workdays, spring and fall are grouped together, whereas for holidays, fall and winter, and summer

Figure3. Regression tree for the total visitor number per day, using seasonal informatio and Equivalent Temeprature (T_{eq}).



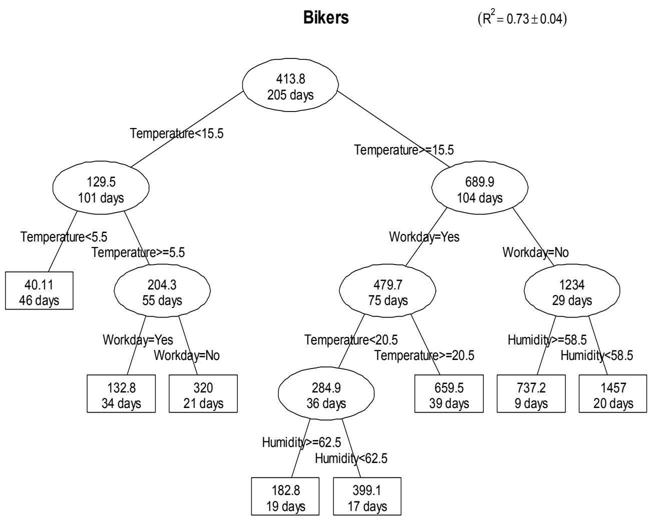
and spring end up in the same terminal nodes. Hardly surprising, the lowest average visitor load is recorded on winter workdays (leftmost terminal node), and the highest on spring and summer holidays (rightmost terminal node). Also, a summer workday has a higher average visitor load (741.1) than a holiday during the colder season (659.7). The overall model quality is quite good for such a simple model (R^2=0.56).

Figure 2 shows the regression tree that incorporates meteorological observations. Here, the main split is according to solar radiation; the next split for both nodes with high and with low solar radiation is into workdays and holidays, and the final splits are by ambient air temperature. The model partitions the observation days into seven subsets, with average visitor loads ranging from 128.7 on workdays with low solar radiation and temperatures below 9.5°C, to 1900 on holidays with high solar radiation. The model quality is quite good (R^2=0.73) and clearly higher than for the seasonal model in Figure 1. For the total number of visitors at least, using meteorological variables clearly improves the model. The resulting model is also remarkably balanced, in the sense that the second-level splits are on workday, and the third level of splits on temperature, so that the final subsets are defined by the same variables in the same order.

Figure 3 finally shows the regression tree for daily visitor counts using only seasonal information and Equivalent Temperature (T_{eq}) to characterise the different scenarios. The quality of the model is quite as good as that in Figure 2 (R^2=0.72 instead of R^2=0.73), though with a slightly higher standard error (s.e.=0.06 instead of s.e.=0.03). The root node is first split into days with T_{eq} below and above 32.3. This is quite close to the distinction between "comfortable' (35.1 to 49) and 'cool' (below 35.1) given for the T_{eq} in Auer et al., 1990, so we adapt these names here for the right and left branches of the tree, respectively. Both comfortable and cool days are then split up according to the workday, and the cool days are then split up again on T_{eq}, into workdays above and below 21.4, and holidays above and below 21.51, respectively. The splitting values for cool workdays and cool holidays are very similar, so we interpret this as a split between days that are properly 'cold' and days that are merely 'cool', where the limit is at a T_{eq} value of approximately 21.5. The final partition can therefore be read as cold workdays, cool workdays, cold holidays, cool holidays, comfortable workdays and comfortable holidays, with corresponding estimated visitor loads (terminal nodes in Figure 3 from left to right). This is a quite satisfying interpretation, and if we look back to Figure 2, we see that the categories derived using the solar radiation and the temperature can be interpreted in much the same way, though the model contains an additional split of the set of days that we have denoted as comfortable holidays above.

It should also be noted that the models in Figure 2 and 3 do not use the season to partition the observation days. Apparently, the information in both the meteorological variables and the T_{eq} make the rather artificial distinction between traditional seasons redundant in explaining visitor loads for the Lobau.

Figure 4. Regression tree for the number of bikers per day, using seasonal information and meteorological data.



Bikers

The regression tree for the number of bikers per day (not shown), based on seasonal information only, is of comparable quality to the one for the total visitor number (R^2=0.57, see also Table 1), though it is slightly more complex (six terminal nodes instead of only five in Figure 1). Figure 4 shows that again, the inclusion of meteorological information clearly improves the quality of the model (R^2=0.73). The main split here is between days with temperatures above and below 15.5°C: the right branch comprises cool days, while the left branch might properly be designated as 'coolish and above'. The cool days are then split again into outright cold days (below 5.5°C), and moderately cold to cool (between 5.5°C and 15.5°C). Note that even on the 46 cold days, we can expect an average of 40.11 bikers per day! The moderately cold to cool days are split up again into workdays and holidays, with about 2.5 times the average number of bikers on holidays than on workdays. Going back to the root node, the 'coolish and above' days are also split up into workdays and holidays. The holiday branch is then divided one more time, into days with high and low humidity (above and below 58.8%), where humid days see about half of the number of bikers than less humid days. The workdays on the other hand are again divided into coolish and 'comfortable or better' days, according to air temperature (above and below 20.5°C); on the coolish side, we have again the distinction between humid and less humid days (above and below 62.5°C), again with about half the number of bikers for the humid days. Compared to Figure 2, the tree is somewhat larger, and clearly less balanced in the relative importance of the independent variables. This might suggest a more complex relationship between weather and the number of bikers, though it should be noted that the construction of the regression tree in Figure 4 also requires only three independent variables, none of them what might be considered the most obvious meteorological parameter, i.e. precipitation. A possible explanation for this suspicious absence is offered in the Discussion.

Figure 5 shows the regression tree for the number of bikers, using only seasonal information and the T_{eq}. The model shows a clear improvement to the model in Figure 4, indeed it is the best of all our models (R^2=0.81). As in Figure 3, the first split occurs according to the T_{eq}; the splitting value is virtually the same (32.06 instead of 32.3), so again, we consider this as a split between cool and comfortable days. The cool days on the left branch are then split up into cold days (T_{eq} below 21.4) and moderately cold to cool days (T_{eq} between 21.4 and 32.06). The latter are then again divided into workdays and holidays. The comfortable days are immediately split up into workdays and holidays, and only the workdays are further subdivided on the T_{eq}, with splitting value 46.08. In the classification given by Auer et al., 1990, this is at the upper end of the comfort zone (35.1 to 49), already close to the category 'slightly humid' (49.1 to 56). In our case, workday bikers seem to prefer the more humid condition, so maybe here it stands rather for the difference between a 'nice' and a 'very nice' day.

As for the total number of visitors, both the meteorological variables and the T_{eq} make the season redundant.

Hikers

Figure 6 shows the regression tree for the average daily number of hikers, based on seasonal information only. The main split is between workdays and holidays, with workdays further divided into cold season (fall and winter) and warm season (spring and summer), whereas the distinction for holidays is between spring and the other seasons. While the quality is quite good for this simple kind of model (R^2=0.61), adding either meteorological variables or a comfort index (not shown) does not substantially improve the quality of the models (Table 1); these models also differ only slightly from the one in Figure 6, by splitting workdays according to solar radiation and T_{eq}, respectively, instead of seasons, with only minor changes in predicted average visitor loads. Specifically, the distinction between spring and the other seasons remains for holidays, so that the right subbranch is identical to the one in Figure 6.

This implies that for the number of hikers, weather is more relevant on workdays than on holidays, even though its consideration does not

Figure 5. Regression tree for the number of bikers per day, using seasonal information and Equivalent Temperature (T_{eq}).

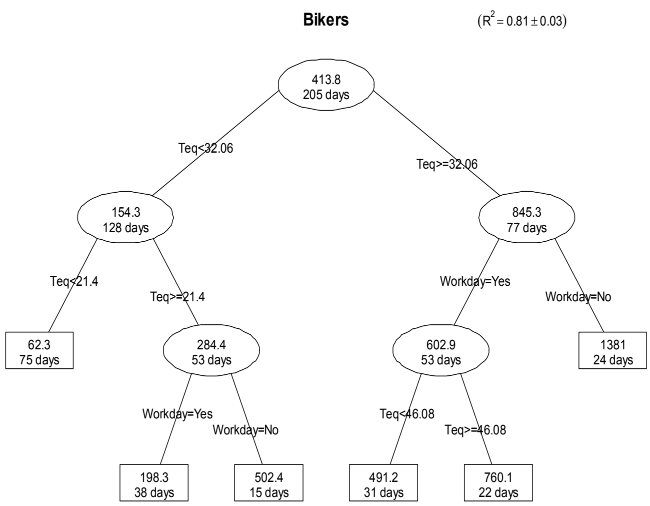
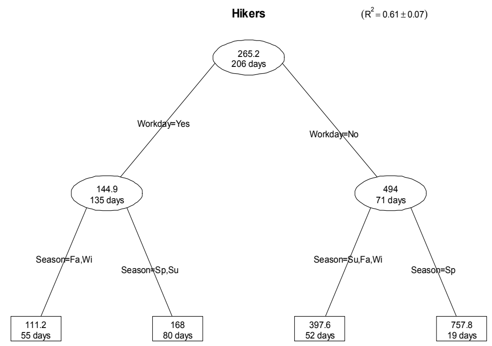


Figure 6. Regression tree for the number of hikers per day, using only seasonal information.



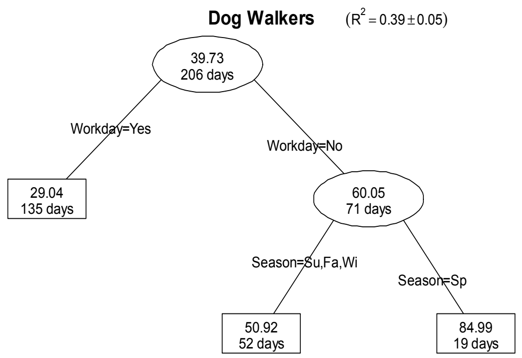
improve model quality substantially. This agrees with the fact that the largest numbers of visitors were observed on the first weekends during spring with tolerable weather conditions (Brandenburg and Ploner, 2002). This seems to indicate that there is a greater willingness for a weekend or holiday walk in the Lobau, regardless of weather.

Dog Walkers

The regression tree for dog walkers shown in Figure 7 is a simplified version of the model for hikers shown in Figure 6: days are split into workdays and holidays, and only holidays are further split into spring holidays and all others. Including either meteorological data or comfort indices did not change this model at all: apparently, the number of dog walkers is quite independent of meteorological conditions. Given the need to walk a dog daily, this is not too surprising, though it might be seen to imply that the majority of dog owners come from the residential areas within walking distance to the Lobau, as it appears improbable that dog owners would travel far under bad weather conditions.

The overall model quality is not good (R^2=0.39), so that apparently, there are factors neither seasonal

Figure 7. Regression tree for the number of dog walkers per day, using only seasonal information.



nor meteorological that cause the variation in the number of dog walkers.

Joggers

The only model we were able to fit to describe the average daily number of joggers distinguishes between workdays and holidays, and is execrably bad (R^2=0.17). The model does not change when meteorological variables or comfort indices are added, so we find ourselves quite unable to make predictions about the average number of joggers.

Swimmers

The seasonal model for the number of swimmers (Figure 8) is quite what we would expect: swimmers only in summer, more on holidays than on workdays. Given the extremely simple structure, the quality of the model is quite good (R^2=0.64).

Adding meteorological variables results in the slightly more complex model shown in Figure 9: no swimmers below 20.5°C ambient air temperature, a few hardened cases between 20.5°C and 24.5°C. Serious recreational swimming starts at 24.5°C, with an average of 20.08 swimmers on workdays and of 70.58 on holidays. While this model also sounds quite plausible, it is even slightly worse than the simple seasonal model (R^2=0.59).

Adding the T_{eq} to the seasonal data, we get the model in Figure 10: no swimmers below a T_{eq} value 42.94, a lot above 42.94 on holidays, a few on workdays with T_{eq} values between 42.94 and 50.4, and an average amount on workdays above 50.4. The model quality is very good (R^2=0.79). Note that the splitting value 50.4 is already in the 'slightly humid' zone (49.1 to 56) given in Auer et al., 1990, whereas the other splitting value 42.94 is safely within the 'comfortable' zone (35.1 to 49).

	Seasonal	***Weather***	***T_{eq}***
Total	0.56±0.05	0.73±0.03	0.72±0.06
Bikers	0.57±0.05	0.73±0.04	0.81±0.03
Hikers	0.61±0.07	0.65±0.07	0.64±0.07
Dog Walkers	0.39±0.05	-	-
Joggers	0.17±0.08	-	-
Swimmers	0.64±0.07	0.59±0.01	0.79±0.05

Table 1. Crossvalidated measures of determination R^2 (with standard errors) for three different classes of regression tree models: using only seasonal information, i.e. season and day of the week (Seasonal), using seasonal information and meteorological variables (Weather), and using seasonal information and the Equivalent Temperature (T_{eq}). For dog walkers and joggers, these models are identical.

Figure 8. Regression tree for the number of swimmersper day, using only seasonal information.

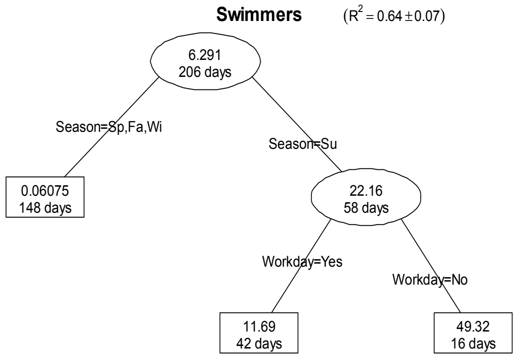


Figure 9. Regression tree for the number of swimmers per day, using seasonal information and meteorological data.

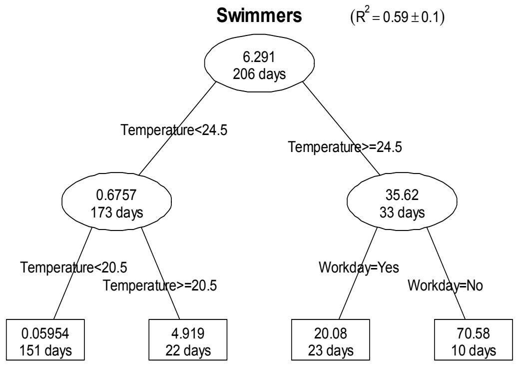
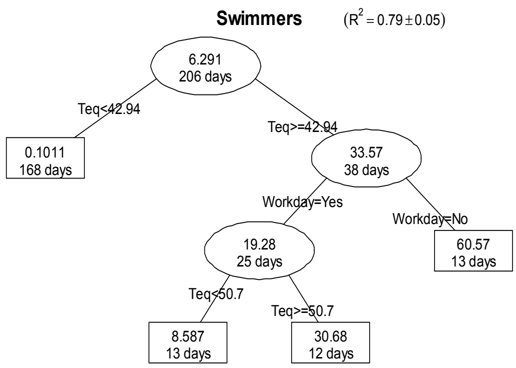


Figure 10. Regression tree for the number of swimmers per day, using seasonal information and Equivalent Temperature (T_{eq}).



DISCUSSION

Suitability

The regression trees for visitor counts exhibited mostly excellent (total count, bikers, swimmers) to acceptable (hikers) model fit, only the trees for dog walkers and joggers were of poor and very poor quality, respectively. The models partition the set of all observations into two to eight different subsets that are defined by seasonal and meteorological conditions. We feel that the interpretations we have given based on the graphical representations of the trees are persuasive, at least for the categories where we could achieve good model fit (total count, bikers, swimmers, hikers). For those categories where we failed to do so (dog walkers, joggers), we suspect that this is due to measurement error: these are comparatively small groups, so that the samples of the video material that were analysed (15 minutes out of every hour, see Brandenburg and Ploner, 2002) did capture the number of joggers accurately enough. Admittedly this is not the case for swimmers, which are not much more numerous, but this might be explained by the fact that the distribution of visitors over the day has only one pronounced peak for swimmers (slightly before noon), but two (one in the evening and one in the morning) for joggers and dog walkers, so that in fact the visitors in the last two categories are spread out more thinly over time.

Comparing these results with the linear models fitted to the logarithmised visitor numbers in Brandenburg and Ploner, 2002, we find that the overall pattern of model quality is the same for most user categories: excellent quality for the total number and the bikers, slightly worse quality for the hikers, only moderate quality for the dog walkers, and very bad quality for the joggers. The R^2 for these linear models is always higher than for the corresponding regression trees, though we do not feel that this represents a serious shortcoming: first, R^2 for the linear models is a proper proportion of variance explained, which, as pointed out above, it is *not* for the regression trees, so these values are not strictly comparable; additionally, the linear models were fitted to the logarithmised visitor counts, so while any predictions made on the log-scale can easily be transformed back to the original scale by taking the exponential function, this is not true of the error of the model. On top of this, we achieved excellent model fit for the swimmers, for who the linear model was even worse than for the joggers, so that we score much better using regression trees in at least one user category.

Using Weather Information

The best tree models are those that incorporate meteorological data as a crucial part (total number, bikers, swimmers); models that retain the season as a variable in the presence of meteorological information exhibit lower model quality (hikers), while those that ignore it are bad to very bad (dog walkers, joggers). In summary, if modelling is worthwhile, it relies on meteorological data and conversely, only through the inclusion of these data are we able to achieve satisfactory model quality.

Meteorological Variables vs. Comfort Indices (T_{eq})

Models based on the T_{eq} are never worse than those using physical meteorological variables, and distinctly better for bikers and swimmers. In case of the hikers, where the comfort index does about as well as the meteorological measurements, we found that the former was more helpful in characterising the partition suggested by the regression trees.

CONCLUSIONS

- Regression trees offer models for visitor numbers that are easily understood and can be displayed attractively. They suggest typical combinations of circumstances for different user groups which influence the decision to visit the recreation area.
- The predictive power of the tree models is comparable to the linear models given in Brandenburg, 2001, without the need to use logarithmised visitor numbers as the dependent variable.
- Using meteorological variables for the tree models improves their predictive quality and makes them more interesting as a short-term predictive management tool, at least for large user groups.
- Using comfort indices, and specifically the Equivalent Temperature, yields models that are more powerful, simpler, and more intuitive than using a combination of physical variables. It is not clear though, whether the comfort indices themselves can be predicted with a sufficient degree of precision to make their use practical.

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GIS-based modeling of car-borne visits to Danish Forests

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Abstract: Vector-based GIS is used as a basic for building a predictive model of car-borne recreational activities in Danish nature areas. Special attention is paid to the forests. The model takes its point of departure from frequencies of forest visits considering type of starting point (dwelling, summer house etc.), travel cost (into four time-bands) and three different nature types (forest, beach, and the remainder landscape). By means of linear regression statistics the model results are correlated with registered activities (number of cars in an extensive selection of parking lots in the nature). Further the effect of various local amenities – distance to the coasts, terrain form etc. – are evaluated. The work is part of the authors Ph.D.-thesis (Skov-Petersen, 2002).

INTRODUCTION AND MOTIVATION

There is a rising request for information about the recreational usage of and pressure on the nature surrounding us. The reasons are numerous including, e.g. more focus on non-market products of forests, a turn in planning and management of the nature to take public participation more into account, and a higher pressure due to the population increase, the sprawl of urban areas, and rising tourism. From the producers side – the forest managers and operators – there is rising concern that wood-production only is not enough to motivate a continued political support, as land is getting scarcer or requested for other activities. As a response to - or a consequent of - this rising emphasis on the multipurpose function of the nature in general and forests in specific, planning and management of the nature needs tools. Further, planning, at least in the developed part of the world, is opening up. This also influences planning of natural recreational resources. Public participation and involvement of NGO's and planning authorities at different levels of planning is getting an integral part of management and planning of nature where it in earlier times was more a concern of few central institutions or land owners. In the process of planning and designing the future forests data and information are needed. This goes as well as a political decision support (Kock, 1975, p 7) and for planning (De Vries and Goossen, 2001).

The Danish forest area has to be almost doubled from approximately 12 % of the national territory to approximately 22 %. In the forest act of 1996 (Miljø- og Energiministeriet, 1996) it is stated that the afforestation must facilitate multipurpose use. Among the main motivations are mentioned protection of ground water reservoirs and facilitation of recreational opportunities to the public. It is the intention of the present paper to demonstrate means for evaluation of recreational potentials of existing as well as planned forests and other nature areas. A full description of the project will be found in Skov-Petersen (2002).

OVERVIEW OF THE METHOD

The present investigation is activity orientated. It is seeking to estimate the potential number of visitors to any Danish nature area (with most focus on forests). The empirical data used include both questionnaires (approximately 2500 responses) and registration of actual activities – in terms of parked car - at approximately 2200 locations in the landscape. Both data-sets were kindly made available to the project by Frank Søndergaard Jensen of the Danish Forest and Landscape Research Institute. Partly as a consequent of the available data only car-borne activities are taken into account. Therefore the estimated modelled number of visits to areas close to highly inhabited areas, where the proportion of non-car-borne activities are significantly higher than in the more scarcely populated areas must be interpreted and used accordingly.

The study has a strong emphasis on the structural component. The main emphasis is on the influence of distance between users and resources – in terms of the travel needed between the point of departure and the destination. It is less focused on the choice process e.g. in relation to socio-economic characteristics of the users. Neither is the attention to compile any kind of economic valuation of non-market products of the nature.

The methodological foundation is heavily GIS-orientated and is therefore limited to model approaches and data that can be implemented in a GIS-context. Travel distances are calculated be means of a digital road network. Each node of the network is attributed information about nature resources (beach, forest, and remainder landscape), and the number of users (population, summerhouses, camping lots, hotels and youth hostels). Transport time is sliced up into 4 bands (0-10, 10-20, 20-45, and 45-120 min.). Classes of resources, users, and transport time are in accordance with those used in the questionnaire survey which provide frequencies of travels made to unique combinations of classes (time vs. user-type vs. nature type). The modelled visit-frequency to each node of the network is compared to the actual number of cars registered by means of linear regression statistics. Further, the effect of local amenities (terrain form, closeness to the sea, etc.) is evaluated.

Eventually, the resulting model is used to evaluate a number of afforestation areas appointed by the Forest and Nature Agency. Additionally, using a 1000x1000 grid an assessment – covering the entire Danish territory - of the recreational effect of afforestation is performed.

MEASURING AND MODELLING RECREATIONAL BENEFIT

When it comes to the unit of model results, there seems to be two mainstreams: One that seek to *capitalise recreational benefits in monetary terms* and one that assess the *recreational activities in terms of behaviour*. The main reason that monetary units are strived for, is that it enables comparison of benefits of accessible natural resources with alternatives, possible costs, loss of production, etc. (See for instance Wilhjelmudvalget, 2001, Powe et al., 1997, or Handley and Ruffell, 1993). The monetary valuation of non-market aspects (including recreational use) ranges according to Handley and Ruffell (1993) from various assessments of the value of a day in the forest, values (both user and non-user) of welfare gains due to afforestation, and estimates of carbon fixing benefits. Additionally, Powe et al. (1997) provides an example of valuation of forest resources based on changes in market-prizes of real estate, as a function of proximity to woodland. Loomis (1994) addresses the effect of recreational activities on local/regional economics as an alternative monetary assessment of recreational values of the natural resources. Contrasting monetary valuation *behavioural or activity-based measures* of recreational values of the nature includes measures of the publics *preferences* for different types of nature, *choices* between alternatives, and finally how these preferences and choices are reflected in the *actual activities* taking.

Another main fault-line in the methods for assessing recreational values is the mode of measuring and accordingly, the following mode of analysis and interpreting. The most direct, in terms of address of user, the approach *of stated preference, behaviour, or Willingness To Pay (WTP)*. Individual people are asked about e.g. their actual behaviour (‘When did you last time visit the forest’, preference (‘Do you like this picture or that?’), or WTP (‘How much would you pay for…?’). Alternatively the recreational values can be obtained by registration of the actual activities taking place in the nature or locations related to it. R*evealed preference, activity, or WTP* as this type of study is referred to, can be carried out e.g. by counting the number of parked cars on parking lots, the number of hikes in an area, or by registration of changes in value of real estate as a function of provision of green resources. Some writers refer to the same two types of valuation as *direct vs. indirect registration* (Smith, 1989 and Wilhjelmudvalget 2001).

When assessing human interaction with its recreational surroundings the three basic components are attributes to the *origin*, *destination* and *the system enabling transport* between the two (see for instance Vickerman, 1974a). Origins can for instance be characterised by demography, socio-economy, land use etc. Destinations by the nature type, landscape form, availability of local facilities, entrance fees, etc. The most basic form of transport costs or impedance’s is the Euclidean distances between origins and destinations. This approximation involves two assumptions: a) homogeneity in the spatial distribution of the transport network and b) that possible travelling speed is even all over the network. As the advances in development of GIS has facilitated efficient and accurate calculation of distances and transport times in digital road networks the use of Euclidean distances has become less abundant. The pros and cons of Euclidean vs. network-distance calculation has been discussed in numerous articles including Brainard et al. (1999), de Vries and Goossen (2001), and Bhat and Bergstrom (1997). The effect of increasing distances - e.g. close things means more than more distant ones - or most frequently formulated in terms of 'distance-decay'. The simplest form is the sharp threshold or isocrone functions - anything within a given search radius is included with full effect, whereas all outside the radius are excluded. An example of a more gradual decay function is the 'gravity model' where - in its simplest form - effect is divided by the square of the distance. Distance decay functions, with special reference to recreational resources and behaviour are discussed by Skov-Petersen (2001). In cases where the model includes areas where no roads are available at present – either because a future, potential situation is addressed (Geertmann and Ritseman van Eck, 1995) or because the digital network used doesn’t include small roads and tracks in between main roads Euclidean distances can be used as a supplement to network analysis (Brainard, et al. 1999). Skov-Petersen (1998) provides an example of local Euclidean distances used in a raster-GIS environment for assessment of barrier effect of larger traffic constructions.

A special problem in modelling recreational choices is handling the influence of *alternative choices,* i.e. the effect of the amount of recreational resources available at a point of origin. It can be assumed that the number of visits from an origin to a destination is a function of the magnitude of the demand (e.g. the total number of forest visits), inversely related to the sum of the available resource (e.g. the total number of ha forest available within the time-constraints considered) (Smidt, 1989, Luzar and Hotvedt, 1992, Loomis, 1995). The same issue is sometimes referred to as *intervening opportunities* (Thompson, 1979).

ASSESSMENT OF THE METHODS USED FOR THE PRESENT STUDY

Of the above referred studies the present study resembles especially Brainard, et al. (1999) and de Vries and Goossen (2001). Both predecessors are using GIS as central platform for implementation, and both are highlighting the problems and possibilities in using a digital road network for assessment of travel costs. Further, both studies are aiming at development of a method that could facilitate estimation of recreational values in any nature area within a given region. As de Vries and Goossen (2001) this study is considering a dual data-set including a *stated preference assessment* ‘feeding’ a travel cost model and a *revealed behaviour study* of activities, registered directly on site in the nature. The motivation is the same; to validate the model in terms of correlation between modelled and registered activities and to enable evaluation of the effect of local facilities and amenities in the nature on recreational activities. Brainard, et al. (1999) argues that an economic valuation is needed to enable transfer of (economic) benefit between sites, whereas the present study wishes to evaluate the effect of landscape amenities on recreational activity. Brainard, et al. (1999) consider different types of origins – dwellings and summer houses – similar to the present study which additionally includes departures from camping sites, youth hostels, hotels, and holiday departures from private homes. Since Brainard, et al. (1999) are using information about the individual respondents origin as well as destination, they have the opportunity of evaluating effect of socio-economic characteristics of the zone of origin on choices and behaviour in terms of forest visits. The evaluation of socio-economic characteristics was given less priority in the present study. A general difference though, is the inclination of Brainard, et al. (1999) to value the nature in monetary terms, contrasting the present study’s search to model activities in terms of visits. The obvious spatial components in the phenomena of recreational benefit and behaviour seems not to give raise to much attention to the geographical aspects of the [economic] studies involved (Brainard, et al. 1999).

The basic motivation – to facilitate the planning process with knowledge regarding recreational aspect of the nature in terms of recreational activities – is shared between de Vries and Goossen (2001) and the present study as are a number of basic assumptions and approaches. Despite of this the two studies seems to deviate on three points: de Vries and Goossen (2001) addresses a) both car- and bicycle-born activities (the present study only includes cars), b) a gravity model is used (the present uses time bands), and c) a rather detailed conception of the quality of different nature types is included (the present study considers only beach, forest and the remaining landscape). Further, de Vries and Goossen (2001) have a high degree of details on differences in social groups living in different points of departure but, as a contrast to the present study, only departures of the dwelling population are considered. De Vries and Goossen (2001) makes no attempt to evaluate their model results in terms of real world registrations of actual levels of activity, which is included in the present study.

To summarise the present study is characterised by:

- The introduction of both revealed and stated preference information in the same model
- Even though calculation of travel cost is considered central, it is kept in terms of transport time - not in monetary terms.
- Points of departure are disaggregated into residential houses, summer houses, hotels, camping lots, and youth hostels not only on population being only an indicator of departure from residents.
- Travel cost is treated as probabilities of activity in time bands (not as a monotonous distance-decay)
- Division of the number of users at an origin by the total area resource within the considered time-band as a means for treatment of intervening opportunities or surrogate destinations
- Finally an address is made of the way the size of destination regions is influencing the correlation between model results, local amenities, and actual, registered visitors.

OVERVIEW OF THE METHOD AND DATA BACKGROUND

The following section describes the data-background, the pre-processing of data. Later the steps of the accessibility modelling process are described. The pre-process includes a) extraction of data from interview survey, b) digitising ‘car-registration points’, c) filtering the road-network, d) calculation of transport-time for each road-segment, e) calculation of population-data, and f) aggregation of user- and resource information to the nodes of the road-network.

Five types of data are used for the analysis:

- A *national* set of information about the stated preferences and behaviour of the general population
- The number of cars registered at a number of parking lots in the landscape during 1995
- L*ocal* data-sets about resources (forests, beaches and remaining untilled landscape.
- A *local* data-set of the number of potential users (population, summer houses, capacity of hotels, youth hostels and camping lots).
- Information about the *transport-network* (describe data background and attributes, filtering, spatial aggregation).

National data refers to non-spatial information being general for the entire area under investigation - the country of Denmark. Local data is geographically disaggregated information, information that differs from one location to another. The distinction between local and global information is made to highlight the difference in nature of the two data-types. The national information serves as ‘constants’ that can be used for calibration of local information, which can be used for the modelling of spatial interaction.

The modelling processing included a) calculation of the yearly number of trips generated by each combination of time, means of transport, nature-type and type of point of departure (from the questionnaire survey), b) calculation of the amount of resource available at each origin, c) calculation of the number of trips generated at each origin, d) calculation of the number of trips made to each destination, and finally e) comparing calculated number of trips and the number of cars actually counted in the nature.

CORRELATION OF NUMBER OF COUNTED CARS AND ESTIMATED TRIPS

Registration of cars took place 22 times during 12 month in 1995-96. The registration was made at parking lots or along stretches of road known or expected to be used during recreational visits in the nature. The nature areas was enrolled voluntarily by the administrators and registration locations was configured to cover entire nature areas, i.e. it was expected that all cars coming to an area during the time span of a single round of registration would be included. To relate the registration-point to the landscape surrounding them, buffer zones had to be introduced. In some cases – depending on the buffer-size and the spatial distribution of the registration-points – the buffer zones would embrace more than one registration points. This way a single buffer-zone containing a number of registration-points and a series of landscape attributes becomes the minimum unit of investigation

A key point is the selection of a feasible size of the buffer-zones. The buffers should be big enough to even out local variation, both in terms of different attributes to the individual parking lots that might influence the number of visitors and in terms of the data background used for estimation of trips and local attraction parameters (see below). On the other hand they should be small enough still to support estimation of recreational use at a local scale. If only correlation’s can be established for large regions it would disable the evaluation of natural areas smaller than the regions. Further, using too big buffers would in cases include natural areas not included in the car-registration campaign. Whichever buffer-size is selected it must also be considered in the context of the behavioural phenomena investigated. The buffer should represent the landscape in a vicinity of the registration point relevant to the activity considered. If a too small buffer is selected, the activity will stray outside it – or is it a too big buffer it will include areas of no relevance to the recreational activity. To unwrap the influence of buffers size a number of different sizes – 125, 250, 500, 1000, and 2000 m - were tested.

The problems associated with aggregation of data into area units – with special reference to the inferential effects of changing aggregation units - are generally referred to as the Modifiable Area Unit Problem or its abbreviation MAUP (Oppenshaw, 1980). Very different correlation’s between the same set of variables can be obtained by using different aggregation units. The phenomena can be separated into *a scale effect and an aggregation effect*. The scale effect includes in general that the larger the aggregation units, the larger the correlation between the variables investigated. The aggregation effect occur when a constant number of aggregation areas are moved, reshaped, and resized over an area of investigation. According to Oppenshaw (1980) the optimal or most correct correlation coefficients can in principle be obtained by introduction of all possible configurations of aggregation areas and the examine the frequency distribution of the resulting coefficients. The present approach of using multiple buffers gives the opportunity to investigate the stability of estimates over changing scales in aggregation units. In this way the effect of MAUP – specially the scale effect – can be assessed and envisaged.

At the destinations the natural resources are only considered as belonging to one of he three broad classes; beach, forest, and the remaining untilled landscape. It can be seen as a background pressure of potential visits. Obviously, despite of this background pressure, number of visits varies very much even between sites situated very close to each other. Therefore a number of parameters representing local attraction of the nature were introduced as additional descriptive and/or explanatory variables. These variables include ruggedness of the landscape, closeness to the coast, closeness to lakes, and closeness to locations marked as especially scenic or picturesque.

STATISTICS

A central question if the model performs any better as a predictor of the recreational activity in the nature than the classical models entirely driven by population potential (See for instance. Skov-Petersen, 2001). To assess this expectation of explanatory effect correlations coefficients of the number of cars and the predicted values was calculated. As can be seen in 0 the two classical models (model 2 (exponential distance decay function) and 3 (isocrone distance decay (15 min.))) do not provide any marked explanation of the recreational activities in the areas encounter. Further there is no effect of increase in the buffer size. For the full model (model 1) the picture is more positive there is a marked increase in the correlation coefficients as a function of increasing buffer size.

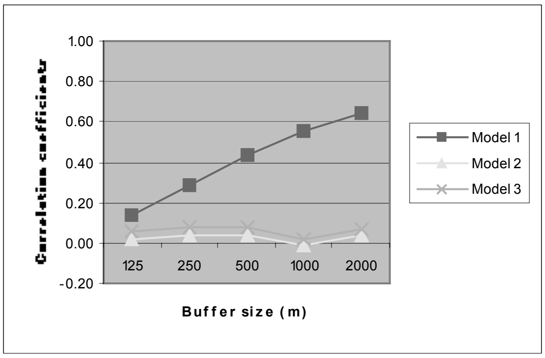

Figure 1: Pearson correlation coefficients of the three models vs. counted number of cars as a function of rising buffer size. Figures are based on the logarithm of counts and model results.

From 0 it can be seen that the number of trips modelled by *accessibility, distance to the coast*, and *slope index* all provides significant estimates of the regression coefficients. All three appears to be robust – in terms of the sign of the estimate vs. increasing buffer size. Accessibility and slope are both positively correlated – i.e. the higher prediction of the accessibility-model and the more slope the landscape, the higher is the recreational activity. Distance to the coast is negatively correlated – the further to the coast the lower the activity. The correlation with the distance to the coast might be an influenced by the high number of registered activities at parking lots facilitating the beaches.

Buffer size (m)	Accessibility (Model 1)	Distance (m) to coast	Slope index
125	0,420720 (0.0001)	-0,000014 (0.0012)	0,435067 (0.0001)
250	0,466505 (0.0001)	-0,000027 (0.0001)	0,289057 (0.0001)
500	0,519789 (0.0001)	-0,000037 (0.0001)	0,276821 (0.0001)
1000	0,603275 (0.0001)	-0,000033 (0.0001)	0,305682 (0.0001)
2000	0,571046 (0.0001)	-0,000037 (0.0001)	0,172477 (0.0962)

Figure 2: Estimates of regression coefficients for parameters selected by stepwise linear regression vs. buffer size. Level of significance mentioned in brackets. Estimates of significance lower than 0.1500 are excluded.

USING THE MODEL FOR ASSESSMENT OF RECREATIONAL EFFECT OF AFFORESTATION

The following two sections provides two implementations of the estimated regression coefficient's of the accessibility model (based on population, summer houses, hotels etc. and existing recreational resources) and local amenities (distance to the coast and terrain form) as independent variables and the expected number of car-borne visits to existing and potential afforestation areas as dependent variable.

When interpreting the data it is important to bear in mind that the estimates represents car-borne activities only. Generally car/motorcycle born activities takes up 46.3 % of the entire national recreational activities but the proportion of other, softer forms of traffic increases when the transport distances decreases (Jensen, 1998, pp 46). E.g. at less than one kilometre approximately only 10 % of the participants are using the car. This means that the closer the fringes of the inhabited areas the less significant is the car-borne activities when compared to other means of transport. With special reference to the present model this is in particular true when the case is rims of small towns. No-one in these cases can travel long distances to go to an area close to the rim. In the cases of larger cities the population of the centre of the city are potentially 'long-distance users' of the recreational areas at the rim. Accordingly, care must be taken not the neglect the potential effect of non-car-borne activities, especially in the case of close-range travel distances.

EVALUATION OF STATE AFFORESTATION AREAS

The Danish Nature and Forest Agency has appointed a number of areas of special action in terms of afforestation. A digital map of 95 of these areas were made available to the project. As an example for the results for the County of Funen are found in figure 3 (index map found in figure 4).

Index number	Project name	Area (ha)	Lower confidence interval (95 %)	Predicted number of yearly visits by car	Upper confidence interval (95 %)
19	Højstrup	283	2165	2763	3526
20	Kerteminde	388	1307	1760	2369
21	Middelfart	1088	2697	3547	4664
22	Årslev	146	713	868	1055
23	Ejby	148	458	592	765
24	Gelsted	26	95	138	197
25	Kirkendrup	498	3031	3883	4973
26	Ringe Skov	456	647	824	1048
27	Søgård	173	838	1059	1338
28	Assens	1247	966	1420	2086

Figure 3: Assessment of the number of car-borne visitors to afforestation areas of the county of Funen. Location of the areas are shown on 0.

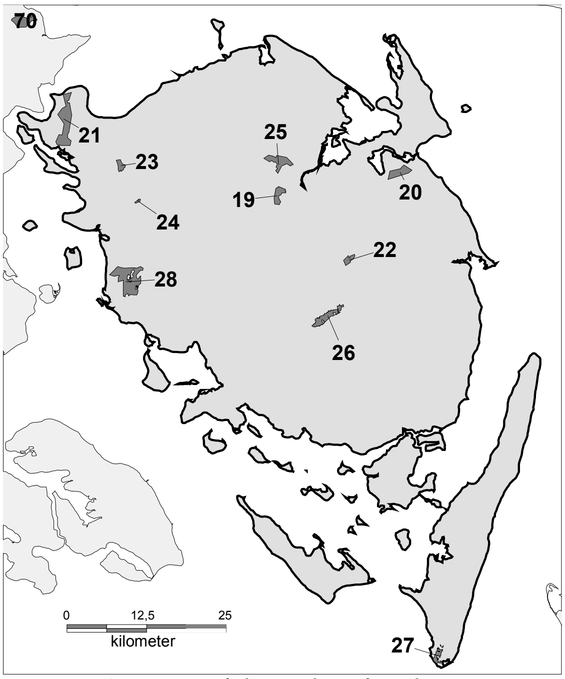

Figure 4: Assessment of the number of car-borne visitors to afforestation areas of the county of Funen. Numbers of the areas corresponds to the index number of 0.

GENERAL ASSESSMENT OF THE POTENTIAL OF AFFORESTATION OF THE DANISH LANDSCAPE

To assess the areas of the country where afforestation potentially would be most beneficial to car-borne recreation the yearly number of visits was estimated for 1000x1000 m. cells for the entire territory (figure 5). With reference to the previous discussion (for further details refer to Skov-Petersen, 2002) and as were the case in the previous section it is assumed that there is no ‘intervening opportunity effect’ of the introduction of new forest areas. In other words the resulting map cannot be interpreted as what will happen if all Denmark was covered by forest; each cell is evaluated individually assuming that the rest of the relevant land use is unchanged.

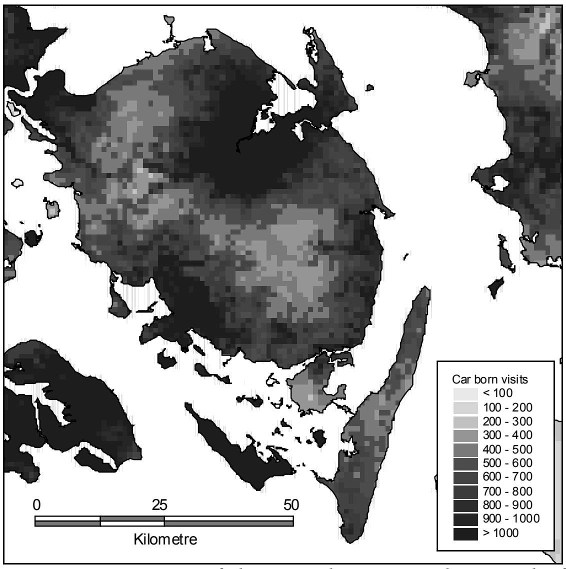

Figure 5: Estimation of the general recreational potential of afforestation of Funen (1000x1000 cells). It is important to notice that afforestation of each individual cell is evaluated independently, i.e. afforestation of adjacent cells does not influence calculation as intervening opportunities.

CONCLUSION

GIS has been proven to be an efficient platform for modeling the recreational activities in Danish forests. ‘Reality-data’ captured by questionnaire techniques and by registration of the number of cars at parking lots in the nature can be spatially generalized. Hereby it is not only possible to estimate the potential number of visitors to existing forests; it also provides the possibility of predicting the recreational gain by planned forests. The model demonstrated only includes car-borne activities. This is particular a problem in areas close to populated areas because there is a marked tendency of dominance by softer forms of traffic for shorter travel-distances between origin and destination. Further it is problematic that the populations frequency of trips to the nature is assumed to be independent of the amount of local recreational resources. Both the latter issues are obvious fields of future extensions of the work presented.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
Conference Proceedings ed by A. Arnberger, C. Brandenburg, A. Muhar 2002, pages 240-245

Monitoring of Tourism in the Czech National Parks

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Abstract: Recreational and tourist exploitation of selected parts of four Czech National Parks has been investigated since the year 1997. The article presents cross-section data from 2000. During a nine-day period in the high summer season the basic quantitative census of tourists, cyclists and cars on selected crossroads of tourist paths in the core area of national parks had been carried out and qualitative characteristics, opinions and attitudes of visitors were evaluated. Relation between socio-demographic structure of visitors and their behaviour and attitudes to conservation management activities of the national park's Authorities was analysed using a special type of a questionnaire based on interviews with a random and representative sample of visitors. There are evident differences between various National Parks (Krkonose, Sumava, Podyji, Ceske Svycarsko) and between the attitudes of foreign visitors and Czech visitors. Investigation has been focused also on local inhabitants and elected representatives of local communities. Results are used by NP Authorities within the process of estimation of ecological and psychological carrying capacity as well as the one of appropriate indicators of sustainable development of the Czech National Parks. Monitoring will continue in the next years.

INTRODUCTION

Based on four nine-day surveys (August 12 - 20, 2000) and using results of similar research activities from previous years we evaluate selected quantitative and qualitative data, which characterize recreational and tourist exploitation of the central part of four Czech National Parks - Krkonose, Sumava, Podyji a Ceske Svycarsko (Fig. 1). While monitoring the national park Podyji we have also evaluated the Hardegg point that lies in the Austrian National Park Thayatal (Cihar & al. 2001).

The given research project enhances and develops research activities of the Institute for Environmental Studies, carried out also in Czech landscape protected areas Zdarske vrchy, Slavkovsky les, Krivoklatsko, Labske piskovce, Litovelske Pomoravi and around the capital city of Prague. The research reflects modern trends and requirements for a progressive conservational management (e. g. Shipp & al. 1993, Ceballos-Lescurain 1996 , Messerli & Ives 1997, Godde 1999). In the year 2000 we focused on the counting of tourists at 20 pre-selected monitoring points, together with interviewing the random sample of visitors. The aim of interviews was to ascertain basic social demographic characteristics of the tourists and to describe their opinions and attitudes regarding the environment and environmental

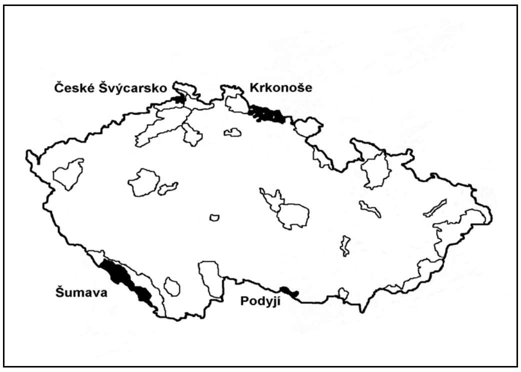

Fig. 1 – National Parks (black) and Protected Landscape Areas (white) in the Czech Republic

conditions in the national parks. Parallel survey ascertained a range of opinions held by high-ranking representatives of local governments (e.g. Cihar & al. 2000a). However, the results of these two surveys are outside the framework of this article.

SOME SELECTED RESULTS

Quantitative aspects of monitoring

In the course of survey at all 20 monitoring points (Tab. 1) the research team counted hikers, cyclists and cars (CIHAR & al., 2000b, c, d, e, f, 2001a). The total number of people passing/biking/driving through was 390.074. Each person is recorded twice at each monitoring point – for the first time, when arriving *to* the point, for the second time, when coming *from* the point, the documented number of records corresponds with almost 200.000 monitored tourists. A total of 160.801 hikers, 23.961 cyclists and 7.925 cars were recorded to have passed the monitoring points. The ratio hikers : cyclist is therefore 1 : 6,7, with the peak at Pricky (Podyji) with ratio 1 : 0,7 and minium 1: 2.921 (ridge locality at Slaski dom, Krkonose). Regarding the hiking tourism, the most frequented site in Krkonose National Park appeared to be the crossroad at Slaski dom (daily avarage 5.518 tourists), in Ceske Svycarsko National Park the crossroad Pravcicka brana (1.194), in Sumava National Park the monitoring point Antýgl (1.176) and in the Czech part of Podyji National Park the crossroad Na Keplech (117).

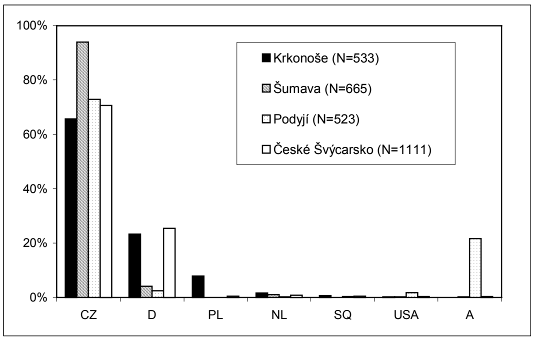

Fig. 2 - Nationality of respondents (over 0,5%)

With regards to cycle tourism, the predominant area was Modrava in Sumava (daily average 719 tourists), Turisticky most in Ceske Svycarsko (172), Na Keplech in Podyji (117) and Lucni bouda in Krkonose (8). It should be mentioned here that cycling is not permitted at any monitoring point in a ridge art of Krkonose. For more details see Tab.1.

To conclude and summarize the results of quantitative part of our research, in terms of hiking tourism intensity, Krkonose National Park is the most affected, mainly its ridge locations influenced to a large extent by nearby terminals of funiculars. They are followed by easily reachable natural attractions in Sumava (Antygl) and Ceske Svycarsko (Pravcicka brana). In respect to cycle tourism, the most frequented localities can be found in Sumava (mainly Modrava and Kvilda). High densities of cyclists are also recorded in the northwestern part of Ceske Svycarsko (Turisticky most, Na Tokani) and in the entire area of Podyji.

Qualitative aspects and results of opinion poll

In the course of our tourist opinion poll in 2000, 2822 completed questionnaires were gathered, computer-processed and analyzed (Krkonose 533, Sumava 665, Podyji 523, Ceske Svycarsko 1111). Each questionnaire covered basic social and demographic characteristics of tourism (the structure of the questionnaire was similar in parallel surveys in all Czech National Parks. We employed the standard method of personal interviews. As to the method of selecting people for the poll, this was carried out on a random basis. From the results of research final reports (Cihar & al., 2000b, c, d, e, 2001b) we refer to the following primary findings:

1. In the national make-up of respondents (Fig. 2) there is prevailing domination of Czech tourists. The highest proportion of Czech tourists is characteristic for Sumava (94% of Czech visitors), followed by Podyji (72,8%), Ceske Svycarsko (70,6%) a Krkonose (65,7%). In terms of the national structure of foreign visitors, the most frequent are Germans (in Ceske Svycarsko 25,5 % of respondents, in Krkonose 23,3% and in Sumava 4,1%). The only exception is Podyji National Park where the small proportion of Germans (2,5%) is compensated by a high number of Austrians (21,6%). Other foreign visitors in the Czech National Parks are of Polish (7,9%) and Dutch (1,7%) nationality in Krkonose, American in Podyji (1,7%) and Dutch again in Sumava (1,1%).

If we focus in a more detail on the Czech visitors of National Parks, the highest percentage of tourists comes from Prague, followed by visitors from nearby districts. In case of Krkonose, Prague constitutes 28,9% of visitors. On the second place there are inhabitants of Semily district with 6,9% and on the third one Trutnov district with 6,3%. In case of Sumava is Prague with 31% followed by Plzen (7,4%), in case of Podyji is Prague with 22,8% of visitors followed by Znojmo (15,6%) and Brno (13,5%) districts, and finally in Ceske Svycarsko there is 15,9% of visitors from Prague and 8,6% from local district of Decin.

2. The majority of all respondents were male (Podyji 58,9%, Ceske Svycarsko 57,9%, Krkonose 56,3%, Sumava 53,4%). As to the social make-up of the tourists, the predominant group constituted white-collar workers (Ceske Svycarsko 42,5%, Sumava 42,4%, Krkonose 41,7%, Podyji 39,2%), and the predominant age category was 40-59 (children under 14 were not counted). Sumava is the most attractive park for elderly people (age groups over 40 and over 60), on contrary, Podyji for younger people (up to 39). The majority of all respondents had completed a secondary school education (from 44,6% in Krkonose to 56,7% in Sumava), and approximately one third of respondents were university graduates (from 31,4% in Podyji to 39,5% in Krkonose).

			average number of records per day per direction			number of records per whole period	
monitoring point	NP	number of directions	hikers	cyclists	motor vehicles	average per day	total
Slaski dom	Krkonose	7	1576,6	0,6	3,1	11061,9	99557
Snezka (summit)	Krkonose	3	1674,0	3,3	3,7	5042,2	45380
Modrava	Sumava	4	371,0	359,5	98,5	3316,7	30533
Antygl	Sumava	3	784,0	152,3	4,7	2823,7	26447
Pravcicka brana	C. Svycarsko	3	796,3	5,7	1,0	2409,4	22003
Horska Kvilda	Sumava	4	114,8	194,8	242,3	2207,0	20362
Mezni mustek	C. Svycarsko	4	540,3	1,5	1,0	2170,7	19830
Lucni Bouda	Krkonose	5	419,4	3,2	3,0	2128,1	19153
Snezka ("traverse")	Krkonose	3	653,0	0,7	0,0	1960,4	17644
U ctyr panu	Krkonose	5	370,6	10,6	2,0	1915,4	17239
Kvilda	Sumava	3	237,0	315,0	35,0	1761,4	16525
Ruzohorky	Krkonose	3	433,3	1,7	3,7	1316,4	11848
Kralovsky smrk	C. Svycarsko	3	225,3	34,7	0,7	781,8	7345
Hardegg	Podyji	3	163,3	65,3	18,7	742,1	6843
Na Tokani	C. Svycarsko	5	82,6	51,8	10,2	722,6	6690
Loupeznicky hrad	C. Svycarsko	3	188,0	32,0	2,7	667,8	6175
Turisticky most	C. Svycarsko	4	55,5	86,0	4,5	583,6	5373
Na Keplech	Podyji	3	77,7	78,3	8,3	493,8	4544
Pod Sobesem	Podyji	3	73,0	71,7	5,3	450,2	4173
Pricky	Podyji	5	18,8	28,6	5,0	264,2	2410

Tab. 1 - Quantitative characteristics in the monitoring points in the Czech National Parks (August, 12 - 20th, 2000)

3. Interesting finding represents rate of the first time visitors of the National Park to regular visitors. In the case of Krkonose, this rate is 18,4% to 75,2% respondents, in Sumava 20,2% to 75,9%, in Podyji 69,2% to 31,5% and finally in Ceske Svycarsko 44,2% to 48,1%. The highest number of people who owns weekend house (typical Czech phenomenon of the "second-housing") in the park was recorded in Ceske Svycarsko (6,2%), the lowest in Podyji (1,5%). The same park embodied the highest rate of local inhabitants in the interviewed sample (4%), on the contrary to lowest number that was documented in Ceske Svycarsko (1,5%). The most frequent period of stay for both „large" parks was one week (Sumava 45,5%, Krkonose 35,8%), smaller parks are characterized by one-day visits (Podyji 32,9%, Ceske Svycarsko 25,2% - see Fig. 3).

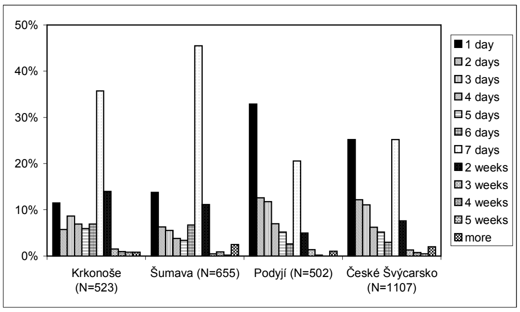

Fig. 3 - Period of stay in the National Parks

4. The most popular type of accommodation was in case of three parks a pension (Sumava 37,9%, Podyji 31,1%, Krkonose 27,8%). In Ceske Svycarsko the largest part of respondents was preferring "other" types of accommodation (e.g. house of friends, outdoor etc.). Car is the far most popular mean of transport to the Czech National Parks (from 68,1% in Krkonose to 78,8% Sumava). There are differences on the second place: it is bus in case of „large" parks, bicycle in Podyji and finally train in Ceske Svycarsko.

5. With the sentence „the reason why I am staying in the National Park is the nature and its beauties" agreed or quite agreed 99,4% of respondents in Ceske Svycarsko National Park, in Sumava 98,8%, in Krkonose 98,5% and 76% of respondents in Podyji (see Fig. 4A). With the similar statement „the reason why I am staying in the National Park are sporting activities" (Fig. 4B) agreed 80,4% of respondents in Krkonose, 71,9% in Sumava, 65,7% in Ceske Svycarsko and 65,0% in Podyji. The third most important reason of visits to NP is "relaxing" (Sumava 91%, Krkonose 89,6%, Ceske Svycarsko 85, 9%, and Podyji 81,7%

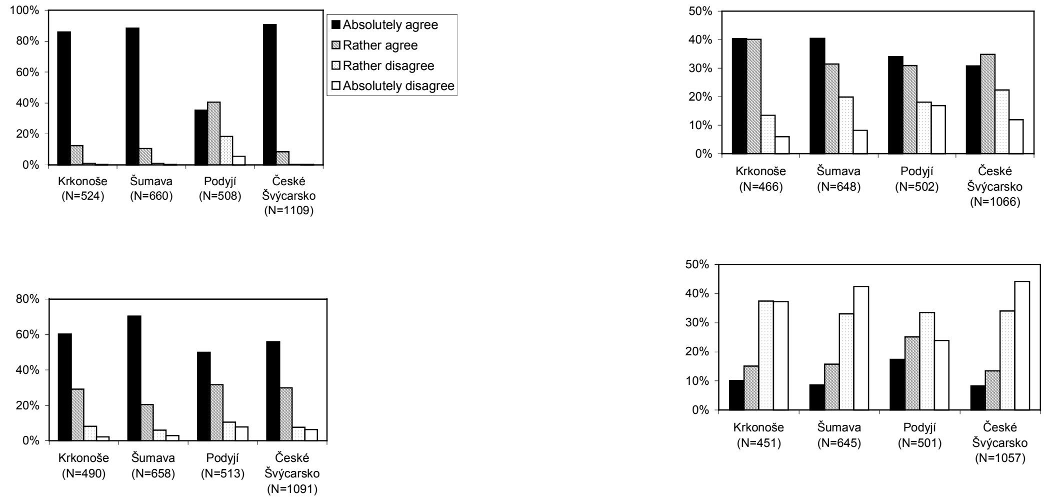

Fig. 4 - The main motive of visit in the National Parks (A - The scenery/nature spots, B - Sporting activities, C - Relaxing, D - Cultural activities)

(Fig. 4C.). „Cultural activities" (Fig. 4D.) as the main reason of visits play an important role in Podyji (42,5%). In other words, the south-moravian park is attractive not only for its nature, but also for its cultural features (compared to the other parks).

6. The highest number of visitors, who believed that the quality of environment in the National Park "has got worse" throughout the last decade was in Sumava 18,4% (!), followed by Krkonose with 10,7%, Podyji and Ceske Svycarsko with only 5,2% (Fig. 5). Especially interesting and significant finding for park management (public relations departments) represents the number of people who wasn't able to evaluate the state of the environment (e.g. in Podyji it raises to 61,8% of respondents). Over the last four years, the number of people who positively view the current state of the environment has increased among the respondents from Krkonose and Sumava (Cihar a kol., 2000a,b).

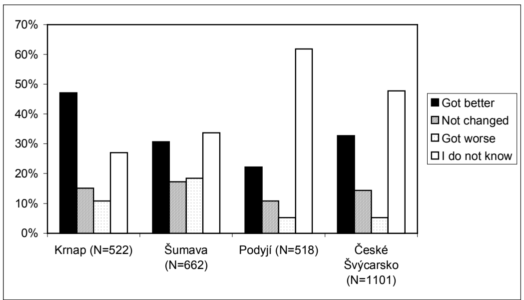

Fig. 5 - Do you think that over the last decade the condition of the environment in the territory of the NP has…

7. Respondents (60,5% of them) was able to name (in an open question) at least one ecological problem in Sumava NP (eight-toothed engraved beetle calamity was with 40,2 % indicated most frequently). The same question was able to answer only 53,7% of respondents in Krkonose (the state of forests and waste management were among the prevailing problems). In Česke Svycarsko, the amount of filled open questions decreased from 31,7 % of the answers (the problem number one was waste management) up to 16,6 % in Podyji (among the mentioned ones there were agriculture, environmental pollution and waste). When having the optional choice (Fig. 6), visitors of "large" National Parks tended to choose the state of the forests, in "smaller" parks the prevailing problem indicated was the question of waste and eventually the quality of water (Podyji).

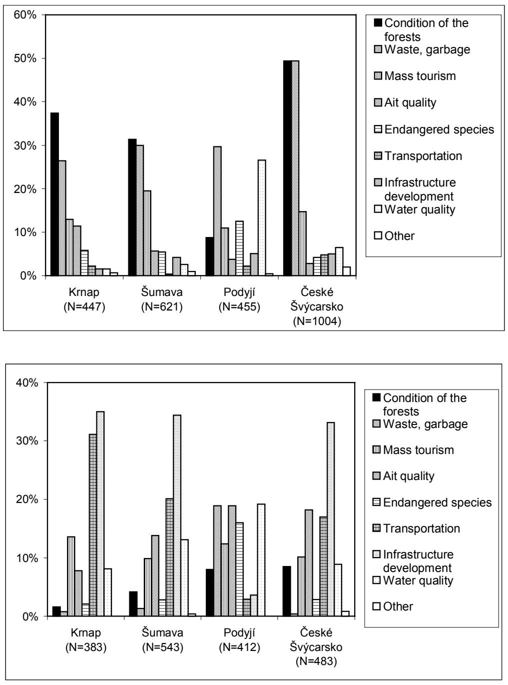

Fig. 6 - The problems needs to solved first (A) and least (B)

8. The number of tourist who used border-crossing points for pedestrians and cyclist during their stay was relatively balanced (Krkonose 28,9%, Sumava 29,1%, Ceske Svycarsko 25,3%) with the exception of Podyji 61, 4 % (Fig. 7). On the other

hand, as many as 76,1% of respondents in Podyji, 75,5%, in Sumava 73,8%, in Ceske Svýcarskou and in Krkonose 72% were in favor of opening new border crossings of this kind.

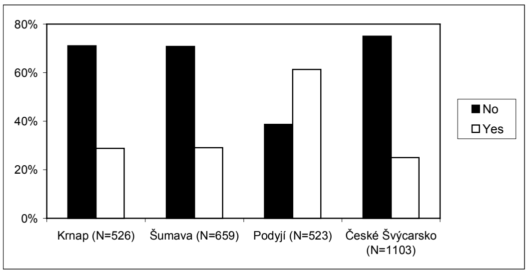

Fig. 7 - The use and potential use of pedestian border crossings in the territory of the NP

9. The majority of respondents in all four parks (Podyji 49,3%, Ceske Svycarsko 45,9%, Sumava 44,5%, Krkonose 43%, see Fig. 8) considered the cost of their stay in the Sumava National Park to be "in accordance with their expectations". Foreign visitors are more satisfied with the cost of their stay than Czech visitors: "satisfied" or "greatly satisfied" is 78,9% of foreigners and 43,1% of Czech visitors in Sumava, 66,1% of foreigners and 29,2% of Czechs in Krkonose, 55,6% of foreigners and 30,4% of Czechs in Ceske Svycarsko and finally 48,5% of foreigners and 38,2% of Czechs in Podyji. In contrast, 12,7% of foreign tourist and 3,9% of domestic visitors in Krkonose expressed extreme dissatisfaction. Similarly, it was 9,7% of foreign tourist and 3,7% of Czechs in Ceske Svycarsko, 9,2% of foreign tourist and 2,2% Czechs in Podyji and 1,8% of foreign tourist and 5,3% of Czechs in Sumava. As to the most common estimate for daily expenses per person (accommodation + board), foreign tourists stated the equivalent of CZK 800 in Podyji, CZK 500 in Krkonose, CZK 400 in Ceske Svycarsko and CZK 200 in Sumava. Czech tourist estimated the same expenses as CZK 300 in Sumava and Krkonose, CZK 200 – 300 in Podyji and CZK 200 in Ceske Svycarsko.

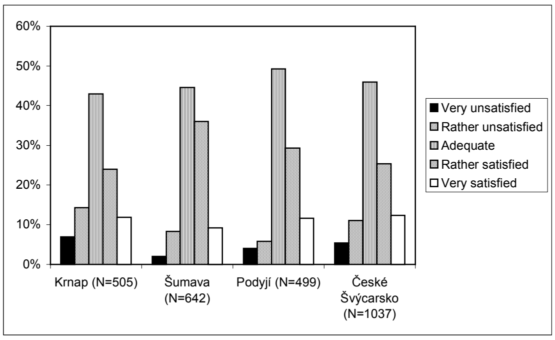

Fig. 8 - How are you satisfied with your holiday expenditures in the territory of the NP?

CONCLUSIONS

The data presented in the paper represent only small part of the results of the far-reaching tourism monitoring in the Czech National Parks. In the year 2000, for the first time in history of the tourism research in the Czech Republic, all four National Parks in the Czech Republic were observed using the same research criteria and assumptions.

Further in-depth evaluation of all origins and implications of inner- and inter- park tourism–management relations is needed. However, given results outline the fist step to the continuous monitoring of the tourism exploration of the Czech protected areas. Accordingly, their practical dimension makes them irreplaceable for park management structures.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Visitor Use of USDA Forest Service Recreation Areas: Methods and Results from the National Visitor Use Monitoring Effort

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Abstract: One stratum of survey sites in the USDA Forest Service's National Visitor Use Monitoring (NVUM) effort contains agency-managed elements of the National Wilderness Preservation System. Two related methods are used to estimate the amount of visitation that occurs in these areas. One utilizes annual information on the number of use permits at the sites where these are mandatory; the other employs a double-sampling approach to estimate visitation. In both cases, on-site visitor sampling is required to obtain the information necessary to estimate actual visitation. A few additional questions on the survey enable us to describe visitor demographics, evaluate customer satisfaction, and estimate economic values and impacts of these visits.

The presentation discusses development of the sampling design as well as calibration issues for both use estimation methods. A comparison of the statistical accuracy and cost of each is made. Because the sample design is based on the spatial-temporal combination of Wilderness exit points and the days they are open, some analytic adjustment to the sample survey data is required (beyond simple sample means) to get results that describe the visiting population. The analytic framework is presented, along with some empirical results from the first year of sampling at six selected National Forests to give the flavor of the managerially-relevant information we have so far obtained. The presentation concludes with a discussion of how we plan to extend the analysis that can include issues such as developing models of visitor flows and relating visitation levels to perceptions of crowding.

INTRODUCTION

One of the goals assigned to the National Visitor Use Monitoring (NVUM) team in developing estimates of the volume of visitation that occurs on USDA-Forest Service lands was to be as accurate as possible, i.e., to try to minimize the error associated with the visitation estimate. This was an important but substantial issue, given the expected size of the quantity to be estimated, and the scope of agency lands to be covered each year. One way our research project tried to do that was to make use of visitation-related annual counts that are routinely compiled by the agency at some of its recreation sites. Examples of information that can serve as a proxy for the level of visitation include: permanent traffic counters along roadways at trailheads or at developed sites such as visitor centers, mandatory permits to be able to use some wilderness areas, fee envelopes or concessionaire records at developed campgrounds, fee receipts charged at some day use sites, downhill ski areas, usage reports for cabins or lodges, and special use permits obtain for use of certain facilities. Usually, sites that have reliable information of this type are more heavily used than those sites that do not.

The primary intent in incorporating the additional data was to reduce the overall variability in the visitation estimate for national forests. Since annual counts for visitation proxy information were known without error, variability would come only from calibrating the proxy counts to visits. For example, traffic counts must account for variation in number of people per vehicle, and the proportion of non-recreating vehicles. This paper examines the statistical efficiency of the types of visitation proxy information used in the first year's data collection. We compare the variability of estimates for sites that had some sort of visitation proxy to the sites that did not.

RESEARCH METHOD

We outline only the basics of our method here. More detail can be found at the NVUM website version of our methods paper (http://www.fs.fed.us/recreation/recuse/methods/methods052001.rtf). The basic research unit was a national forest. In the U.S., there are about 125 national forests which jointly manage about 192 million acres of forests and grasslands. We sample forests on a five-year cycle. About one-fourth of

	Non-proxy Site Days		**Proxy Site Days**	
Forest	Sampled	Population	Sampled	Population
Beaverhead - Deerlodge	170	47,965	23	6,001
Flathead	187	36,714	21	4,441
Nez Perce	147	38,284	0	0
Rio Grande	123	44,158	14	3,468
San Juan	150	36,453	10	6,267
Arapaho	173	106,998	9	1,379
Cibola	169	66,135	15	5,800
Coconino	206	48,191	35	8,274
Kaibab	101	14,294	21	3,121
Boise	123	49,634	40	9,804
Caribou -Targhee	152	125,530	23	4,883
Sawtooth	122	29,605	24	2,439
Humbolt - Toyiabe	215	331,830	18	5,685
Angeles	231	31,940	45	8,409
Lassen	162	19,255	12	5,892
Modoc	143	13,200	11	2,038
Plumas	158	18,669	14	5,965
Mt. Baker - Snoqualmie	119	29,433	18	9,986
Ochoco	166	25,098	17	4,435
Okanogan	184	25,265	2	61
Olympic	171	21,954	25	5,765
Columbia Gorge	152	13,599	9	906
Florida	109	101,959	25	4,760
George Washington - Jefferson	205	122,340	27	3,828
Ouachita	161	163,009	0	0
Carribean	41	5,124	4	365
Superior	153	37,313	20	17,642
Hiawatha	139	41,140	16	3,998
Green Mtn. - Finger Lakes	221	67,885	10	1,229
White Mtn.	160	42,236	45	12,592
Tongass	133	42,563	11	12,352
TOTAL	4,846	1,797,773	564	161,984

Table 1. Sample size for the first sample year (CY2000), by forest.

the forests are sampled each year. The fifth year allows time to revise and improve the research process. During calendar year 2000, 31 different forests were involved with sampling.

The primary sampling frame was the spatial-temporal combination of a recreation site and a calendar day on which people visit the site. Each sampled national forest first identified every developed recreation site, such as campgrounds and picnic areas, as well as wilderness trailheads and access points to the general forest area. For each site, every day in the year that the site was open was assigned to one of three sampling strata (high, medium, or low), according to the level of exiting recreation traffic. In addition, each site-day was classified as to whether some credible visitation proxy existed (proxy site-days) or not (non-proxy site days). Proxy site days were then stratified according to the type of use proxy information, rather than by use level.

For non-proxy site days, the number of daily exiting visits was estimated using a double-sampling method. A traffic counter was placed at the site for 24 hours. Interviews occurred during a six-hour period, to determine the proportion of traffic that was completing a recreation visit, and the average number of persons per vehicle. Mean and variance of daily visitation were calculated across all days in a sampling stratum, and expanded to the forest population of site days in that stratum.

Visitation for proxy site-days was estimated somewhat differently. On sample days, no 24-hour traffic count was used. Instead, surveys were conducted to obtain a daily estimate of a calibration coefficient for the proxy information. Mean and variance of the calibration coefficient for a sampling stratum were calculated across all of the sample days in the proxy stratum, and expanded to the total forest count for that type of use proxy, summed across all sites that used the proxy.

Table 1 shows the size of the site day population and number of sample days for both proxy and non-proxy strata on each sampled forest. In general, proxy days made up ten to fifteen percent of the sample size in forests that had proxy site days. The overall sampling rate for proxy site days was somewhat larger than for all nonproxy days. The reason for this is that most of the non-proxy site days were in low exit volume categories that were sampled at a much lower rate than were the medium or high exit volume categories. By contrast, very few proxy days were classified as having low exit volume of visitors.

EVALUATION OF PROXY DATA

We expected there would be less variation in the calibration coefficient across sample days in proxy strata than there would be in daily visitation estimates for non-proxy strata. Thus, incorporating the proxy data into our research design was expected to reduce the variance in the total visitation estimate for each forest. To evaluate whether this was true or not, we chose to compare coefficients of variation (CV) for non-proxy versus proxy strata for each forest. The coefficient of variation (CV) was used as a measure of the precision of the visitation estimate and is defined as

$$CV = 100 * \frac{\sqrt{VAR}}{TOTAL}$$

The CV shows the variance of an estimate relative to the size of the estimate itself. For our purposes, we expect CV for visitation estimated for site days for which there is proxy data to be much lower than those for visitation estimates for site days that do not have proxy data.

FOREST	Non-proxy CV	Proxy CV	Total CV	Current	Sample Size: Needed to reach Total CV without proxy data
Beaverhead - Deerlodge	19.44	8.92	17.56	193	186
Flathead	12.13	14.38	9.49	208	279
Nez Perce	19.14	--	19.14	147	147
Rio Grande	31.28	5.81	28.25	137	134
San Juan	11.84	6.20	11.22	160	193
Arapaho	18.72	1.96	9.42	182	197
Cibola	19.40	2.07	17.29	184	243
Coconino	14.70	4.31	11.21	241	291
Kaibab	31.20	7.18	24.41	122	134
Boise	23.19	14.38	12.64	163	515
Caribou -Targhee	19.70	9.40	17.88	175	167
Sawtooth	17.04	6.11	10.06	146	305
Humbolt - Toyiabe	19.25	7.09	15.87	233	211
Angeles	14.66	6.01	10.36	276	389
Lassen	21.13	12.26	18.87	174	207
Modoc	21.80	13.69	20.34	154	169
Plumas	19.53	7.72	18.06	172	201
Mt. Baker - Snoqualmie	14.08	18.46	13.72	137	130
Ochoco	16.04	29.90	18.12	183	181
Okanogan	21.16	0.00	20.32	186	203
Olympic	18.96	2.47	12.73	196	401
Columbia Gorge	15.34	27.73	13.94	161	195
Florida	19.23	0.42	15.54	134	185
George Washington - Jefferson	11.40	6.05	11.10	232	225
Ouachita	13.66	–	13.66	161	161
Carribean	35.46	8.72	34.74	45	45
Superior	14.34	1.97	13.31	173	208
Hiawatha	13.58	9.22	12.36	155	165
Green Mtn. - Finger Lakes	17.18	5.12	12.86	231	364
White Mtn.	12.29	32.95	23.33	205	199
Tongass	25.90	9.09	25.81	144	167

Table 2. Comparison of coefficient of variation (CV), by forest.

The results of this comparison show pretty much exactly what we expected. Across all 31 forests, nearly half had a CV for the non-proxy portion of their visitation between 17 and 21 (Table 2). Three had CV values over 30. The median value was slightly less than eighteen. Across the 29 forests that had proxy data, thirteen had values between 5 and 10, and six forests had values below three. Here, the median value would be just under eight. In nearly every case, the non-proxy CV estimate was improved by the addition of the proxy visitation estimate and its relatively smaller variance. Overall, we used 564 proxy sample days to estimate about 16.6 million site visits on these 31 forests. In the non-proxy strata, we used 4,846 days to estimate about 50.5 million site visits. That is, in the non-proxy strata, we needed eight times as many sample days to estimate three times as much visitation.

There were some unexpected results in the CV comparisons that merited further examination. In particular, there were five forests for which the CV for proxy visitation was larger than for the non-proxy. These forests were the Flathead, Mt. Baker-Snoqualmie, Ochoco, Columbia Gorge, and White Mountain. For each forest, we examined each type of visitation proxy that was used. Two forests, the Ochoco and the Columbia Gorge, included permanent traffic counters on forest roads as proxy information for visitation to parts of the general undeveloped portion of the forest. To calibrate the traffic counts, the interviews obtained two pieces of information. First was the proportion of vehicles on that day that were finishing their recreation visit to the forest. Second was the average number of people in each vehicle that was competing a recreation visit. On the Ochoco, there was a wide range across sample days of the proportion of vehicles that were finishing a recreation visit. Over the 4 days sampled, the proportion ranged from about 40 percent to 100 percent. On the Columbia Gorge, the proportion of exiting traffic that was finishing a recreation visit was more stable, but the daily average number of people per vehicle ranged from just over 1.2 to almost 6.8. Here, it was the combination of daily means of the proportion that were finishing a recreation visit and the average people per vehicle that generated higher variability.

On the Mount Baker- Snoqualmie, the high variability was caused by using number of tickets sold at a large downhill ski area as a visitation proxy. The annual proxy count was just the total number of tickets sold by the ski area. That total included single day tickets, multiple-day (weekend) tickets and a fair number of season passes. Calibration entailed converting number of tickets to number of visits. The problem centered on the season passes. The ski area is within a short drive of metropolitan Seattle. Although about one-quarter of the people interviewed showed a one-to-one correspondence between tickets and visits, a number of people indicated that they used their season pass 50 or more times. The wide range across individuals caused the higher proxy variance for this forest.

On the White Mountain, a downhill ski area near population centers caused a similar, albeit smaller problem. A more significant issue was with a visitation proxy that counted campsite nights occupied. This forest has some campgrounds that have both family-sized sites, and large-group (25 or more people) sites. To convert from campsite occupancy to visits, we needed to multiply by the average camping party size. On some sample days, only small groups and individuals were interviewed, so the average was slightly less than 2.0. On other days, one or more large groups were encountered, so the average party size on those days was about 9. A potential solution for this is to separate large group and small group sites into different sampling strata.

On the Flathead, a small number of sample days caused somewhat higher than expected variance. A severe forest fire led to extensive site closures during a peak use season. Visitation stayed low after the fire closure order was lifted. Consequently, on a number of assigned sample days, there were no visitors to interview. For one type of proxy count in particular, a count of payment envelopes at fee campgrounds, only 2 sample days occurred that had individual visitor data with which to develop calibration coefficients. The daily average conversion from envelopes to visits on one day was about 2.5, but was over 6.1 for the other day. As a result, the variance estimate was quite high. The mean and variance calculated from these two days were expanded to a forest-wide population of over 1400 days.

SAMPLE SIZE REDUCTION

Overall, it appears that using the visitation proxy data was well worth the effort. However, the gains become more tangible if we could estimate how many sample days were saved. Our project allocated about $375 per sample day to forests to accomplish the sampling. Quantifying sample days would allow us to approximate cost savings. To do that, we extrapolate from the non-proxy sample alone to the entire population of site days on each forest. We compute what sample size would be needed to reach the CV level actually observed when both proxy and non-proxy sampling was used.

The determination of the number of non-proxy site days required to achieve a desired CV for a forest surveyed under a stratified random sampling design used three types of information obtained from the original survey. First, the total number of site days (N_h) in each site type-use level stratum was obtained by combining over non-proxy and proxy site days. The strata weights (W_h) were defined simply as the proportion of total site days in stratum h. Next, strata daily visitation means (y_h y) and variances (s_h^2) were approximated by assuming the estimated means and variances from the original non-proxy survey. Regional averages were used in a few instances where a stratum was based on only proxy site days.

The above quantities were used to derive an estimate of the total number of site visits defined as:

$$TOTAL = \sum_{h=1}^{L} N_h \bar{y}_h$$

with estimated variance defined as

$$VAR = N^2 \sum_{h=1}^{L} \frac{W_h^2 s_h^2}{n_h} - N^2 \sum_{h=1}^{L} \frac{W_h^2 s_h^2}{N}$$

where

N = the sum of the N_h and

n_h = the number of site days sampled in stratum h.

Since TOTAL and VAR are fixed except for the n_h's, a desired CV can be obtained by iteratively adjusting the n_h's until the specified CV is achieved. Summing across strata yields the total sample size n associated with the target level of precision. For simplicity, we simply increased all the n_h's by the same proportion.

The results are found in the last two columns of Table 2. For eight of these forests, eliminating sample days to calibrate proxy counts would allow a reduction their overall sampling burden without sacrificing accuracy. Three of these forests were ones that had high variability in their proxy visit estimate, as discussed earlier. For them, the reduced sample size reflects the relatively lower variability in the non-proxy strata. The other five fell into one of two categories. Two were forests that had similar problems with high variability in estimating visitation from ski area or vehicle traffic proxy counts. The other three were forests where proxy site visitation was less than 10 percent of the forest's total visitation. In this last instance, sampling gains existed because the sample days used to estimate the small amount of proxy visitation would have been better used improving the estimate of the much larger non-proxy visitation. However, on twenty of these forests, not employing the visitation proxy data would have required a larger sample size to achieve the same level of precision. For these forests, using the proxy visitation data reduced the sampling need by an average of over 70 days per forest.

Under the current sampling protocol, there were 5,410 sample days accomplished across the U.S. If the visitation proxy data were not used, nearly 6,800 sample days would be required to have the same accuracy in the estimate for each of the 31 forests. That additional 1,400 sample days translates to an increase of over 25 percent. Accomplishing these extra days would cost over a half-million dollars in staff time. Additional costs would be incurred for printing and mailing survey forms, data entry, and data cleaning.

DISCUSSION AND CONCLUSION

The analyses presented here show that using the visitation proxy information did reduce the overall sampling level that we needed at the national level. The sampling reduction was somewhat more that we had anticipated. To understand why so many more days were needed to equate the CV measures, we need to examine which kinds of proxy counts worked best.

Not surprisingly, the best results were obtained at day-use developed sites whose counts were based directly on visitation. Ski areas that reported skier visits had essentially zero variance, since the counts needed no conversion to visits. These were especially important in reducing overall variance, because of the high volume of visits that occur there. Other developed sites that charge per-person fees did almost as well. There were a few instances where the one-to-one relation did not hold. Individual or vehicular traffic counts, such as turnstiles at visitor centers or pneumatic tubes at picnic area entrances had to be adjusted for return entrants on the same visit, or people who entered to just use the bathrooms.

Proxy counts for use of overnight developed sites with homogenous user patterns also had low CV estimates. Regardless whether the proxy was number of campsite-nights occupied or number of fee envelopes collected, if the campground was composed of just family-sized sites, the variability was lower than for overnight sites without proxy information. The gains in sampling were relatively greater on forests that had a large number of campgrounds, where the campgrounds are heavily used, or where the campgrounds are large – then the benefit of measuring a high visitor volume outweighs the variability.

Permanent traffic counters, especially those placed on roads that provide access to the general forest performed worst. Forest roads are used by commuters, loggers, agency staff, and others on non-recreation trips. The percentage of vehicles on non-recreation purposes can vary widely by season and day of the week. Variability was very high for ski areas that reported ticket sales, rather than skier visits. In general, vehicle-based counts had higher variance than counts based on number of sites used or number of people.

There were other reasons to use the proxy data as well. Personnel costs for sample days were reduced. Setting up the 24-hour traffic counter required at least two trips to the interview site, three if the interview period was neither at the beginning or end of the 24-hour period. Travel from staff offices to interview sites often took several hours. Because 24-hour traffic counts were not needed for proxy sites, forest staff made at least one less trip per interview day. Some of this savings was offset by the staff time needed to collate and verify the annual counts from the various proxy sites.

Perhaps a more important benefit of using the proxy data is that it provides a means by which national forests can inexpensively estimate visitation in non-sample years. First, the forest must obtain the appropriate counts for proxy sites in the off-years. If we assume the forest-wide relationship between the proxy count and the associated visitation is nearly constant between survey cycles, the same calibration coefficients can be used to approximate visitation in the off years. Summing over all proxy sites and types gives a new estimate of proxy site visitation. We can further assume that the forest-wide ratio of proxy site visits to total visits is constant over the same time. Thus, if we apply the ratio of total visits to proxy site visits from the sample year to the off-year estimate of proxy visitation, we get an estimate of total visitation in the off-year.

Clearly using this type of information has the potential to dramatically affect the sample size needed to accurately estimate visitation. However, before using visitor proxy information in that fashion, researchers and managers need to consider certain issues carefully:

(1) How close is the proxy count to the measure of visitation desired? What other pieces of information are needed to convert the proxy counts into actual visit estimates? How will that information be elicited and how accurate and/or variable will those be?

(2) Does the visitation proxy account for all use of the site? If not, how can an accurate measure of its proportion be obtained?

(3) The research process presumes that the proxy count is an actual count, and known without error. Can the visitation proxy actually and accurately really be obtained from field staff? Can the count be verified readily?

(4) Are there other uses of the proxy counts, such as approximating visitation in subsequent years that make employing those counts feasible?

The answers to these questions can determine whether or not it is worth using visitation proxy data.

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Standardisation of Visitor Surveys – Experiences from Finland

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Abstract: A visitor survey standardisation project was conducted in 1998-2000 in Finland. The visitor survey standardisation project was part of a large national outdoor recreation demand and supply inventory (LVVI). There are two reasons for the standardisation of visitor surveys. First, it is possible to collect comparable information from different kind of areas. Moreover, the information gathered can be combined on a national level. Secondly, standardised measurements assure long-term monitoring of behavioural changes in each studied area.

The visitor survey standardisation project developed a standardised questionnaire for the most important information gathered with the help of visitor surveys, that is visitor profiles, activities, distribution of use by area, distribution of use by time, duration of the visit, expenditure of visitors and information on visitor satisfaction and motivation. It is recommended that the data collection be carried out by means of self-conducted questionnaires. The project produced a visitor survey manual and a Microsoft Excel application for computing descriptive results in order to encourage the personnel of recreation areas to conduct visitor surveys independently.

The implementation of standardised visitor surveys is mainly carried out by Metsähallitus (Forest and Park Service) which manages the majority of the state-owned protected areas and national hiking areas in Finland. At the beginning of 2002, there were 33 national parks, 7 state-owned hiking areas and some 400 other protected areas. About two million recreational visits take place annually in state-owned protected areas and national hiking areas. The number of recreational visits seems to be on the increase.

All together 22 different visitor surveys have been conducted in state-owned areas in the last few years. The results of some of the surveys have almost immediately been used in management and planning of the area in question. In general, there is increasing understanding and interest in the use of visitor information as a tool in decision making: services can be improved to meet visitor expectations better and scarce resources can be allocated more effectively. Along with visitor surveys, systematical visitor counts have recently been started using electronic trail and traffic counters, guest books or manual counters in several protected and recreational areas. At the moment, the next step will be to develop a national database of the collected information, and also to develop good practice in order to benefit from the information on a national level.

This paper discusses, firstly, the structure and type of information that is needed from a visitor survey, secondly, how to conduct a visitor survey as a routine method in planning processes, and the framework within which visitor information can be utilised in planning and management. Thirdly, the Finnish experience of the benefits to be gained by using a standardised model for conducting visitor surveys is discussed.

THE NEED FOR VISITOR SURVEYS

The management of state-owned protected and recreational areas in Finland

Protected and recreational areas include national parks, state-owned hiking areas and wilderness areas and other nature conservation areas to which access is permitted, as well as other areas reserved for recreation. In Finland, protected and recreational areas are mainly managed by Metsähallitus (Forest and Park Service). Metsähallitus is a state enterprise, which, in addition to business activities, also has social responsibilities. The Natural Heritage Services of Metsähallitus manages most of the state-owned areas reserved for nature conservation and recreation and controls their use. Issues relating to nature conservation and recreational services provided for citizens are social responsibilities and they are mainly financed by the state. At the beginning of 2002, there were 33 national parks, 7 state-owned hiking areas and some 400 other protected areas in Finland. In addition, several new national parks and hiking areas are being planned. One national park and some protected areas are administered by the Finnish Forest Research Institute (Metla). There are more than two million recreational visits annually to state-owned protected and recreational areas.

Need for visitor information in state-owned areas

The number of recreational visits to state-owned protected and recreational areas is continually growing, thus presenting increasing challenges in the planning of their management and use, although this also creates new opportunities. The growing numbers of visitors leads to increasing problems in relation to the ecological and social tolerance of the protected and hiking areas. Heavy visitor traffic causes deterioration and other disturbances in the terrain from the perspective of nature conservation. Visitors may experience congestion as disturbing to their own recreation.

At the same time, the amount of budget funds allocated to recreation services has not increased to meet the growing service needs of the increasing number of visitors. It has become more important than ever to know how many visitors use the area and also to know the visitor profile and their opinions, so as to manage and prepare for changing situations in advance.

Metsähallitus has started systematic visitor counts in several areas, especially in national parks and hiking areas. A variety of methods can be used. Metsähallitus uses electronic trail and traffic counters and mechanical counters. In addition to these, trail logs, in which the visitor can write comments are also useful tools for estimating the number of visits (see Rauhala et al. in this proceedings and Horne et al. 1998).

Besides the number of visitors, other information on visitors is also necessary. This is gathered by means of visitor surveys. Visitor counts and visitor surveys are complementary to each other and they should be carried out simultaneously.

Standardisation of visitor surveys

There were several reasons for the standardisation of visitor surveys in Finland. Visitor surveys had been conducted earlier in municipal recreational areas and state-owned hiking areas and national parks (e.g. Sievänen 1992a and b, 1993, Ovaskainen et al. 1999). In several contexts, it was found to be necessary to compare visitor information gathered from different areas or from the same area at different times.

There was a need to collect information on the demand for outdoor recreation throughout the country and to create a national information system on recreational use. This was the motivation behind compiling of a national outdoor recreation demand and supply inventory (LVVI) (Sievänen 1998). The demand for recreational use was studied with the help of an extensive population survey, the results of which reveal among other things how often and where Finns participate in outdoor activities. Every fourth Finn visits state-owned recreational areas yearly, and 10% of all outdoor recreation takes place in these areas.

An information system was developed to inventory the supply of outdoor recreation. It gathers information on recreational areas, hiking trails and recreational services. Unfortunately, information on the use of the area, i.e. number and type of visitors to the area, is not often included in the gathered information (Sievänen 2001). One of the objectives of the LVVI study was to find ways of developing methods for visitor surveys that would enable us to obtain comparable information on the use of the areas.

One of the aims of the visitor survey standardisation project was to evolve a method for gathering data, tested indicators for visitor information and also calculation and reporting methods. Another objective was to produce a manual for conducting visitor surveys and utilising visitor information in planning the management and use of the areas. The visitor survey standardisation project was conducted as a cooperation project by Metla, Metsähallitus and the University of Helsinki in 1998–2000.

STANDARDISATION OF SURVEYS AND MEASUREMENTS

The aim of the standardisation of visitor surveys is to produce commensurable and comparable information on the same factors. It is not necessary to carry out the measuring in exactly the same way in each place, but the measurement method, the variables and the indicators must be compatible, so that the information can be rendered commensurable.

The visitor survey standardisation project developed standard questionnaires and also guidelines for sampling, the calculation of results and reporting.

Standard form

Only the most relevant issues that are usually of interest in visitor surveys were included in the questionnaire. Special attention was given to the formulation of the questions and to the structure of the questionnaire. The standard questions form the basis of the questionnaire in all visitor surveys, but there is also room for questions specific to the areas.

The questionnaire was tested in the hiking areas of Syöte and Evo (Erkkonen 2000) and also

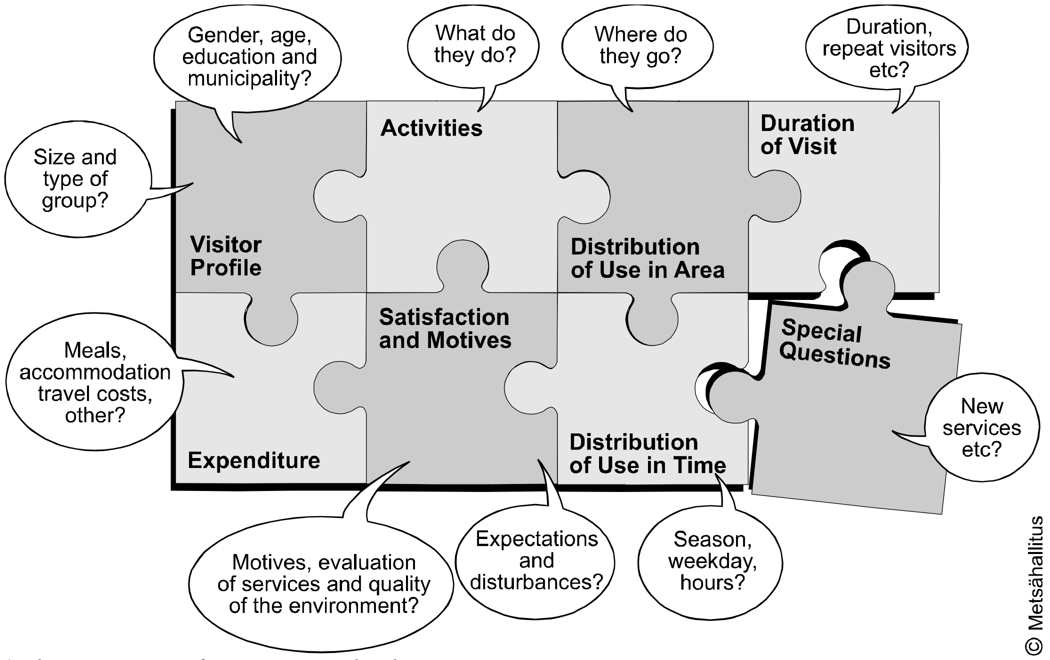

Figure 1. The most important factors inventoried in the visitor survey.

in the Pallas-Ounastunturi national park in 1998 (Erkkonen 2001). The standard form has been further developed as experience has accumulated from the visitor surveys. It has evolved into a basic form that is effective and can easily be applied in different areas (Erkkonen & Sievänen 2001).

Recommendations for data collection

Visitor surveys are carried out by means of questionnaires and interviews among the visitors to the area. Metsähallitus usually uses guided questionnaires. In most cases, it is recommended that some 300–500 questionnaires be collected during the survey period (summer, winter). Sampling arrangements and the size of the sample vary considerably depending on the nature of the area and the resources available. The randomness of the sample is ensured by distributing the collection of the questionnaires over the entire data collection period. Questionnaires are also collected at different entrance points to the area, so that at least the most important peak areas of visitor flows are covered. It is recommended that visitor surveys should be repeated about every 5 years, depending on the area.

WHAT INFORMATION IS COLLECTED?

Visitor surveys are used to gather information about visitor profiles, activities, use of the area, visitor satisfaction, duration of visits and expenditure during visits.

Visitor profile information consists of normal socio-economic data. In addition, visitors are asked whether they have visited the area before and if so, when they visited the area for the first time. The questionnaire also asks the ages of the oldest and youngest members of the group and whether any visitors are handicapped.

Outdoor activities and other forms of use are inventoried, mainly for the purpose of correct dimensioning of services and accommodation different visitor groups in the same area. Visitor satisfaction is measured by means of an indicator that consists of almost 20 different factors. Visitors are also asked to assess factors that disturb their recreation experiences. The questions relating to specific areas may concern such things as traffic arrangements and the need to increase or decrease the amount of services (Figure 1).

OUTCOME OF THE VISITOR SURVEY STANDARDISATION PROJECT

The actual outcome of the project is the visitor survey manual (Erkkonen & Sievänen 2001). The manual contains comprehensive instructions for carrying out a visitor survey, reporting its results and utilising visitor information (Figure 2). The purpose of the manual is to facilitate the conducting of visitor surveys, so that the basic tools, such as the questionnaire and the report model, are ready for use after minor modifications. The manual also gives instructions for planning sampling and the arrangements for data collection.

A MS Excel (Excel 97) application was developed during the project for saving the questionnaires and processing the data. It produces various tables and graphs (direct distributions and averages), which can then easily be transferred to the report. The application produces the results in the form of the report model presented in the visitor survey manual. This makes it considerably easier to compare the results for different areas or within the same area. The application is used by Metsähallitus.

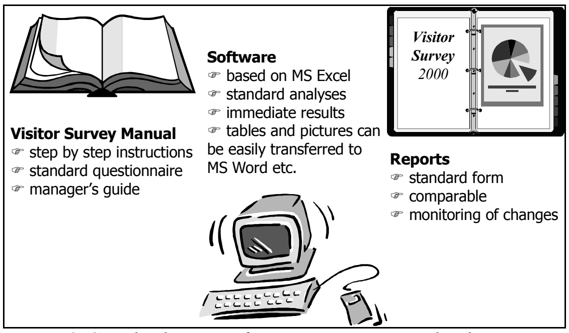

Figure 2. Standardisation of visitor surveys in Finland.

NUMBER OF VISITOR SURVEYS ON THE INCREASE

More than 20 visitor surveys have been conducted in state-owned protected and hiking areas in 1998–2001 (Figure 3). The surveys have been carried out using a standardised method, and their results are for the most part comparable (e.g. Erkkonen 2000). In the future Metsähallitus plans to carry out 5– 10 visitor surveys annually.

With the help of the manual, the personnel of protected and recreational areas can conduct visitor surveys in the course of planning their activities, and they do not have to start from scratch or hire an external researcher for the job. Metsähallitus has trained the personnel of the protected and recreational areas in the conducting of visitor surveys. Most of the visitor surveys have been organised by Metsähallitus' own personnel, however with the help of students and other temporary employees. Metsähallitus has employed one person to train, guide and co-ordinate visitor surveys.

INTERPRETING AND UTILISING VISITOR INFORMATION

A visitor survey primarily produces information for resolving practical problems relating to planning and management, and to facilitate decision-making. Visitor surveys provide a wealth of information that is easy to interpret and apply. They can be used to decide the locations and scope of the services provided and also in the timing and maintaining of these services.

Information on visitors and their experiences is needed in order to develop the services. Information about the wishes and expectations of the visitors are especially useful when changes are made that affect the services. Most changes are improvements or additions to the present services, but sometimes the intention is to cut out unnecessary services. It is also recommended that visitors' opinions be taken into account on issues

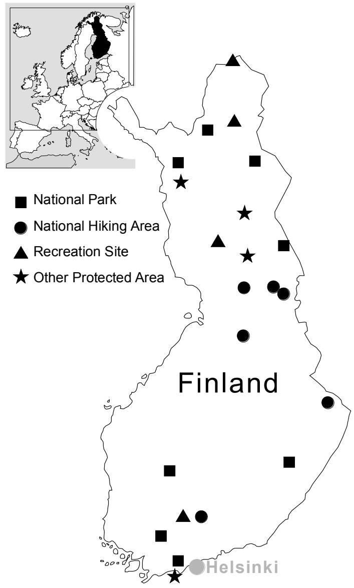

Figure 3. Visitor surveys carried out using the method developed by the visitor survey standardisation project in 1998–2000.

relating to the management of the environment. In addition, visitor information is used in allocating human and other resources and in marketing the recreation areas and services (f.ex. Dales 1993).

Preparation of management plans

When compiling a management plan, a visitor survey is one of the basic studies carried out at the outset of the process. The visitor survey and the visitor count both produce important basic information which is used to describe the present status, to analyse problems, to look for solutions and finally to set targets. However, a visitor survey does not produce solutions for problems, but at best supports planning and decision-making by suggesting alternative solutions.

Information provided by surveys helps to identify and analyse problems as well as to understand the links between entities and their individual elements. The advantage of systematic information is that it is comprehensive and generally applicable, and thus it gives a better picture of facts and phenomena than sporadic observations and everyday experience. Metsähallitus has already utilised visitor information in the compilation of several management plans.

Controlled visitor guidance

Information about outdoor activities can be used if there is a need to control visitor activities in the area in some way. This may be necessary due to conflicts between different visitor groups, visitor traffic peaks or use that exceeds the ecological carrying capacity of the natural environment. By controlling the use of the area it is possible to guide visitors towards activities that are most suitable for the area in terms of ecological and social sustainability.

It is useful to know the distribution of the sites visited, for example, when planning services, trails and routes, rest points, firewood supply and waste disposal. Systematic control of visitor flows can also help to avoid deterioration of the terrain and to level out peaks.

Allocation of resources reserved for the maintenance and management of the area

With a view to the management and planning of the area, it is useful to know why visitors come to the area and what their most important motives are. The activities provided by the area can then be developed in the direction that visitors consider important. The aim is to offer visitors the opportunity to have the kind of experience that they expect of their visit.

On the basis of visitor satisfaction information, resources can be allocated to develop services that visitors are dissatisfied with or that they have found to cause problems. However, the manager of the area must decide the threshold limit beyond which measures are taken. It is not feasible to fulfil all wishes.

Information about how well visitor experiences have met expectations and to what extent visitors report on disturbances during their visit also tell something about visitor satisfaction. Changes in visitor satisfaction can be studied by repeating visitor surveys.

Information on the vehicles used to reach the area and the time of arrival at the area are used for planning the working hours of the visitor centre and service points personnel and for recruiting temporary staff as well as for planning car parks and directing traffic, for example.

Information on the expenditure of visitors is utilised in the planning of paid services (accommodation and restaurant services) and in developing new services (new activities and recreation services). In addition, information on the number of visitors and their distribution in the area can be used as grounds for new investment plans presented to project funding agencies and for more efficient allocation of human and other resources between the different sites.

Visitor centres and service points

A visitor survey carried out in a protected or hiking area can also be utilised by a visitor centre or service point in the area or in its vicinity. It can provide vital basic information for deciding on opening hours, exhibition themes and the needs for developing new services. In addition visitor information can be utilised when planning brochures, identifying and selecting target groups and deciding on the focal points of nature interpretation.

Marketing and communications

Information relating to visitors' backgrounds and their place of residence is exploited in the marketing of the services and recreational activities offered by the area. It is also advantageous for nature interpretation to know the visitors of the area as well as possible. The visitors' place of residence indicates whether the area is of local, regional, national or international significance.

Assessing the impact of measures taken and monitoring changes

Conducting visitor surveys systematically and on a routine basis at regular intervals enables us to monitor changes in the recreational use of the area in question. Changes can concern the visitor profile or their opinions on the area or the quality of services. The monitoring of changes makes it easier to assess what impacts the measures taken have had on visitor satisfaction (e.g. increase or reduction of services) and whether changes in management policy have influenced the visitor profile.

Comparison between areas

If similar questions and indicators have been used for monitoring the use of areas, it is possible to compare different areas with each other, even though the areas are very different. In addition to qualitative descriptive visitor information, comparable quantitative information on the number of visits (visitor counts) is also necessary. Comparable information on recreational areas maintained by the state or local governments is needed for monitoring the use and cost development of the areas.

National database of visitors

Metsähallitus is at present making preparations that will lead to the collection of visitor information from state-owned protected and recreational areas in one information system. The work is challenging and is still in its early stages. A consistent database could be utilised in the monitoring and reporting of annual operations, in research and in quality classification of the areas.

Recreation demand at the national level

Comparable quantitative and qualitative information about recreational use is also needed by public agencies providing funding for recreational services, such as ministries and municipal decision-makers, in order to direct the allocation of resources according the recreational needs of the population. Information on the amount of use and the expenditure of visitors can furthermore be used as a basis for calculations and conclusions concerning the impacts of the national park or hiking area on the economy of the region.

Visitor information from state-owned and municipal areas is collected in the National Sport

Databank in Finland, which is maintained by the University of Jyväskylä. Information about the demand for recreation gathered from the areas is compared with information obtained from population surveys. The on-site information about recreational use provides a sound basis for analysing whether the recreation demand and supply meet.

CONCLUSIONS

In Finland most extensive protected and recreational areas are owned by the state and administered by Metsähallitus. The situation is good in terms of visitor surveys, as good and tested methods are put into practice very quickly around the country. In the state-owned areas visitor surveys are currently well under way, but we are only starting out on the long road involved in collecting monitoring data. One of the challenging tasks facing us is the closer integration of visitor surveys and visitor counts into the routine planning of management and use of these areas. We therefore need to invest more in gathering both qualitative and quantitative visitor information. In particular, the reliability of visitor statistics should be improved.

One of the most significant achievements of the visitor survey standardisation project was its impact on attitudes. Now attitudes towards visitor surveys are positive, and the surveys are considered important for the development of recreational areas. In a few years the number of visitor surveys has increased many times over compared with the previous level. Conducting visitor surveys and systematic counting of visitors by various methods has now been registered as one of the annual targets of the recreational areas managed by Metsähallitus. This being the case, the accuracy of visitor information is increasing and it will be exploited more actively in the future.

Although the primary objective of the visitor survey standardisation project was to create a uniform method for conducting visitor surveys for the use of the state and local governments, this method is also suitable for other than public agencies that want to conduct visitor and customer surveys. All those who need information about visitors or customers (e.g. nature tourism enterprises) can utilise the tested indicators when developing recreational services.

Information gathered from protected and recreational areas maintained by the state and local governments and registered in the national database can be used to assess recreational services and projects financed from the state budget and also to support the setting of targets, decision-making and the implementation of recreational policy. In the years 2002–2001, the Finnish government commissioned the Ministry of the Environment to prepare a programme for the development of outdoor recreation and nature tourism (2001). In this task population statistics produced by the LVVI study and information from the visitor surveys was used. In the future, information produced by visitor surveys will be exploited in following up the development programme.

In recent years (especially since Finland joined the EU), ministries and other government bodies, such as Metla and the Finnish Environment Institute, have received many European and other international statistics surveys, which include questions about the recreational use of the natural environment. Monitoring of the sustainable development of natural resources also requires updated statistics that can be used to assess any changes in the use of the natural resources. In addition, national visitor statistics provide necessary and useful background information for research on recreational use of natural resources.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Standardisation of Visitor Counting– Experiences from Finland

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Abstract: In 2000 we started to test visitor counters for the Natural Heritage Services of Southern Finland, in the Teijo Hiking Area. At the same time we tested both an appropriate method for visitor counting and counting equipment. Encouraged by this experience, we started systematic visitor counting in nine southern national parks in 2001.
Traditional everyman's rights (right of public access) guarantee all people - Finnish or otherwise - free access to Finland's forests, whether the forests be privately or publicly owned. This makes reliable visitor counting difficult, but at the same time extremely challenging.
The main reason for visitor counting is the fact that the total number of visitors is not known well enough in protected and recreational areas. We also need to have comparable and reliable visitor information from different types of area and in the long run we need to know the trends as regards the number of visitors. Besides being very important for Metsahallitus itself, the reliable estimates we are able to produce are also of great regional significance.
Visitors can be counted by electronic and mechanical counters of different kinds. We have four types of counter in use. Three electronic types can be used in trail and traffic counting and also indoors. In addition there is one mechanical type which can be used indoors, for example.
At the moment the Natural Heritage Services of Southern Finland have about 40 counters in use. Each counter calculates visitors somewhat differently, depending on the installation of the counter, its placement and the quality of the counter. Also, different weather conditions may affect the counters. For these reasons, each counter must be calibrated independently, after which each counter has its own coefficient. After calibration one can calculate the counter’s final result. Thereafter it is possible to calculate the estimated total number of visitors in a specific area.
Metsahallitus also carries out visitor counting in other parts of Finland, but not yet as systematically as in southern Finland. Naturally there is a connection between visitor surveys and visitor counting, as both qualitative and quantitative information is important in planning and management processes.
This paper presents practical experiences of visitor counting from the Finnish perspective. The presentation deals with the process of planning visitor counting, the special equipment needed in counting and ways of transforming the figures from the calculators into estimates of the number of visits in a specific area. In addition, the results of a pilot study from the Teijo Hiking Area are presented as a case.

INTRODUCTION

In Finland the number of visitors to protected and recreational areas has almost doubled during the past ten years. Now it is estimated that about two million visits are made annually to national parks and other recreational areas. This assumption is based on different ways of estimating the number of visits. Earlier, the estimates were based on trail logs, examination of footprints and deterioration of the trails, various permits and best estimates made by personnel working in the areas.

Traditional everyman's rights (right of public access) guarantee all people - Finnish or otherwise - free access to Finland's forests, whether the forests be privately or publicly owned. This makes reliable visitor counting difficult, but at the same time extremely challenging.

During the past two years Metsahallitus has begun to count visitors to the areas more systematically and consistently. Some counters were already in use in the mid-1990s, but insufficient use was made of them. More accurate estimation of the number of visitors was made considerably easier by the publication of a manual on visitor counting in Finnish (Horne et al. 1998), which has been widely applied in practice. Other good manuals on visitor counting have been published, for example, in Scotland and the United States (e.g. Dales et al. 1993 and Yuan et al. 1995).

The problem has been and still is to some extent the lack of systematic and sufficiently reliable visitor statistics. Reliable estimates of the number of visitors are extremely important for planning and managing the use of the areas in question. On the basis of such estimates, it is possible to gain a clearer picture of the use of the area and the sites where visitor traffic is heaviest. Information on visitor numbers help the people responsible for managing the areas to control the flow of visitors, for example, by directing them to routes that cause less deterioration to vegetation and landscape. In addition, visitor counts also help to maintain and develop services so that they better correspond to the real number of visitors to the area (e.g. firewood supply and waste disposal). Furthermore, reliable visitor statistics are needed, together with other information gathered from visitor surveys, for evaluating the effectiveness of the area's own activities and for monitoring changes (see Erkkonen & Sievänen in this publication).

Visitor counting involves the following distinct stages:

- Careful planning of the visitor count
- Installation of counters in the terrain
- Monitoring of counters in the terrain
- Defining the correction coefficient for the counters
- Counting the number of visits

Visitor counting thus provides statistics on the number of actual visits that have been made to an area. When this information is combined with information gained from visitor surveys, it is possible to estimate the number of visitors, i.e. how many people visit the area.

METHODS OF VISITOR COUNTING

Both electronic and mechanical counters are used in visitor counting. The counters usually comprise infrared photocell sensors, reflectors, a power source and a counter with delay circuits and a housing. The power source is generally an enclosed lead or nickel battery, which is selected to suit the counter and its application. The mechanical counters used are generally Mechanical Stroke Counters, which are built into the structure of a door or its lock (bolt), for example. In addition, visits can be estimated with the help of guest books, permits, various types of surveillance equipment, admission fees, observation by personnel and questionnaires.

Installation of counters

The site for installing visitor counters should be chosen so that it gives the most representative picture of the movements of visitors in the area. In selecting the site, the focuses of visitor traffic in the area must first be defined. At the beginning this is done by using the best available local knowledge.

The counters are placed as far as possible in places that are protected and not readily discernible to the public. Vandalism directed at counters or intentional manipulation of statistics can at worst render the count useless and cause considerable financial loss.

The careful installation of counters, combined with careful servicing and reading, is the cornerstone of visitor counting. At least the following factors must be considered at the installation stage: installation site, height of installation, width of the passage, mounting of the counter parts and direction of sensors. The installation site is selected to suit the characteristics of the type of counter to be used. The sensor and a reflector, if used, should be placed about one metre from the ground. This height corresponds roughly to waist height and prevents (at least) double counts caused by counting the legs of visitors separately. Depending on the distance at which the counter operates, reflector or sensors should be placed 4–10 metres from each other. The formation of overlong sensor lines should be avoided as this may cause disturbances and unreliability of the equipment. The best installation sites are at gates, duckboards, or narrow passages where the sensors can be installed without a reflector and visitors are not able to walk side by side.

Choice of the counter model and type is influenced by the characteristics of the site and the amount and quality of the information needed. The features of the installation site include the width of the passage, the possibilities for reading, monitoring and installing the counter, and the electricity supply available. The choice of counter depends above all on the quality of information required. This is basically a question of whether the information is needed all the year round or not. The need for year-round information is greater the more frequently visited the area.

Reading and servicing of counter

The information produced by counters is still at present collected from the installation site. The counters should be read and serviced regularly. When reading the counter, the time of day, date and reading are recorded. The difference between successive readings constitutes the reading interval i.e. the information on the number of visits between readings. The reading interval is influenced directly by the accuracy of the available information or the data needed. The more accurate the data needed, the more frequently the counter must be read. For collecting particularly accurate information the counter should be read at the same time of day on different days. Reading and accuracy of reading can probably be improved by introducing new equipment (see further development of counting methods).

In connection with reading, the functioning of the counters, the direction and camouflaging of the sensors is checked, and batteries are changed if necessary. The interval for changing batteries depends on the power consumption of the equipment used, and the capacity of the batteries, varying from two weeks to a couple of months. During servicing, possible sources of error are also checked. There should be no branches, grass or brushwood in the line of the counters. Errors in readings have often been found to be due to grass or brush that has grown during the summer. In practice such intervals have to be omitted or an estimate made of the visits during that period.

Systematic training

In order to ensure quality and commensurability of the results, the personnel participating in the counts should be trained in almost identical situations. By the beginning of November 2001, three training sessions have been held, and one is still being planned. The training deals with the basic elements and aims of visitor counting as well as counter technology and installation techniques. In the context of basic elements and aims, efforts have also been made to influence attitudes. Attitudes are very important for the success and development of visitor counting. The training also includes teamwork covering the installation of various counters, calculation of coefficients and checking of results using visitor counting in the Teijo Hiking Area as a case. The instructors were Senior Planning Officers Joel Erkkonen and Heikki Iisalo together with Planning Officer Jere Rauhala.

Correction coefficients of counters

The readings given by counters describe the number of visits at best as relative changes in readings between counting intervals. In order to establish the actual number of visits, the counters have to be calibrated. A qualitative and technical correction coefficient is defined for each counter separately because the counters give erroneous readings. Technical errors are caused by characteristics of the counter and the installation site. Such errors are caused, for example, when visitors are side by side or too close to each other, especially when the passage is wide. In addition, weather conditions (misting or ice) may cause technical problems. Qualitative errors are caused by movements that do not represent real customers or visitors. These include movements of servicing and other personnel, animals (for example reindeer in northern areas) and any other unfounded or unauthorised movements in the area.

The counters are calibrated by monitoring the counting stations at different times of day (and at different times of year, if the area is one that is used all the year round). Metsahallitus has a standardised monitoring form so that every counter is calibrated on the same basis. During monitoring, the times at which the observation period began and ended, the passers-by, their number and direction of movement and (other) factors that might affect the counter's results (such as visitors going round or passing the counter several times or walking side by side with another person) are recorded. All factors that have been observed are recorded during the one-hour observation periods. For each calibration interval there should be at least 4–6 hours of observation. In order to calculate correction coefficients, several calibration intervals are required, preferably 4–6. The more calibration intervals are included in the coefficient, the more accurate the results.

The correction coefficient is defined for each counter on the principle that, as far as possible, only "genuine" visitors are registered and preferably only once. The coefficients help to eliminate sources of error. The counter-specific coefficient is made up of technical and qualitative factors, for example, as follows (Horne et al. 1998):

Correction coefficient **0.51**

=	1.12 (technical corr. coefficient)
X	0.92 (other than personnel)
X	0.96 (no passing back and forth)
X	0.52 (visitors entering)

CASE: TEIJO HIKING AREA

The Teijo Hiking Area is in the southernmost part of Finland, about an hour's journey east from the city of Turku, and two hours' distance west of the capital, Helsinki. The area covers a total of 3000 hectares, is formed of the recreation area itself and two adjoining nature conservation areas. The area borders on the sea and in addition it encompasses four lakes, with a total area of approx. 300 hectares.

The Teijo Hiking Area has a strong cultural-historical aspect. The region has been inhabited for a relatively long time and both the area itself and its natural features have been influenced by the activities of three ironworks, which began to operate at the end of the 17th century. All three of the ironworks were either situated within the Teijo Hiking Area or adjoining it. Three of the area's four lakes were formed by dams built during the 17th and 18th centuries. There are many old wooden buildings in the area and signs of charcoal burning in the forest. Water power was obtained from the dammed lakes and fuel from the forest, and the effects of these activities are still to be seen in the area today.

The Teijo Hiking Area was founded – like all six other recreational areas in Finland – on the grounds of the Act on Outdoor Recreation. The area was established by law in 1991 and its activities started in 1992. The site will be ten years old in summer 2002. The purpose of the area is to improve and guarantee opportunities for outdoor recreation. For example the Recreation Area can be used for forestry, fishing, hunting and other forms of outdoor exercise. The normal right of public access applies to the area, except for some protected areas.

Metsahallitus has organised fishing and other outdoor recreation services in the area. There are some 45 kilometres of trails in the area, some of them artificially constructed, several campfire sites, covered campfire sites and lean-to shelters. In addition, there are sites in the area reserved for scout camps. Fish have been introduced into the fishing grounds of Lake Matildanjärvi, primarily salmon. For fishing there are about 30 boats for hire. In addition, there are buildings providing accommodation in the area, the oldest of them dating back to the 18th century. In the immediate vicinity of the Teijo Hiking Area there is a golf course, a downhill skiing centre, a marina and accommodation services. Tourist services are provided in the area by several local businesses and also by some entrepreneurs from outside the area.

The Teijo Hiking Area plays a very important role as a natural tourist attraction in the region, and is popular with a large clientele. There are many regular visitors and at the same time new customers continue to discover the area. A visitor survey was carried out at the site in 1996 (Ovaskainen et al. 1999), and on the basis of the survey it was calculated that the area brings in a total of about 1.41 million € annually. About half of this sum (46%) has an impact on the immediate surroundings (Kangas et al. 1998).

Due to the difficulty of estimating the number of visitors, an overall count was started in the year 2000. The decisions and preliminary plans for starting the count were made in 1999. The objective was to establish the total number of visitors or the total number of visits to the Teijo Hiking Area, in order to provide a basis for calculating future trends, regional impacts and earnings and to measure the effects of action carried out. Other aims were to discover possible sources of error, and to gather experience of servicing and management. The planning of further development of counting methods was also begun immediately.

The counting stations were decided on the basis of experience, making use of local knowledge. It was decided to install four electronic counters, which were distributed around the area at the busy sites shown on Map 1. One of the counters is a traffic counter and the others are trail counters. All the trail counters are similar in structure. The counting stations are the same in 2001 as in 2000. In 2001 mechanical stroke counters were installed on the bolts of doors of outdoor toilets. In addition pressure mat counters were tested, installed in the same outdoor toilets as the mechanical stroke counters. Altogether seven counters have been in use in 2001. In the Teijo Hiking Area the electronic counters are not used in winter, because their batteries cannot withstand hard frost. Also, because of the seasonal nature of the area's use, it has been considered necessary only to keep the counters operative on the main route – Matildanjärventie – which is best suited for year-round visitor counting.

Counting was begun in May 2000 on the same day throughout the area. The reading interval was fixed at one week and one person was trained at this stage and made responsible for reading and servicing the counters. This person's normal duties included all the maintenance and servicing jobs in the area, as well as supervision of statutory compliance.

In order to implement the calibration plan, a temporary employee was trained for the summer. The calibration dates are shown in Table 1. In 2001 the calibration employee was available only on a few days. However, correction coefficients were checked for the most important counting stations and especially for the Matildanjärventie route. Even on the basis of the results for year 2000, it was possible to show that the Matildanjärventie counting station was the most heavily used counter, as experience had also suggested.

Site	Calibration days			
	2000	2001	2002 *	2003 *
Matildanjärvi	4	2	3	3
Luonnonpuisto	3		3	
Kirjakkala	4	1	2	
Nenusta	3		3	
Total	14	3	11	3

Table 1. Counter calibration days in Teijo Hiking Area. (planned)*

From the readings and calibrations we can calculate and estimate the total number of visits. In cycles of a week we can draw curves showing the development trends in the use of the area. The readings and number of visits are shown in Table 2.

Site	Counter readings		No. of visits	
	2000	2001*	2000	2001*
Matildanjärvi	21203	28797	26609	48954
MS Counter 1.	-			
MS Counter 2.	-			
Pressure mat 3.	-			
Luonnonpuisto	5389	7613	4026	5686
Kirjakkala	5641	4500	4430	3533
Nenusta	2023	5439	1123	3018

Table 2. Visits to Teijo Hiking Area in 2000–2001 (preliminary information).*

Before counting was started, the annual number of visits was estimated at approx. 30 000 visitors a year. The earlier figure was based on information from fishing permits, visitors to the visitor centres and camping sites. In addition to the sum of these

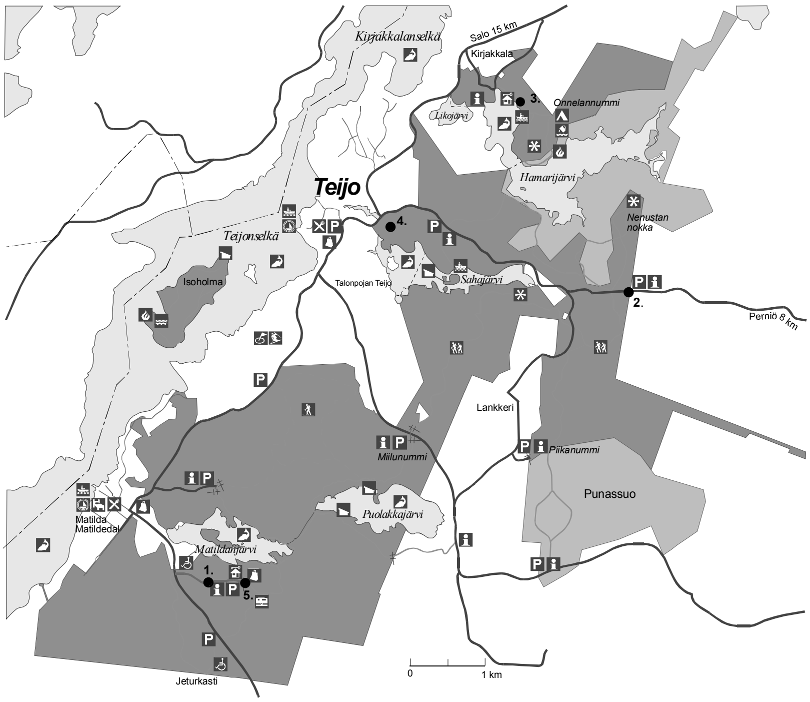

Figure 1. Map of theTeijo National Hiking Area. Location of the counters is marked from 1 to 5.

figures, an estimate was made of the number of visitors who were not recorded at all.

Even after the count, it will still be necessary to estimate the total number of visits. The total figure is made up of the readings of the four counters described above, the number of visitors to the customer service point and the people who enter the area by other routes than those covered by the counters. In addition it is necessary to estimate the number of visits outside counting time at those stations where the counters are out of use in winter. The total estimate of visits is thus not directly calculated from the sum of the results of the four different calculators. It must also be borne in mind that the same people may pass one or more counters several times during the same visit. These cases also have to be estimated (in the case of the Teijo Hiking Area), because the information from the visitor survey of 1996 does not show the relative distribution of visits between the different sites. This will be established in the Teijo Hiking Area visitor survey II to be carried out in 2002, which will also make it possible to compare changes in other factors with the situation seven years ago.

On the basis of the figures shown in Table 2 and considering the facts presented, the number of visits for 2000 was estimated at 40 000. For 2001 a preliminary estimate of 60 000 visits has been made. The rapid relative growth is explained by the fact that counting was carried on throughout the whole year in 2001 and the estimate for 2000 was perhaps fairly conservative. Another reason for the strong relative growth is also a real growth in the number of visitors and the popularity of the area.

Even before counting was started, there had been a distinct shift of focus in the use of the Teijo Hiking Area away from the visitor centre to recreation in the terrain. The most popular site was the Lake Matildanjärvi fishing grounds and their immediate surroundings. After the first year of counting, it was possible to verify this by the regional distribution of use.

On the basis of the visitor count it was decided to modernise the whole customer service concept and to build a customer service point in place of the present nature centre, which had operated in rented premises (about five kilometres away from it). This new service point is to start operating in summer 2002 in the context of the area’s tenth anniversary. At the same time it was decided to build a sauna on the shore of Lake Matildanjärvi, since the number of visitors is as high as 40 000. When the number of visitors is known it is considerably easier to decide on the services needed and to anticipate the personnel requirement for the next season.

CONCLUSIONS

In practice, determining the correction coefficients of the counters has proved to be the most difficult aspect of using the counters and estimating the number of visits. This has been due partly in the past to the fact that there were no clear instructions on this. If coefficients are not defined the result is an estimate of how the number of visits develop at a counting station, but not a very reliable estimate of the number of visits at the station.

Recent experience of standardising visitor counting has, however, been very encouraging. It seems that the methods can be standardised throughout the country. Equipment, tasks and responsibilities have been defined clearly enough to allow the creation of a functioning system.

So far, however, a number of problems have been observed, and the possibilities for influencing them vary. Practice has shown that the servicing and reading of the equipment often causes problems. The reasons may be the remote and scattered location of the counters and the shortage of personnel in relation to the tasks. Employing more personnel is a serious problem costs wise. The reliability of the counters is technically very good, and very few functional defects have occurred. There have been some defects in the counter components, which seem to be repeated and to be expected, but they are few in number. Functional defects are often connected with faulty installation. Careful installation also has an impact on error sources through camouflaging. When the equipment is well concealed for example in structures, the counter cannot easily be manipulated or vandalised. As the cost of the equipment is approx. 420 €-800 € per unit, vandalism can cause considerable losses.

Training can be used to eliminate the above mentioned errors. The attitudes of personnel are also crucial for the success of visitor counting. If the issue is considered important, the employees are more committed. Weather conditions cause problems that cannot easily be influenced in the more northerly latitudes. However, in Southern Finland, snow and sleet cause fewer problems than in the north and so far they have not caused any notable damage. The impact of frost affects the whole country, but the choice of equipment is important for the functioning and reliability of the counters, especially in year-round counting. Some of the counters are designed only for summer use and these are only used from early spring to late autumn.

DEVELOPMENT PROSPECTS

Development work is being carried out at present with three counter types and arrangements that function all year round in indoor use. The counters are maintenance-free and thus economical to use but they are not yet suitable for use as trail counters. Mechanical devices are extremely economical compared to electronic ones, costing only about 50 € per unit. Two pressure mat counters are in use. These may operate for several years having a power source built into the counter component, but frost may evidently prevent the mat from working. The price of the mats varies depending on their size.

Perhaps the biggest development is; however, the electronic counter type based on a data logger and wireless gsm data transfer technology. The counter is equipped with a gsm telephone for the logger's data transfer. The recorded data can be read via a data interface in office conditions, or the counter can be read automatically by computer servers at the desired intervals. Three counters of this kind have been installed for trial use by Metsahallitus during November 2001. They are used to monitor three sites with heavy visitor traffic in the Nuuksio National Park, the Häme Visitor Centre and the Teijo Hiking Area. The Visit system (VisitLog, VisitNet and VisitSoft) Data logger and gsm-based counter software developed by the Finnish company Teknovisiot Oy (see www.teknovisio.com) is still under development, but it is already possible to use it with given criteria for automatic reporting, and the production of statistics and prognoses. According to a preliminary view, this kind of counter system could be installed in the busiest and thus most important sites. Even with the introduction of new counter types, it will still be necessary to calibrate and service the counters, though.

With the present equipment and the devices in trial use and with the current methods it is possible to achieve the aim of making visitor counting a part of normal operational routines. The significance of visitor statistics for planning the use of the areas in question and for developing tourist services is very considerable. These statistics will enable more informed decisions to be made in both the private and the public sectors.

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Measurement and analysis of congestion at the traditional Japanese garden "Korakuen"

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Abstract: Nature and greenery spaces are especially required in the high-density residential areas of Megalopolis in Japan. People are looking for rich greenery spaces and they are requiring for the preservation of the greenery space in redeveloping areas. But people have recently found that parks often were too crowded, when they visited them for enjoying a quiet greenery environment. Almost all old Japanese cities have parks in traditional garden style, which have been opened to the public since Meiji revolution, i.e. a hundred years ago. Originally, the gardens were possession of the Daimyo, i.e. the feudal lord, and they were enjoyed privately. Recent increase in visitors destroyed the original use pattern and the unique atmosphere, and this, of course, confused the management of the park administration. The administration and the users therefore encouraged investigations concerning the appropriate management of park as a pleasant environment.
To find a preferable carrying capacity of green spaces, the impression of congestion and quietness was analyzed in a traditional Japanese garden, using the number of visitors as an indicator. The following results were obtained.
The impression of congestion is significantly correlated with the number of visitors in the park, and 700 persons on 7 hectares generates the impression of congestion for a half of visitors.
To satisfy the impression of quietness for more than a half of visitors, their numbers must be reduced to less than 400 persons for 7 hectares.
The decreasing in number of visitors provides a more efficient impression of congestion than that of increasing.

INTRODUCTION

Generally, an increasing number of visitors in the park suggests a strong needs for greenery spaces and natural areas. In Japan, the number of visitors has heavily increased in natural parks in the last 50 years. The annual usage of the natural park has been estimated to be more than 900 million people since 1990 (Nature Conservation Bureau 1999). The most rapid increase was observed from 1965 to 1975 and the number of visitors has grown twice in this decade compared to the 10 percent increase of the total population. The demand was formed by the rapid urbanization, i.e. by the strong immigration to urban areas. This sprawl in high-density areas had isolated the residents from natural areas and prevented them form enjoyment in natural spaces. In the enlarged urban areas, the few existing green spaces were scarcely developed and people lost the chance of enjoyment of rich greenery. As a consequence, they rushed into the greenery areas left in the city center to enjoy the precious nature. Since the Meiji revolution, Tokyo has designated the private gardens of the Daimyo, i.e. the then feudal lord, to the public. But they had never established large parks in the city for the residents, as it was the case in European cities. Furthermore, the Tokyo Metropolitan Government had once opened the gardens free of charge to the public. But as it turns out, park use has become too strong to maintain the gardens in a pleasant environment. For the present, they tried to impose the entrance fee again to control the visitors' number. But they don't know the suitable or pleasant carrying capacity of the gardens (Aoki 1984).

Park use must be controlled now to fit the mass of visitors into the traditional style of Japanese Garden. This paper aims to find reasonable carrying capacity of the traditional Japanese Garden at Koishikawa Korakuen Garden by carrying through the inquiries concerning the visitors' congestion impressions.

RECENT STUDIES

An investigation method was developed by Kirchner (1970) for the visitors' numbers of the urban parks in Vienna. Thayer (1979) developed an estimation method of park use by a multiple regression model. Cooper (1981) surveyed tourist behavior at Jersey Island, and Dwyer (1988) studied the prediction of daily use of urban forest at Chicago. Aoki (1988) studied sampling schemes for counting the daily number of visitors. Tooke and Baker (1996) investigated the effect of film to the visitors' number. Aoki and Fujinuma (1996) analyzed the effects of weather conditions and social aspects on the daily use of parking lots at the Nikko National Park, and Loomis (2000) proposed the Long-Term Monitoring for the recreational use. The investigation of park use was firstly carried out in 1923 (Yoshida 1934) and is continuing until now in Japan.

As for the study of congestion, Helberlein and Shelby (1977) firstly reported the satisfaction model of the carrying capacity and Schreyer and Roggenbuch (1978) studied the effects of the number of people encountered on the impression of congestion. Vaske, Donnelly and Heberlein (1980) reported the effects of past experience on the evaluation of congestion. Manning and Ciali (1980) reported the relationship between density and dissatisfaction. Womble and Studebaker (1981) reported the effect of noise, and West (1982) the effect of user behavior on congestion. Ditton and Fedler (1983) studied on the expectation contributing to perception of recreational crowding, and Shelby and et al. (1983) studied the preferences in recreation activities on congestion at Wisconsin. Gramann and Burge (1984) investigated the effects of attributes at intensively developed outdoor recreation sites of Lake Shelbyville. As to boaters, more precise effects were studied at Nantahala River in North Carolina by Tarrant, Cordell and Kibler (1997). Stamps and Stamps (1985) investigated the effects of sociological aspects; e.g. Race and Class, and Fujita (1997) compared the differences in Japanese and Europeans. Tarrant and English (1996) proposed an estimation model of perceived crowding including social factors. Caffyn and Prosser (1998) reviewed the policies for quietness in the national parks in England and Wales.

But the studies on this subject have not been frequently done in this realm (Greiner und Helmut 1975, Aoki 1999). And there are no studies on the congestion and the quietness of the park environment related to the number of park visitors.

STUDY AREA

Koishikawa Korakuen was planned in 1625 in Edo era by the gardener Sahyoe Daitokuji for the first feudal lord of Mito Tokugawa family (Yoshikawa 1981). The garden comprised 7 hectares and was designed as a typical traditional Japanese garden in Kaiyushiki style, e.g. enjoy walking around ponds, and has 3 ponds, the main, the west and the east (Tamura 1929). Nowadays, people normally enter from the gate of southwest, called Kantokutei Gate, thus beginning the tour on the west side of the garden. They walk at first through an open lawn area and then cross over the west pond. The pond is established as a miniature of Lake Shifu, in the South of China, which is appreciated as a beautiful landscape in China. Then people arrive to a small bridge, called Togetsu Bridge, from where they may look to the famous bank, called Sotei, which is again a miniature of the original Sotei Bank at lake Shifu. On the other side of the bridge, people find a small waterfall. After that they come up to a mountain, where they may enjoy an overview of the main area of the garden. Continuing the path, they walk up and down a mountain and come across the Engetsu Bridge. This bridge was constructed by the vice Shogun Mitsukuni under the guidance of the Chinese scholar Shunsui. They then come up and down a hill and enjoy Iris fields. These Iris fields are very beautiful in May and June because of the colorful flowers. After that people stop at Kyuhachiya cottage looking at the main pond on their right side. The fascinating trail then leads the visitors into a clad, beyond which they pass through the ruin of Karamon Gate. They now enter the inner garden, which they may enjoy by a round trip. Back to the gate, they walk to the westward along a narrow trail like in the mountains. Behind a deep forest, they can find light impression of a maple wood. For the wood is not densely planted and kept clear by the harvesting. In autumn, especially in late November, people can enjoy beautiful colored leaves there. From the area, they also can see the island in the main pond. The island, called Horaijima, symbolizes a kind of paradise. Over a bridge the visitors finally come back to the lawn field at the beginning of the tour.

The garden captures an area of about 7 hectares and the walk takes almost an hour. The garden is maintained by the local Government of Tokyo since 1936. They once the garden opened to the public without entrance fee. But because of the destructions and the growing congestions in the garden, only one entrance is available and it requires an entrance fee of 300 yen per adult, at present. Several members of the managing stuffs and part-timers have maintained the garden, so far. But now gardening is put out to contract to the professionals of maintenance companies. The garden has a Japanese style restaurant, which provides food and meeting rooms. People use the restaurant for the tea ceremony, Haiku meeting and so on. At present the annual visitors are estimated as to some 200.000 persons, constantly.

Date of suvey	total visitors	maximum residence	ratio of peak use	weather at noon	temperature (C)	humidity (%)	wind (m/s)
3. Oct. 1970	611	305	0,5	cloudy	20,5	50	4
5. May 1971	3719	894	0,24	fine	20,7	30	6,7
15. May 1971	751	295	0,39	cloudy, fine	20,5	63	5,3
3. May 1972	3511	875	0,25	fine	16,6	24	3,2
24. May 1972	1298	206	0,16	fine	20,1	43	3,8
27. May 1972	1205			cloudy, rain	25,7	48	8,3
3. June 1972	1575	384	0,24	cloudy	22,3	60	5,3
11. June 1972	2839	647	0,23	fine	27,4	57	4
14. June 1972	1693	508	0,3	fine	22,9	44	4,2
12. May 1973	1352	450	0,33	fine	18,8	35	3,7
13.May 1973	2586	704	0,27	fine	21,9	59	4,7
5. May 1974	2922	929*	0,32	cloudy	21,9	59	4,4
14. May 1974	350			fine, cloudy	19,9	56	4,5
13.Dec. 1974	89	28	0,31	cloudy, rain	7,5	45	2
14. Dec 1974	350	105	0,3	fine	14,1	52	3
15. Dec. 1974	507	141	0,28	fine	9,4	30	5,2
10. Dec 1978	361			cloudy, rain	18,5	67	10
20. May 1979	1633			fine	23,2	41	3,1
3. May 1980	2498	863	0,35	fine	21	47	4,4
5. May 1991	2851	650	0,23	fine	16,9	30	2,8
15. May 1991	531	159	0,3	cloudy, rain	21,5	63	2,5
26. Oct. 1991	397			coudy	18,2	66	2,7

***: maximum residence observed, ratio of concentration: maximum residence/ total visitors**

Table 1: Date of Survey

The most congested month is April and the most congested day is normally 5. of May (Aoki 1984). The largest visitor number of the day was estimated about 7.000 persons.

INVESTIGATION

Visitors' number has been studied from 1970 to 1991 (Table 1). Several questionnaire surveys were conducted and we focused the survey of 5. of May 1974, in which the maximum number of the visitors' residence was observed. The questionnaire was distributed to the every 10th visitors and collected at the entrance. The fact that only one gate was available, is useful for this kind of investigation. 91 % of the people cooperated with us and 268 samples were obtained. The respondents drew their behavior in the map and responded the question of feelings about congestion and quietness. Simultaneously the number of visitors in the garden was also counted at the entrance. The responses were accumulated in each period of time and the subjective impressions of congestion and quietness were calculated. The investigation gathered the answer of the visitors' behavior in the garden on the map in which they lined the trails walked and marked places stopped (Fig 1 and 2). The weather of the day was cloudy and pleasant. The temperature of noon was 22 degrees (Celsius) the humidity was 59% and the wind was 4.4m/s at the observation tower of Meteorological Agency located at Otemachi, 2 km away from the garden. The total number of visitors of the day was 2922 and the peak of the simultaneous stay was estimated at 929 persons. During the whole day, 46% of the visitors have a feeling of congestion. The highest ratio of impression of congestion amounted to 60% of people at 14 o'clock in the afternoon.

RESULTS

The answers, which indicated the behavior of the respondents, were overlaid and totaled at each route and place. The largest number of the passengers was observed at the path along the Tatsuta River (Fig. 1). And the largest number of the stops could be found at the open area in front of the Kuhachiya cottage (Fig. 2). More than 10% of spent some time even in peripheral areas of the garden. So more than 100 groups visited whole area of the garden on that day.

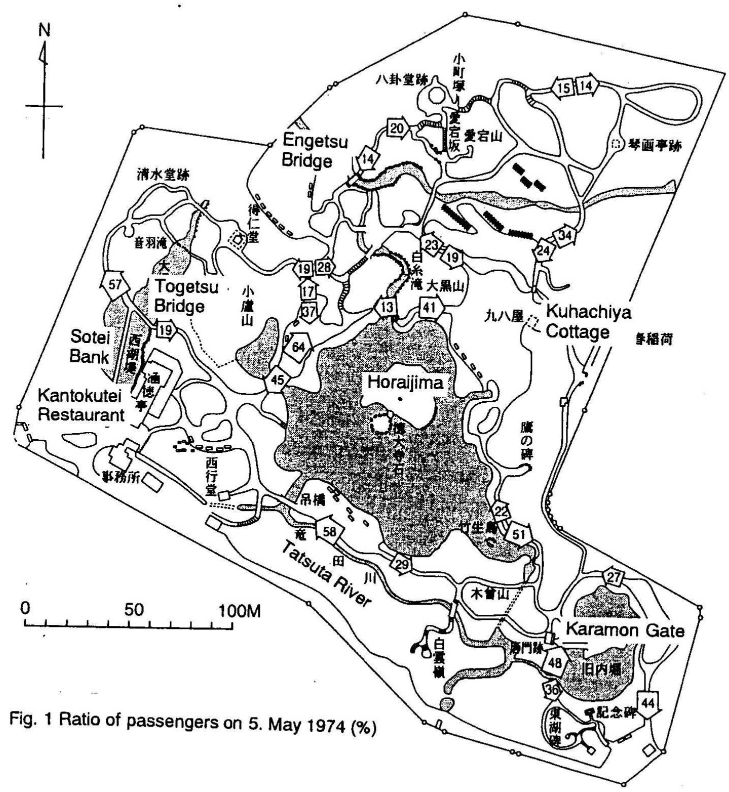

Fig. 1 Ratio of passengers on 5. May 1974 (%)

Figure 1: Ratio of passengers on 5.May 1974 (%)

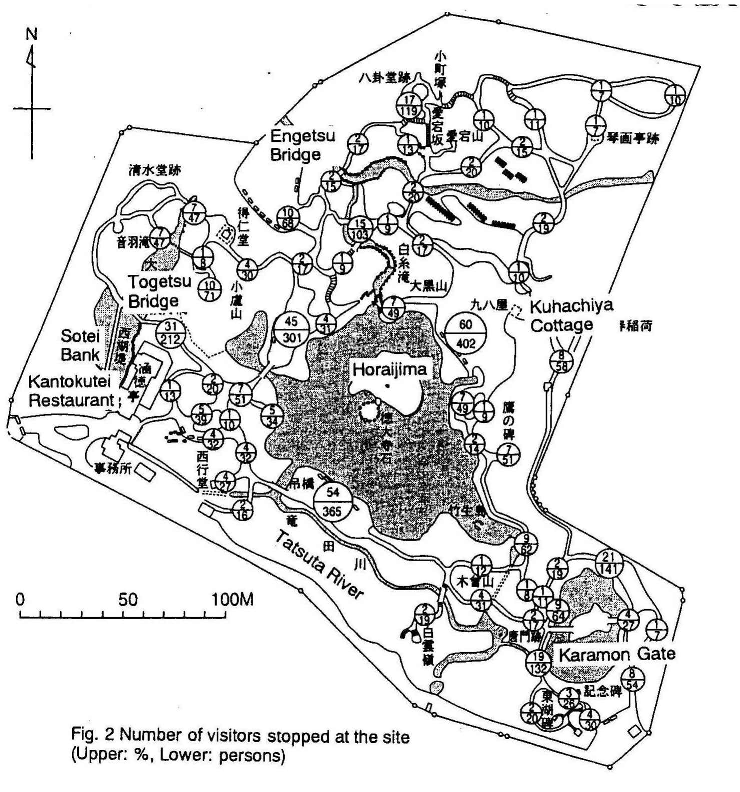

Fig. 2 Number of visitors stopped at the site
(Upper: %, Lower: persons)

Figure 2: Numbers of visitors stopped at the site (Upper: %, Lower: persons)

Factors	coefficients	T-value
Distance from the entrance	-0,099	-1,6
Area of site (m2)	0,4	5.2**
Canopy closed	0,59	0,6
Gradient of groud(%)	-1,55	-1,9
Object grade A (1,0)	5,46	4.0**
Object garade B (1,0)	4,61	4.5**
Object grade C (1,0)	2,36	2.7**
Constant	1,84	0,9

Corrected correlation coefficient was 0.89.
Number of site was 80.
****: 0.01 statistical significance level**

Table 2: Effective factors to visit the sites of garden (Analysis by multiple regression equation)

The use of peripheral areas showed a full of visitors at the peak use.

The frequencies were analyzed by the multiple regression equation to find the effective factors for visitation to the local sites. The width of site and interesting objects affected to the frequency with the statistical significance level of 0.01 (Table 2), i.e. they are effective factors to visit for the respondents.

The number of the visitors in the garden was increasing in the morning and at noon (Fig. 3), it decreased after 13:30 o'clock. The impression of congestion increased slowly related to the number of visitors. And the impression was decreasing rapidly after 14:00 o'clock.

Analysis of regression equation was applied (Fig. 4) for testing the relationship between impression of congestion and number of visitors. The results satisfied the significant statistical level of 0.01.

But the efficiencies of the regression equations were not the same in case of increasing and decreasing of the visitors' number. The data obtained at the increasing of congestion fluctuated more gently than the decreasing. It was assumed that different psychological effects had happened in the density of increasing and decreasing.

This analysis reveals that the impression of congestion was related strongly to the number of visitors in the garden. It was shown that more than 700 persons in the garden arises the feeling of overcrowding in more than half of the respondents.

The analysis of regression equation was tried (Fig. 5) for the impression of quietness, too. The regression showed a statistically efficient result in relation to the decrease of the visitors and less than 400 persons simultaneously in the garden provided the impression of quietness for more than half of the visitors.

To propose a carrying capacity for this garden, the maximum number of the residence was generally estimated around 30% to the total visitors of the day (Table 1). According to this proportion, the daily number of visitors should be controlled less than 2100, to prevent from the congested impression of more than 50% of visitors. And if the daily number will be kept under 1200 persons, the criteria of quietness will also be satisfied.

With these criteria, we estimated the number of congested days within 6 months of this fiscal year of 2001, i.e. from April to September. The result showed 8 days overcrowded and 22 days unsatisfied quietness.

DISCUSSION

The carrying capacity of the Koishikawa-Korakuen was estimated at 700 persons. But this was not preferred density of the users. Quietness requires more rigid control of the visitors' number: it has to be kept under 400 persons in the most congested period.

In historical times, when the feudal lord used the garden, his guests and their subordinates, only, the maximum number of people entering the garden simultaneously may be estimated at approximately 20 persons. Ono (2000) reported that the largest number of the visitors at Rikugien Japanese Garden, which comprises 10 hectares, amounted up to 50 persons in Edo era (ca. 1780). Then the density planned was seemed much lower than our result.

For example, the imperial gardens office of Kyoto has controlled the maximum guests under 40 persons simultaneously for 5 hectares of Katsurarikyu garden and 50 persons for 54 hectares of Shugakuinrikyu garden. We had better to propose more strict use capacity for the traditional Japanese gardens.

As for the entrance fee, this garden requires 300 yen per adult. But the garden of Saihoji temple, a moss garden, is reported to require about 3000 yen per adult (Dodd and Richmond 1999). Regarding better maintenance of the garden we can suggest much higher entrance fees.

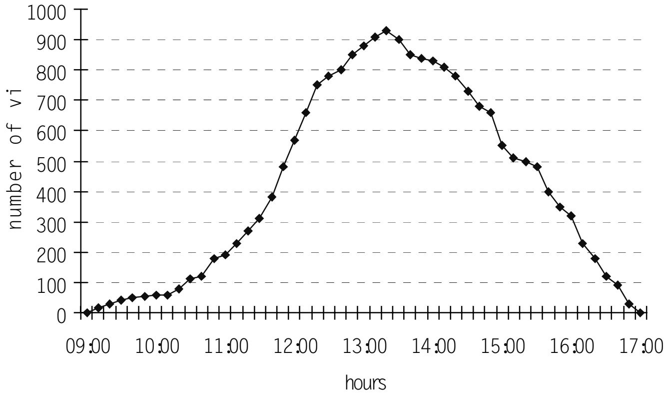

Fig.3 Fluctuation of visitors' density

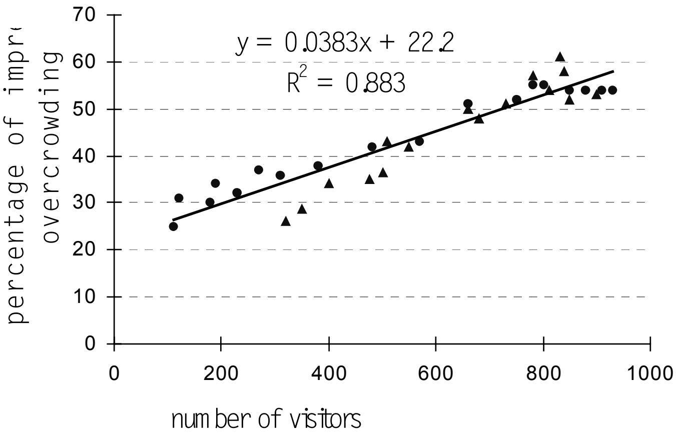

Fig. 4 Relation between congestion and visitors' density

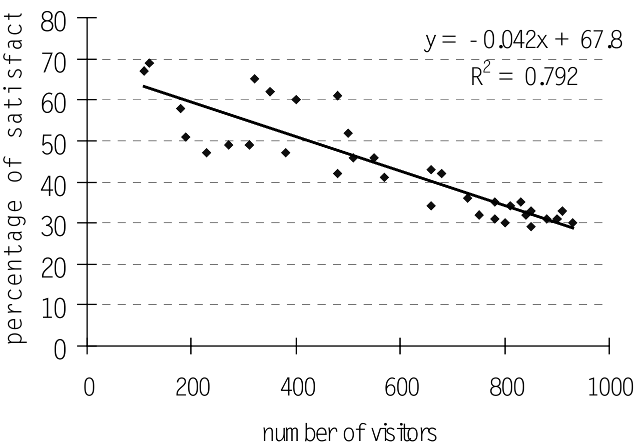

Fig. 5 Relation between quietness and visitors' density

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Monitoring and Managenment of Visitor Flows in Recreational and Oprotected Areas
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Public Use of the Public Parks and Protected Areas of Budapest

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Abstract: Based on the series of studies investigating the public uses of various public parks and nature conservation areas of Budapest, a comparative evaluation was prepared which allowed us to quantify the actual recreational role of these two types of green areas in the green area system of large cities. The approach involved on-site interviews with questionnaires and on-site monitoring, with additional urban planning analyses. The results provided direct help in the development of green area management guidelines for cities and in the preparation of future management plans for protected areas. In addition, the results allowed us to develop planning guidelines and a basis for developing new means of environmental awareness raising and education.

INTRODUCTION

Park use studies in Budapest have been prepared regularly since 1986. Of great importance was 1994 because a comprehensive, simultaneous investigation was done in various types of public parks. In the last couple of years, public uses of public parks in Budapest were individually studied in connection with investment projects or city development plans. The data gathered throughout these years are now also suitable for assessing changes or trends in such uses.

In Hungary, the exact evaluation of the visitedness and public uses of protected areas has been brought into focus only for about 1 or 2 years. A series of similar, all-round-year comparative studies on the locally protected areas of Budapest were prepared for the first time in 2000.

Primarily, this study presents the results of the studies of 1994 on park uses and those of the studies of 2000 on protected areas (Nagy, 1997, Kellner, Nagy, 2001). The large number of data obtained during these two series of studies is suitable for comparative evaluation.

OBJECTIVES

The assessment of both public parks and protected areas had a number of objectives.

Evaluation of the data obtained provided direct help to the practical job in, for example, the maintenance of green areas, the design of playgrounds, the installation of additional pieces of furniture, reconstruction of some parts of parks according to new needs, the development of annual management plans and the design of educational pathways (Kellner, Nagy 2001).

In addition, the results form the comparative studies assisted both the planner and the decision-maker in the preparation of city development plans and conceptions, and as a basis for justifying individual plans and actions (Nagy, Pinter, Wettstein, 1998, Nagy, Szilagyi, 1998).

Furthermore, the information gained from these studies were essential in developing planning guidelines, green area development strategies and design indices (Nagy, 1997).

METHODS

The primary means for data collection included on-site interviews with questionnaires, structured, on-site monitoring (personal observation) and visitor flow counting, combining at least two of these approaches in each case. Depending on the topic, this was supplemented by demographic analyses, deep interviews, targeted "traffic" counting and city development investigations (evaluation of land use, traffic, parking, institutions, surrounding residential areas, etc.).

Normally, a dBase-based inquiry system was used to reveal the relationships between the test data.

In 1994 and 2000, on-site questionnaires were used in combination with on-site monitoring using "tables". The questionnaire included questions focusing on visiting habits (e.g. frequency, use of public transport), purpose of the visits, duration of the visits, determination of the extent of the catchment area and assessment of new needs.

On-site monitoring was done using previously compiled, matrix type tables to record the number, age and activity of the people staying in the park or in a part thereof.

STUDY LOCATIONS

During the studies, data were collected in a total of 8 locations in 5 parks. One of the criteria for selecting study locations aimed at selecting locations different in type and size (0.5 ha-100 ha) so as to represent the diversity of the parks in Budapest. Thus, two large city parks on the east (Pest) side (*Városliget*, *Népliget*), one park in a blockhouse area (in *Kelenföld*, Buda side) and two downtown public gardens (*Károlyi Garden, Hild Square*) were selected.

Similar criteria were used in selecting the locations for the assessment of protected areas.

The study locations included:

- *Apáthy Cliff:* part of the protected forest area of Buda and a traditional target for excursions in Budapest,
- *Rupp Hill:* located in the outskirts, adjacent to areas of intensive residential development zones,
- *Róka Hill:* former limestone quarry near to a blockhouse area,
- *Kis-Sváb Hill:* located nearest to the inner city, an island-like hill wedged in a family house zone,
- *Lake Naplás:* located in the outskirts of the east side (Pest), in a plain area, and includes a huge secondary lake, a creek and a forest area.

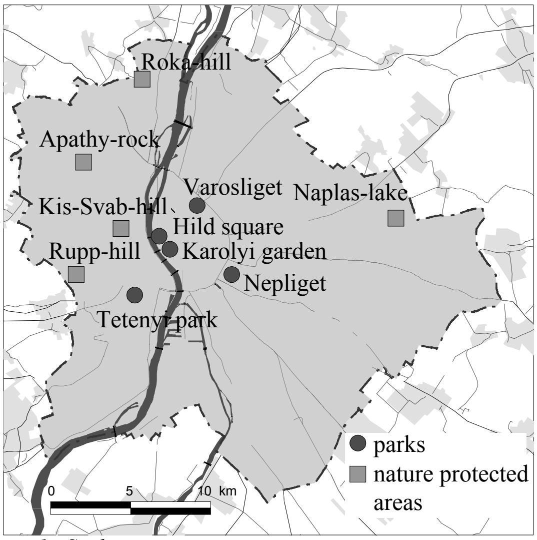

Figure 1.: Study areas

DATE AND DURATION OF THE STUDIES

Sampling for the park use studies were done in two phases, between 1 June, 1994 and 30 September, 1994, and between 1 October, 1994 and 15 December, 1994.

In the protected areas, data collection occurred continuously in three phases between April and December, 2000.

Samples were taken at predetermined points in time, representing both weekdays and weekends, at various parts of the day and under various weather conditions.

AMOUNT OF DATA

The comparative studies on parks involved 1500 questionnaires and 128 targeted monitoring events in 5 parks.

In the protected areas data from a total of 750 questionnaires were processed. As a result of on-site monitoring, 220 data tables were evaluated.

In addition to the quantifiable data, subjective opinions of the visitors were also recorded. Thus, an additional job was to classify and evaluate such opinions.

MAIN RESULTS

Characteristics of the uses of parks in Budapest

- 60% of the visitors visit their favourite park every day.
- Among park users, the ratio of regular visitors is increasing.
- The catchment area of parks consists of the residential areas within 15 minutes distance, i.e. 75% of the visitors live within this area.

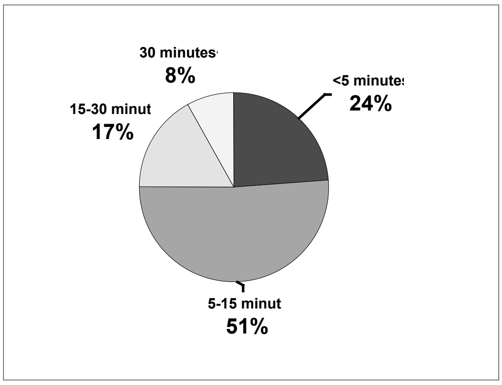

Figure 2.: „How long does it take to reach the park?”

- Significant differences were observed between the catchment area of the two large (100 ha) parks. The popularity of *Városliget* and the surrounding town-like residential areas make it attractive to visitors form larger distances than *Népliget*, which is of similar size but of lower prestige and surrounded by industrial areas.
- On average, visitors spend 1-2 hours in the parks during one visit. The time spent on visiting parks have been dramatically decreased over the past years.

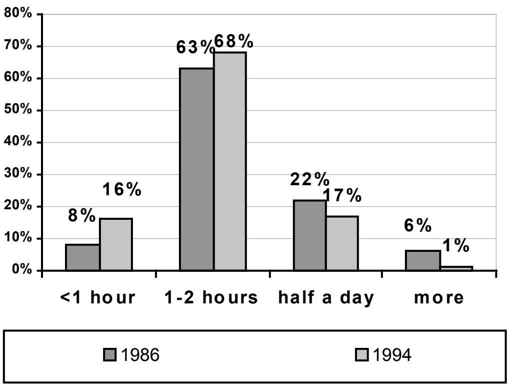

Figure 3.: Change of spent time in the city park Varosliget

- On average, visitors of public parks changes six times per day. This daily "turnover" shows an increasing tendency (in the 70's the average turnover was four times according to certain studies).
- The percentage of visitors above 30 years of age, including pensioners, is much lower than the average in Budapest, and this tendency is augmenting. Those in the active age (i.e. in the working age) would go to parks at an increasingly lower frequency. Most probably, this is due to the permanent time pressure. On the other hand, pensioners would justify their absence by public safety reasons.

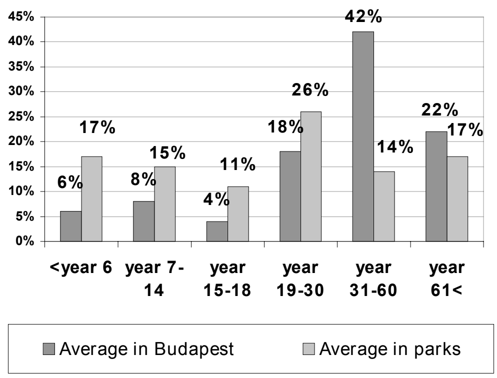

Figure 4.: Share of age-groups

- Today, park users would mostly pursue moderately active (e.g. walking, playing) and inactive (sitting, sunbathing) activities. Active activities involving a lot of exercises are almost exclusively typical to those below 20 years of age.
- The percentage of those walking with dogs is increasing at a very high speed and this is a source of conflict in the parks of Budapest. (In a 10 ha park located in an intensively developed, small house residential area, almost half of the visitors were walking with dogs!)
- Downtown gardens are more visited during the weekdays than in the weekends.
- The recreational role of public parks in Budapest is lower in the weekends than during the weekdays. That is, parks are more intensively used during the weekdays.
- Public parks and gardens are more like a neutral meeting points, with increasing agora character.

Results of the studies in protected areas (nature conservation areas)

- Mostly, the purpose of the visits is to spend one's leisure time outdoors, in good air and natural environment. The ratio of visitors specifically visiting these places to see the natural values is less than expected (12%). Every fifth visitor uses the protected areas as a place for jogging or cycling. A part of the young would regularly meet friends. Many come to walk their dogs.
- Protected areas located in the traditional excursion targets are more visited in spring and fall, i.e. during the excursion season.
- The island-like areas, which are surrounded by residential zones, are almost only known to and visited by those living in the neighbourhood.
- Most of the visitors of protected areas are regular visitors, some areas have almost like a clientele. Almost half of the visitors visit the specified area on a weekly basis. Mainly in the case of island-like areas (surrounded by residential areas), the percentage of regular visitors can be as high as 80% (dog owners!).

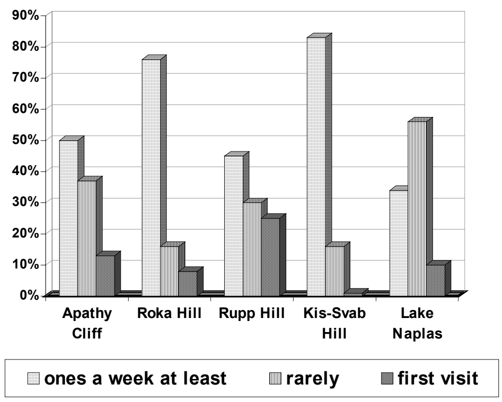

Figure 5.: Frequency of visits

- On the basis of the time spent to arrive to the specified area, 60% of the visitors of protected areas live within a distance of 15 minutes. Apáthy Cliff, which is also an excursion target, and Lake Naplás are visited form larger distances, too.

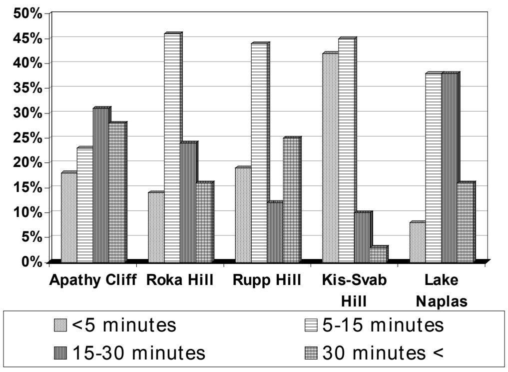

Figure 6.: Percentage of the spent time to reach the area

- On average, every second visitor arrives on foot, and 14% comes by bicycle. In the case of Lake Naplás, which is located at a larger distance from residential areas and is difficult to reach by public transport, 70% of the visitors arrive by car.

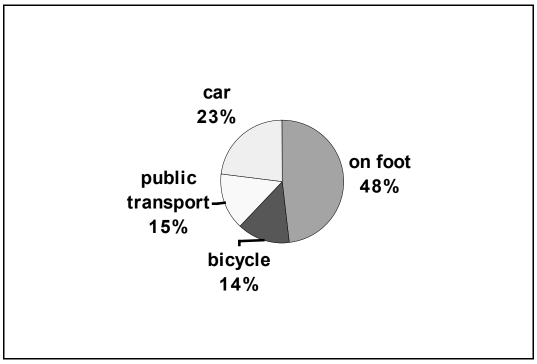

Figure 7.: „How do you reach the area?"

- Most of the visitors visit the protected areas in the weekend, in the afternoon period. The number of visitors to island-like areas is considerable during the weekdays, too.
- The biggest problem in almost all locations is litter and periodic abuses. In addition, in places where many walk with dogs (*Kis-Sváb Hill*) or rides a bicycle (*Apáthy Cliff*), or where parking places are not available (*Lake Naplás*) public use may also create direct damages to habitats (soil compaction, treading, erosion).
- The level of education among visitors to protected areas is much higher than the average in Budapest, and is also slightly above the average of public park visitors.
- People living in family houses with gardens are more bound to protected areas, and would visit such places at a higher frequency than those living in blockhouse areas of in the inner city.
- The protected areas of Budapest are not completely known even to the visitors. On average, 80% of the visitors were aware to be in a protected area. Most of them had this information form the local signs. Most of the children heard about protected areas in the school or from the parents. The adult population would gather information mostly form local newspapers. However, a remarkable number of people believed that all the large parks in Budapest are protected areas.

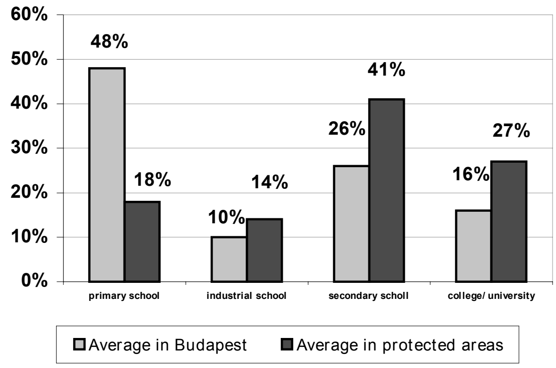

Figure 8.: Level of the education

COMPARISON OF THE VISITING HABITS IN THE PUBLIC PARKS AND IN THE PROTECTED AREAS OF BUDAPEST

Based on the investigations, protected areas are also used as places to spend leisure time and play an important role in public recreation. One of the reasons is that Budapest has few green areas in the direct neighbourhood of residential areas, and the overall size of green area per person is also low (as low as 10 m^2 per person, even if the forest zones are also included).

In the areas where public parks are missing, the use of protected areas (i.e. frequency and intensity of visiting, characteristics of the daily turnover, etc.) is similar to that of public parks. Similarly, the percentage of those walking with dogs is high, as is in the public parks of Budapest. In other protected areas the uses are typical of a park forest. The varied cliff configurations and geological formations attract the young mostly as playgrounds for adventure types of activities.

However, there is a significant difference between the motivation of visitors to public parks and protected areas. Many people like to go to protected areas because, in contrast to public parks, the vegetation is natural, and these are the only areas in a city where nature can be enjoyed in its original state. In general, visitors to protected areas are also more bound to public parks. However, many of the park users only know and visit "their own" nearest park.

Also, assessment of crowdedness is different in the protected areas. Visitors would already complain about crowdedness if more than 2 or 3 groups (families) are within eyeshot, simultaneously in the same part of the area. In the case of public parks the feeling of crowdedness depends on the size of the park. In the case of small public gardens, intensive use is better tolerated, whereas in large city parks, visitors would feel much comfortable in a quiet, less intensively used part of the park, with the exception of walkways, playgrounds and sports fields.

With respect to the percentage of cyclists, there is a surprising difference between public parks and protected areas. The results show that the average ratio of cyclists is only 4% in public parks, but is as high as 13% in protected areas, although cycling is forbidden in certain parts of such protected areas. More than twice as much people go to protected areas by bicycle than to public parks. However, there is an interesting similarity in that the percentage of those arriving on foot is exactly the same, i.e. 48% for both types of green areas. Visitors of the parks and gardens much more frequently arrive by public transport, whereas almost one fourth of the visitors of protected areas arrive by car due to the larger distances and the difficulties with public transport.

Much similarly to public parks, most of the protected areas have regular visitors, some of them even have a clientele. Only 30% of the visitors of protected areas is occasional visitor and the rest visit these places on a weekly basis.

The primary catchment area for both parks and protected areas consists of the surrounding residential zones within a distance of 15 minutes. In spring and fall, i.e. during the excursion season, protected areas have a slightly larger catchment area with every fifth visitor travelling more than 30 minutes to arrive.

Age distribution of the visitors is similar in parks and protected areas. The percentage of those between 31 and 60 years of age is higher, but the percentage of those younger than 6 and older than 60 is lower in protected areas than in public parks. The percentage of those in the school years and of the youth is almost the same.

Distribution according to the level of education is the same for both types of areas. The results demonstrate that the green areas of Budapest, both natural and near natural, are visited by the more educated, with an outstandingly high percentage of people with college/university level education.

PRACTICAL USE OF THE RESULTS

Primarily, park use studies are prepared for the purpose of planning in the best accordance with public needs and of developing planning and management guidelines. In addition, the evaluation of these results creates a basis for recommendations that we prepare with regard to developing green area policy guidelines, and justifying and supporting municipality decisions. Investigations in the protected areas serve as a basis for the assessment of recreational loadability and for the identification of the public role of these areas within the green area system of Budapest.

The study results have been used for the following specific objectives so far:

- Defining the main function for proposed future public parks (e.g. sports park, events park).
- Preparing guidelines for green area planning.
- Identifying the green area development objectives of development programs and regulation plans.
- Measure and design of parking places based on actual demand.
- Measure and design of playgrounds.
- Identifying buffer zones for protected areas.
- Recommendations on the assignment of the most loadable visitors' zones in protected areas.
- Preparation of recommendations to improve education and awareness raising with regard to nature conservation.

SUMMARY, CONCLUSIONS

The present series of studies indicated that such data collection methods resulted in a database (not available from other sources) that, when evaluated and analysed for potential relationships, provides practical assistance in the development of green areas and in the management – in the good sense – of the natural values of Budapest.

Quantified results demonstrated that protection of the nature conservation areas in a city with a population of 1.8 million should not involve hermetic, reservation type of protection, i.e. absolute elimination of visitors. In large cities where the number of public parks is low or the availability of green areas is scarce, protected areas have an additional, special recreational role.

At the same time, island-like protected areas (i.e. those surrounded by residential areas) compensate for the missing public parks in a given zone, therefore their use is similar to that of a park.

Such recreational load should be considered in the management of protected areas. Protection of the endangered, sensitive habitats and zones is only possible if the intensive uses may be canalised to other parts of the area. These would be the locations for the "equipment, and furniture" for raising attention, offering interactive programs or interesting information, which can provide long term and valuable assistance in public education and awareness raising with regard to nature conservation.

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A Survey of Recreation Interests in Urban Forests, the Influence of Travel Distance

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Abstract: The forest complex of Heverlee-Meerdaal, which consists of two forest parts, is located on a gradient from a rural region to an expanding urban area. By means of counts an interpretation on congestion and on spreading of visitors in time and space in the area was made. On the basis of these counts questionnaires were carried out in the forest throughout the whole year and among all activity groups. The questionnaires dealt with socio-demographical characteristics of the visitors, preferences and perceptions of the respective activity groups and their interpretation of the forest area concerning structure and infrastructure. According to this study, the geographical distribution of the visitors in the forest is highly determined by the position of the forest along a gradient relative to the conurbation.

INTRODUCTION

The region of Flanders (northern part of Belgium) has a long history of intense agricultural exploitation and high population densities, which resulted in a complex cultural landscape with a dense urban and infrastructural network. Forest cover is limited to 10%. The last decades there has been an increasing demand for outdoor recreation areas and particularly for afforestation in an urban environment. To ensure proper design of urban forests, more research needs to be done on visitors' perceptions, preferences and expectations (Rydberg & Falck, 2000). Little is known in depth about the interaction between the structural characteristics of the recreation site and recreation patterns in particular. However, much information has accumulated empirically by landscape architects in order to offer optimal planning, design and management solutions at particular sites for specific types of outdoor recreation (Bell, 1997). In sociological research a lot of attention is paid to the link between visitor characteristics and their behaviour in a broad spectrum of recreation activities (Tarrant & Green, 1999). An appreciation of visitor demands on natural resources and man-made facilities is required to identify the key issues that can be useful in decision-making and management. The recreation function of forests has been highlighted (Anon., 1993), but it is a task for the manager to integrate this function with all others, including nature conservation and silvicultural goals. As with most aspects of outdoor leasure, an attractive physical environment is demanded. The choice of a recreation site in a particular geographical area is influenced by site attributes (Clark & Downing, 1984) e.g. size, desolation, infrastructure, …

An important factor for extensive recreational activity is the travel distance to the area (Lindhagen, 1996). This is of crucial interest for the design and establishment of new urban forests. The position of the two studied sites, situated at unlike distances to the city of Leuven, is an unique oppurtunity to study how recreation varies with the gradient from a more rural to a highly urbanized landscape. Next to socio-demographical characteristics of the visitors also their recreation preferences and forest perceptions are examined. We further analysed the demographical patterns of transport towards the forest complex and the interactions with visit typology.

METHODS

Study area

The forest complex of Heverlee-Meerdaal consists of two forest parts and is located in a gradient from 5 to 10 km south of the city of Leuven (Figure 1). It covers a total area of approximately 1890 ha and is the second largest forest complex in Flanders. The complex is a remnant of a vast forest that once covered central Belgium (Tack et al., 1993).

Because of the relative position of the forest complex to the agglomeration of Leuven (88.500 inhabitants), the adjacent parishes (50.000 inhabitants in total) and the public access an intensely practised recreation occurs throughout the whole year at fairly high densities. Therefore it can be considered to be an urban forest. A main road from Leuven to Namur forms a direct connection between the city center and the two forest parts. The forest is state property (Flemish region) and managed by the division of Forest & Green

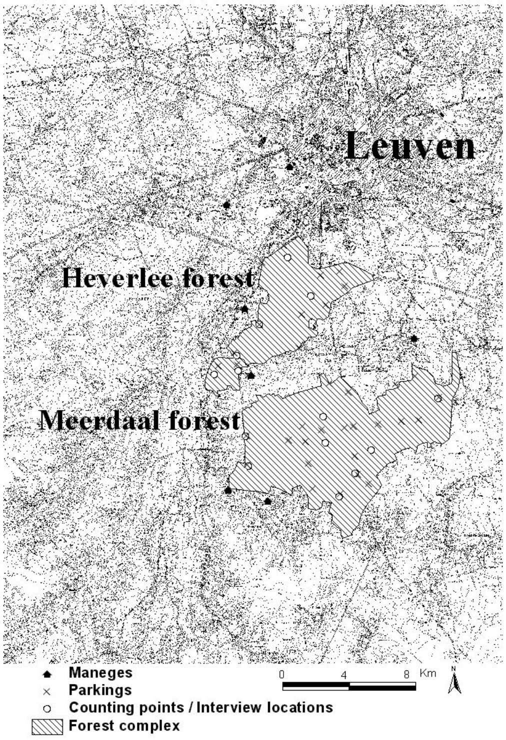

Figure 1: The study area, City of Leuven and the adjacent forest complex of Heverlee-Meerdaal

focussing on three main functions: leasure, wood production and ecological conservation. The latter are detailed and integrated in a forest zonation plan. Managemen t gives priority to a sustainable wood production and an application for FSC (Forest Stewardship Council)-labelling is accepted. Access is restricted to forest roads and paths, with a clear regulation in function of the type of recreation (walking, biking, horse riding, driving,…). In contrast with many other Belgian forests plant biodiversity is exceptionally high, because of the limited fragmentation and the large habitat diversity on a variety of soil and topographic conditions. The forest stands consist mainly (65%) of deciduous tree species like oak (*Quercus spp.* L.; 25%), Beech (*Fagus sylvatica* L.; 30%), Hornbeam (*Carpinus betulus* L.) and Birch (*Betula pendula* Roth). About 35% is covered with coniferous species like Pine (*Pinus sylvestris* L., *Pinus nigra subsp. laricio* Maire; 30%).

Counts and data sampling

The counts (n= 5972) had the purpose of giving a solid impression of the distribution of visitors throughout the total forest area. They were executed at nine predetermined locations (four in Heverlee (HF) and five in Meerdaal forest (MF), distributed over the total area but preferentially at paths used by all recreation types (Figure 1). This was done every season during the weekend as well as during the week between 7.00h and 21.00h. These data are not proper for simulating the total visitor in- and outflux but for each recreation type a reliable minimum of respondents per recreation type could be determined. The counts were used further for controlling the proportional representativity of interviewees compared to visually observed visitors, in respect of preventing over- or underestimation of certain groups (cf. Jansen et al., 1994; Kroon, 1994).

Visitor information was collected by means of a questionnaire, administered through personal interviews in the period between the summer of 1998 and spring 1999, at the same positions where counts took place. The questionnaire was tested preliminary and then amended and made more complete. Visitors were interviewed by the 'next-to-pass' technique (cf. Segeren & Visschedijk, 1997), the sequential interview of a person or groups passing by. The first person taking the floor was considered being the respondent for the complete questionnaire. Initially a quotum of 450 questionnaires was taken because of statistical integrity. By planning and observation these were distributed proportionally over all seasons and recreation types. Finally 526 detailled questionnaires were completed and 606 of an earlier and more incomplete test version.

The questionnaire focussed on visitor profile and origin, complaints and preferences in activity, forest structure and infrastructure. Response formats were either closed (dichotomous, multiple choice) or in ranking scale (cf. Jensen & Koch, 1998). Where needed, questions were clarified by photos. The oral questionnaire gave the possibility of clarifying the questions by direct interaction between interviewer and interviewee, enhancing the reliability of the answers. The interviews were conducted by a professional polling firm.

Data analysis

The data were analysed using categorical data processing methods (Agresti, 1990) such as Pearson χ^2-testing (cross tabulation) and nonparametric statistical tests (Siegel & Castellan, 1988). For all statistical analyses SPSS was used (SPSS 10.0, 1999). Analysis of the data concentrated on the differences between the two forest parts in relation to a distance gradient towards the city of Leuven and a possible influence of this on visiting patterns. Key issues are the distance covered reaching the forest and the transport means used. Another important item is visitor behaviour including the type of activity, group size, visit duration and frequency. The calculation of georeferential data (covered distances and time during journey) was executed using Geographic Information Systems (GIS), more specific with databases like Streetnet Flanders (TeleAtlas) and Route 66 (Copyright Route 66 GIS B.V.) (Moons et al., 2000). Items of interest are also the preferences for forest type and structure, topography and path structure.

SOME RESULTS

Visiting patterns in time and space

The counts give evidence to the fact that recreation appears to be most intense in autumn (28%), immediately followed by summer (26%). 45% of all visits happens in the weekend. There seems to be a preference of some activity groups for certain seasons. Walkers prefer autumn (57%), while joggers (52%) and bikers (41%) mostly come by in spring.

Social characteristics of the visitors

Most respondents (*n*= 1132) are male (71%), which can be considered to be an undistorted measurement because in the independent visitor counts male were 67% part of the visitors' party. The largest group of respondents is the 31-45 age group (37.8%), with second in line that under 30 years (27.9%). The mean and median age are respectively 42 (*sd*= 16) and 40 years. The visitors in HF mostly belong to the youngest or oldest age group, while visitors of MF are rather middle aged. It can be observed that walkers appear more than expected in the oldest age groups, while joggers mainly are between the age of 36 and 45. Biking as well as horse riding are dominated by the youngest age groups.

As far as the educational status is concerned, 50% of the respondents (*n*= 526) has a high level of formal education (higher level -3 years- or university education). Minimum 30% of the others has finished secondary school. 60% works as employee or skilled worker. Retired people and students count respectively 13% and 11% of the respondents.

Most of the visitors are married or live together (63%) and have a family of maximum three persons (60%). About 23% has children older than 15 years. Singles represent 30% of the total group. A minor group (7%) consists of divorcé(e)s and widow(er)s. Each of these groups consists of approximately 2/3 men and 1/3 women, as was also earlier observed in the counts.

Recreation activities

Interviewees were asked for the main reason of their visit and were asked also to ordeny several pre-listed reasons, based on the preliminary questionnaire. Most visitors (48%) came for a walk. There is a pronounced difference (χ^2= 27.159; *P*<0.001) between the two forest parts concerning the main activity. Joggers clearly prefer HF and bikers do the same with MF (Figure 2).

In general, biking (29%) is the second most practiced activity, followed successively by jogging (16%) and horse riding (7%). Mostly confirmed additional reasons for visiting the forest complex are health reasons (64%), relaxation (47%) and enjoyment of nature (36%).

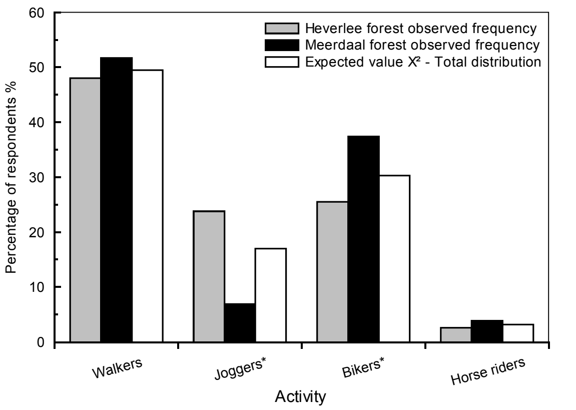

*Figure 2: Distribution of the activities per forest part (n= 526); * significance of difference (P< 0,05) between forest parts*

For all activities, except for walking, a group size of one person is the most given answer (χ^2= 66.570; *P*<0.001). Almost 50% of the interviewees visit the forest on their own. This is even much more for joggers (68%) and horse riders (63%). Walkers have a maximum score by a group size of two persons (48%). Relative frequency declines when group size increases. In MF visitors appear more in group than in HF (χ^2= 19.214; *P*=0.023), matching a different spectrum of visitor activities.

Visitor arrival is maximal in two periods. One peak occurs from 9.00h till 11.00h and the other from 14.00h till 15.00h. The time of peak departure is postponed for about two hours in comparison with arrival (Figure 3). Arrival, as well as departure intensity, drops during noon. The maximum visitor congestion is reached around 11.00h, but there is a nearly stable congestion period between 10.00h and 19.00h. The mean length of a visit to the forest complex is 103 minutes (*sd*= 73).

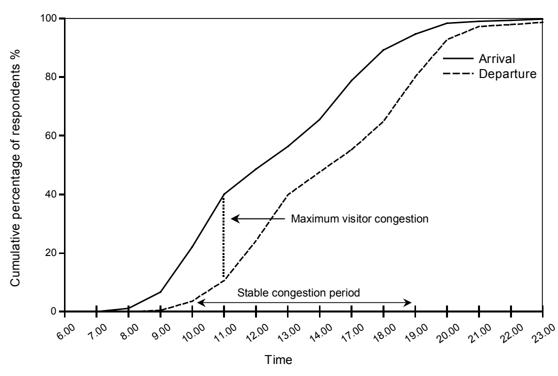

Figure 3: Cumulative percentage of visitors' arrival and departure time (n= 526)

Almost 80% of all interviewees stays between half an hour and three hours. There are some unexpected differences in visit duration between activities (χ^2= 55.810; *P*<0.001) as well as between forest parts (χ^2= 42.298; *P*<0.001). Explicit maxima in duration are observed for joggers, horse riders and bikers, varying respectively in length between half an hour and three hours. In HF most visitors stay between half an hour and two hours (median= 75 min), while there is a peak duration in MF between two and three hours (median= 120 min).

Most of the total number (HF and MF together) of respondents (58.6%) visit the forest at least once a week. 16.7 % does so at least once a month and 24.1 % less. In MF the peak visit frequency is one time a week. In both forest parts a small peak (10.1%) is noticed at a frequency of two or three times a year. The most intensely visited forest is HF (χ^2= 42.014; P<0.001). This is clearly reflected in the counts (n= 5972) indicating that 68% of all visitors go to HF and also that forest recreation is most intense in weekends (45%), spring (36%) and autumn (43%).

Visit duration is significantly correlated with visit frequency (r_s= -0.261; P<0.001). So visitors that come more often, stay less long. People coming only a few times a year and making longer distances stay relatively longer.

Travel distance

Mean distances covered to both forest parts differ significantly from each other (Mann-Whitney: Z= -6.963; P<0.001). People visiting HF cover a mean distance of 6.6 km (sd= 8.9), while visitors of MF do so in 8.8 km (sd= 8.8). Travel distance and time (minutes) to reach the forest proved to be strongly correlated (r_s= 0.964; P<0.001). There is also a significant difference between the distances covered by different activity groups (χ^2= 17.967; P=0.036). Joggers mainly cover short distances, while horse riders make no complaint travelling longer distances. This also explains the strong difference (χ^2= 35.288; P<0.001) in covered distance between the two forest parts (Figure 4). As expected, similar patterns can be observed for the travel time to the forest. Both differences between forest parts (χ^2= 19.863; P=0.001) and activity groups (χ^2= 32.386; P=0.006) are significant.

Most visitors (n= 1132) use the car for transport to the forest complex (55%). 27 % comes by bike and 15 % on foot. Differences between activity groups are significant (χ^2= 219.212; P<0.001). The car is most popular, except for bikers, of which 60% arrives by bike. Approximately 30% of all walkers comes on foot. There also is a significant difference between the transport used for both forest parts (χ^2= 33.459; P<0.001). Both are reached mostly by car, but the difference in frequency measures 25%. Accessibility (45%) is the most given argument if asked (n= 526) why people enter the forest at a specific location, followed by the presence of a well indicated parking area (13%).

There is an interaction between the distance visitors have to cover reaching the forest complex and the way the visit occurs. Visit duration is positively correlated with covered distance (r_s= 0.111; P=0.015), whereas visit frequency and covered distance are less clearly related.

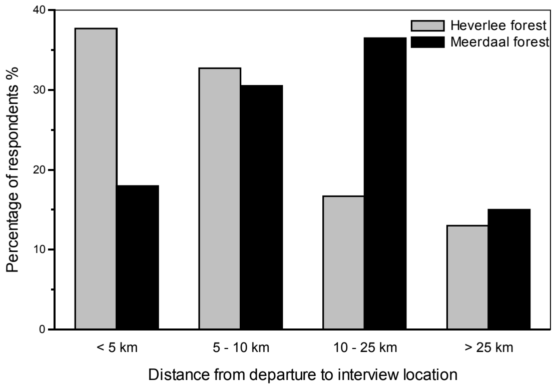

Figure 4: Covered distance per forest part (n= 500)

Visitors' expectations in forest structure and infrastructure

All activity groups were asked to answer multiple choice questions about preferred forest composition and structure. First they had to answer which forest type is preferential, either deciduous, mixed or coniferous (n= 246). Most respondents (59%) explicitly prefer mixed forest (χ^2= 109.780; P<0.001). Walkers react negatively against coniferous tree species and horse riders explicitly prefer mixed forest. Concerning forest structure, 78.9% of the respondents (n= 199) prefer (little or strong) variation in forest layers (χ^2= 14.0; P=0.001). Sloping grounds are preferred over flat terrain (χ^2= 112.154; P<0.001). 84.6% of the respondents (n= 234), distributed over all activity groups, has a strong preference for topographical variation. All activity groups together (n= 223) have a weak but significant preference for wide forest paths (χ^2= 3.771; P=0.05). But only the group of joggers (n= 37) shows a clear (χ^2= 7.811; P=0.005) preference for wide forest paths.

Visitors (n= 526) were also asked to confirm whether certain infrastructure should be present in the forest. Litter bins (88%) are confirmed most, catering facilities least (18%). As expected the group of walkers, joggers and bikers give priority to organised routes for their activity, while non-hardened paths are important for horse-riders.

DISCUSSION

Visitor characteristics are important variables explaining recreation activity. Personal characteristics, combined with those of family status and the specific work and living situation determine recreation activity responses (Katteler et al., 1975). Knowledge about these characteristics is essential to focus on the totality of the visitor population and their inherent demands and needs. We have found that forest visit is related to higher educational levels, which was also suggested by

Loesch (1980) and Jansen et al. (1994). Perhaps it may be explained by the fact that these people need more active relaxation in quiet surroundings. The 31-45 age group is strongly represented, as was earlier detected by Baillon (1975); this group includes mostly working people actively expanding their career and also having created a family or a cohabitation situation (AMINAL, 1993). These groups forms about 24% of the total population of Leuven. Unlike other studies that demarcate the underpresentation of singles (Meeles, 1982), in our results singels form 30% of all visitors. Recreational activities have mainly followed the increasing individualisation of society.

Walking is internationally the most important activity in forest recreation (Germany: Roznay, 1972; Flanders: Gillis & Lust, 1976; Vanderlinden & Lust, 1998; Sweden: Lindhagen, 1996; Switzerland: Gasser, 1997; Ireland: Guyer & Pollard, 1997). The other main pastimes like biking and jogging are a more energetic activity in comparison with the main reason in England, which is walking the dog (Hanley & Ruffell, 1992). In modern society there is a tendency to more active recreation. Horse riding is encouraged by the establishment of several maneges at the outskirts of the forest complex. It is remarkable that 64% of all respondents consider their outdoor activity as being important for their health (cf. Kaplan & Kaplan, 1989).

Compared to earlier European studies (Schmithüsen & Wild-Eck, 2000) the visit frequency is relatively high. It is presumed that distance is a crucial factor influencing the visit frequency of urban forests (Lindhagen, 1996). Small forests at a short distance from conurbation are more intensely frequented than large remote forests (Visschedijk, 1987; Hekhuis & Peltzer, 1995). This pattern is clearly confirmed by the location of Heverlee and Meerdaal forest. People living at a short distance from the forest travel limited time and thereby a visit happens more frequently, but the length is also much shorter. Critical distances, if shown consideration for travel time, are between 0 and 3 km for pedestrians, between 0 and 10 km for bikers and less than 25 km for car transportation (De Nil, 1973; Roggeman, 1982). A journey time of five minutes is already stated to be critical (Coles & Bussey, 2000), which is even more extreme, but relevant in interpreting the visitor proportion of Oud-Heverlee in the study. A total of 60 % of the forest visitors travels a maximum time of 15 minutes, comparable to the results of Elsasser (1996), who computed a total of 75 % travelling less than 20 minutes. The mean visit duration in the forest complex is restricted to approximately 100 minutes, explaining the peak arrival in late morning and afternoon, while there is a decline of activity during noon. This matches well former results observed in Flanders and the Netherlands (Gillis & Lust, 1976; Peltzer, 1993; Hoogstra & Van Kerkhoove, 1995; Vanderlinden & Lust, 1998; Visschedijk, 1999). However there also is an difference between the two parts of the forest complex. Visitors having the intention of staying a longer time take more effort covering the distance to the larger and more distant forest of Meerdaal. The percentage of visitors in this forest part travelling by car is likely much higher, even so being everywhere the most popular transport (AMINAL, 1993; Peltzer, 1993; Schmithüsen & Wild-Eck, 2000), and these visitors stay significantly longer. For the same reason joggers, a lot of them also running toward the forest, are significantly more represented in Heverlee forest. In comparison, bikers have a smaller functional area in HF and benefit a longer travel time being compensated by a larger forest area. The benefit of transportation time is determined by a combination of both the type of recreation and the desired duration of the recreation activity. It is remarkable that more than 50% of all visitors comes minimum ones a week to the forest complex. However comparable high rates were observed in Finland (van de Ven & Konijnenburg, 1994) and Germany (Volk, 1992). Walkers come most frequently, followed by joggers and horse riders. Bikers stay behind in mean visit frequency. The same tendency has been observed in the Netherlands (Segeren & Visschedijk, 1997).

Concerning visitor preferences for forest structure, there is an explicit preference for mixed forest types and strong variation in forest structure and topography. This is in agreement with the hypothesis that diversity and variation makes a forest acceptable for recreation (Coeterier, 1992). Coniferous forests are not popular because of the association with uniform forest stands without variation in tree and brushwood, as they appear in many plantations of northern Belgium. But coniferous trees are quite appreciated in mixed forest because they create variation in winter time (Veer & Boerwinkel, 1998). A preference for wide forest paths is probably the consequence of the fact that one can choose his own way avoiding muddy tracks and a higher safety feeling is sensed.

Visitors give priority to infrastructure minimizing the impact effects of recreation. In particular the occurrence of litter is considered to be disturbing. Organised routes are appreciated by the respective target groups. In contrast with its visit frequency, Heverlee forest is appreciated less than Meerdaal forest. This could be due to the increased visitor congestion (Jensen & Koch, 1998) - even though this is not expressed in the responses -, the noise nuisance caused by the highway crossing the northern part of Heverlee forest or the less expressed variation in forest structure and topography.

CONCLUSION

In this study the recreative use of the forest complex of Heverlee-Meerdaal by the population was investigated. The visit typology can be approached throughout preferences and demands of the visitors themselves, as well by the location and the characteristics of the forest. Counts delivered quantitative data about forest congestion and subsequent questionnaires gave qualitative data concerning motives, perceptions and preferences of the visitors. The average visitor is a middle-aged person with higher formal education and living in a family or cohabitation situation, mostly male.

The preferred activity is walking, followed by biking and jogging. Most of the people visit the area on their own. Visit frequency and are negatively correlated and strongly determined by the covered distance from the residence to the forest.

This distance effect is described by a transport pattern of a gradient from an urbanised to an rural landscape. The dominant visitor group consists of locals and inhabitants of the city. Heverlee and Meerdaal forest attract a different type of visitor, influenced by the size of the forest area, the desired recreation activity and the distance to the forest part. Approximately 70% of the visitors are inhabitants of the city of Leuven and the adjacent conurbation, confirming the urban character of the forest complex.

A preference is given to mixed forest types with variation in structure and topography. Most respondents give a positive response to additional infrastructure, giving absolute priority to the appearance of litter bins. The overall forest area is evaluated very positively.

These data indicate the importance of visitor demands in respect of their interests for outdoor recreation activity. They provide essential information for decision-making concerning forest management in terms of silvicultural practices, infrastructure and the establishment of new urban forests.

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Recent Trends of Park Use at Tokyo Metropolitan Area

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Abstract: Tokyo Metropolitan Government has studying its urban parks since 1982.
Several parks are selected in each year, and the parks under study are increasing. The cost has already amounted more than 10 million yen. At 69 parks, the government counted the visitors' number of the monitoring day and interviewed age of visitors, their way of access, purposes of visit, their impressions of the parks and the requirements of the park management. The results were totaled at each park category. The categories were: A, famous park well facilitated; B, city park with wide. grassy open space; C, sports parks; D, natural forest parks in hilly area; E, historic garden parks with admission; and F, small parks. The density of visitors ranged from 1-200 persons per hectare, and 80% of parks had a density below 50 persons per hectare. The inducement sphere, 80% of visitors accessible, was ranged from 1-50km; the widest radius was observed at the parks with admission and the park at the city center. A frequent arrival of the visitors was observed 1-2 p.m. and the exit was 2-3 p.m. at the historical gardens (E type). The parks, less than 20 hectare, showed the increase in visitor numbers in proportion to the park area. B type park showed the increase of residence time in relation to the park area. Congestion had a bipolar effect on visitors' satisfaction: each park has its own comfortable visitor density.

INTRODUCTION

Since 1966 Tokyo Metropolitan Government has conducted studies of recreational use of parks in coordination with a nationwide survey carried out by the Ministry of Construction. The studies have been carried out by the Metropolitan Government assisted by the private companies since 1982. To assess trends of park use in Tokyo metropolitan area, the annual results were summarized and analyzed in 1989 and 1994.

This paper reviews the trends of studies of recreational use of urban parks in Tokyo since 1982 and shows the results of the analysis conducted in 1994.

TRENDS OF STUDIES ON PARK USE

Table 1 shows the history of park studies conducted since 1982 until 1998. A total of 69 metropolitan parks were investigated and more than a half of them were already investigated twice. Since 1990, we surveyed 6-10 parks in each year and per year and paid more than ten million yen including contract cost.

We investigated the number of visitors at the park entrances, which ranged a few to many depending to the park type, and interviewed a questionnaire in the park. The former task employed 60-310 individuals and the later employed 20-130.

The visitors were counted on a holiday in October since 1990 compared to two separate days, one weekday and one holiday, from 1982-1989. The annual visitors were estimated on the basis of the survey results in proportion to the data of the charged parks where we counted the exact visitors' numbers through the year..

The interview was conducted on a holiday in October. We asked age of respondents, group composition of visitors, means of transportation to access, time duration to reach the park, frequency of visits, reason for choice the park, purpose of visit, facilities used, impression of the park, and requirement of facilities and their image of the park.

RESULTS OF ANALYSIS

The analysis used the results of 46 parks surveyed from 1990-94. We summarize the some trends of park use in Tokyo metropolitan area.

The parks were categorized into six groups according to the factors, as the reason of establishment, park facilities, users' behavior and inducement spheres.

Type A involves well-known major parks with well facilitated (e.g., Hibiya Park, Ueno Park).

Type B involves multipurpose parks and scenic parks which have a large grassy open spaces or a wide recreational areas (e.g., Shakujii Park, Nogawa Park).

Type C involves sports parks with various sporting facilities (e.g., Komazawa Olympic Park).

Type D involves hilly parks and natural parks (e.g., Sakuragaoka Park).

Type E involves historical parks and Japanese-style gardens (Koishikawa-Korakuen Gardens).

Type F involves small parks (e.g., Aoyama Park, Nakagawa Park).

Density of visitors

Density of visitors was calculated as the average density of visitors per park area at each hours. This indicates the congestion of the park of the day. As in Figure 1, 80% of parks showed a visitor density of under 50 persons/ha. Zoological park, botanical gardens and parks with cultural installation or sporting facilities showed much higher densities.

Conversely, as in Figure 2, the lower density was observed at Type D, hilly parks with large forest.

Inducement sphere

The inducement sphere was estimated by the radius of the area where 80% of respondents lived in and the induced distance was calculated as the average radius of the sphere.

Induced distance of each park is shown in Figure 3. Tokyo metropolitan parks had the distance ranged from 1 km to 50 km. The large inducement spheres were observed at the charged parks or park located in the city center. Figure 4 shows the frequency distribution of the inducement sphere of each park type. Type E parks, historical parks and Japanese gardens, had a larger inducement sphere, while other types had a sphere of less than 10 km.

Fluctuation of visitors' arrival, leaving and residence in the park

Figures 5-7 illustrate fluctuation of visitors entering, leaving and residence of each park type.

Type E displayed high concentrations of arrival during 13-14 o'clock and departure during 14-15 o'clock. In contrast, Type C, sports parks, showed a relatively gentle fluctuation for both arrival and departure due to the capacities of the facilities and also showed the gentle peak by the constant use.

Effect of park area to the visitors' number

Figure 8 shows the correlation between the annual number of visitors and park areas.

The greater annual number of visitors was observed at the larger park (Aoki 1984).

However, the large park, e.g. over 20 ha, especially well-known, major parks of Type A showed the inconsistent results. Because these parks were affected by the invents held at the park and the location of the park on the annual visitors. And type D, hilly parks, showed the smaller number of visitors compared to the park area. As for the smaller parks, i.e. less than 20 ha, the annual number of the visitors was related to the park area. (Fig.9)

Effect of park area to residence time

Figure 10 reveals a weak correlation between the average residence time of visitors and the park area. And Figure 11 demonstrates, different residence time at each park type.

Sports parks and gardens showed similar residence time in the park category, because of the similar behaviors at the park. Type B, multipurpose or scenic parks, showed the effect of park area on the residence time, because of the variety of visiting purposes. (Fig.12)

Relation of satisfaction and congestion

Satisfaction ratio was calculated as the percentage of respondents who stated satisfactions in the questionnaire. Congestion ratio was calculated as the percentage of respondents who stated the park to be congested. The level of satisfaction decreased at the weak congestion and at the overcrowded. The highest satisfaction was observed at 15% the congestion ratio. (Fig.13)

This suggests that some visitors are seeking tranquillity and relaxation, and some are enjoying a crowd.

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Table , p Investigations of recreational use in Tokyo Metropolitan Parks

NO.	Park	Area□iâ□	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	Ueno Park	53.4	□œ										□œ						
2	Shiba Park	12.2							□œ				□œ						
3	Hibiya Park	16.2	□œ										□œ						
4	Inogashira Park	36.4			□œ								□œ						
5	Kyu Shiba-rikyu Gardens	4.3									□œ								□œ
6	Daiba Park	3.0																□œ	
7	Yokoamicho Park	2.0											□œ						
8	Sarue Park	14.5			□œ						□œ								
9	Kiyosumi Gardens	8.1									□œ								□œ
10	Sayama Park	24.6					□œ						□œ						
11	Roka Koshu-en Gardens	6.6					□œ						□œ						
12	Koishikawa-Korakuen Gardens	7.1									□œ								□œ
13	Rikugien Gardens	8.8									□œ								□œ
14	Mukojima-Hyakkaen Gadens	1.1									□œ								□œ
15	Hama-rikyu Gadens	25.0									□œ								□œ
16	Koganei Park	77.0		□œ											□œ				
17	Toyama Park	18.7				□œ								□œ					
18	Kyu Furukawa Gardens	3.1									□œ								□œ
19	Kinuta Park	39.2			□œ										□œ				
20	Johoku-Chuo Park	21.2				□œ									□œ				
21	Jindai Botanical Park	45.9												□œ					
	Jindai Greenery Information	——			□œ														
22	Shakujii Park	18.2						□œ					□œ						
23	Zenpukuji Park	7.9						□œ						□œ					
24	Zenpukujigawa Park	18.0							□œ					□œ					
25	Wadabori Park	17.3														□œ			
26	Musashino Park	23.0				□œ										□œ			
27	Meiji Park	5.7							□œ									□œ	
28	Komazawa Olympic Park	41.3					□œ								□œ				
29	Mizumoto Park	72.5		□œ										□œ					
30	Higashi-Ayase Park	15.9													□œ				
31	Ukima Park	11.7								□œ						□œ			
32	Shinozaki Park	23.9						□œ								□œ			
33	Yoyogi Park	54.1		□œ												□œ			
34	Ryonan Park	6.0						□œ									□œ		
35	Aoyama Park	3.8													□œ				
36	Sengenyama Park	7.7												□œ					
37	Shiokaze Park	15.5			□œ												□œ		
38	Akatuka Park	25.0							□œ			□œ							
39	Soshigaya Park	6.8														□œ			
40	Yumenoshima Park	43.3				□œ									□œ				
41	Tonogayato Gardens	2.1									□œ								□œ
42	Higashi-Yamato Park	18.2										□œ							
43	Sayama Sakai Scenic Road	7.7					□œ											□œ	
44	Kameido-Chuo Park	10.3								□œ						□œ			
45	Nogawa Park	39.7		□œ										□œ					
46	Hirayama-joshi Park	6.5										□œ							
47	Naganuma Park	32.0										□œ							
48	Toneri Park	47.2															□œ		
49	Tamagawajosui Scenic Road	11.8																□œ	
50	Hikarigaoka Park	60.8								□œ						□œ			
51	Sakuragaoka Park	22.7										□œ							
52	Nakagawa Park	6.5													□œ				
53	Higashi-Shirahige Park	10.3										□œ							
54	Komiya Park	24.1															□œ		
55	Takiyama Park	24.4															□œ		
56	Higashiyamato-Minami Park	9.9										□œ							
57	Higashimurayama-Chuo Park	12.1										□œ							
58	Noyama-Kita Park	84.4												□œ					
59	Akirudai Park	11.8									□œ							□œ	
60	Rinshinomori Park	12.1											□œ						
61	Kasai Rinkai Park	79.6															□œ		
62	Musashino-Chuo Park	10.1											□œ						
63	Oizumi-Chuo Park	10.3										□œ							
64	Oyamada Park	38.0														□œ			
65	Hachikokuyama Park	22.7													□œ				
66	Fuchunomori Park	16.8															□œ		
67	Kiba Park	22.1															□œ		
68	Ogunohara Park	6.0																□œ	
69	(Senzoku Park)	7.1								□œ									
Number of investigated parks			2	4	5	4	4	4	4	4	10	9	10	8	9	9	8	6	8
Investigated area□ ̂□			69.1	205.9	104.1	88.9	78.5	45.8	57.3	89.1	80.9	133.6	189.7	220.4	239.6	234.9	219.3	45.7	59.6
Number of investigators	Counting survey		134	220	117	126	133	145	160	130	64	99	167	154	310	278	207	89	94
	Questionnaire survey		31	110	44	35	24	26	24	27	58	52	61	102	81	128	100	34	47
Number of sheets			1205	2482	1658	1446	1139	1139	1145	1077	2265	2228	2385	2217	2024	2587	1884	1234	1587
Cost(millon Yen)			3	5	4	5	5	6	6	9	12	14	16	17	18	17	16	11	14

Fig. 1 Density of visitors

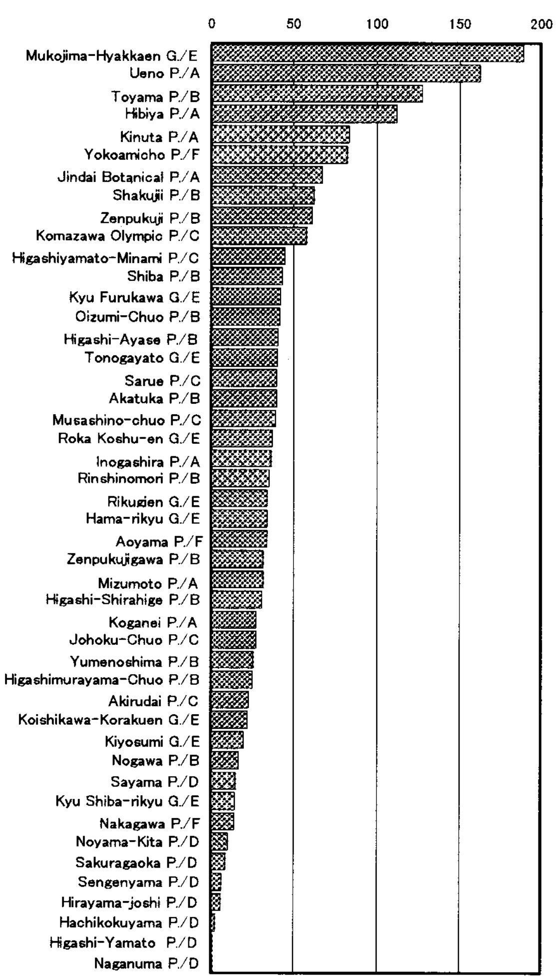


Fig. 3 Inducement sphere

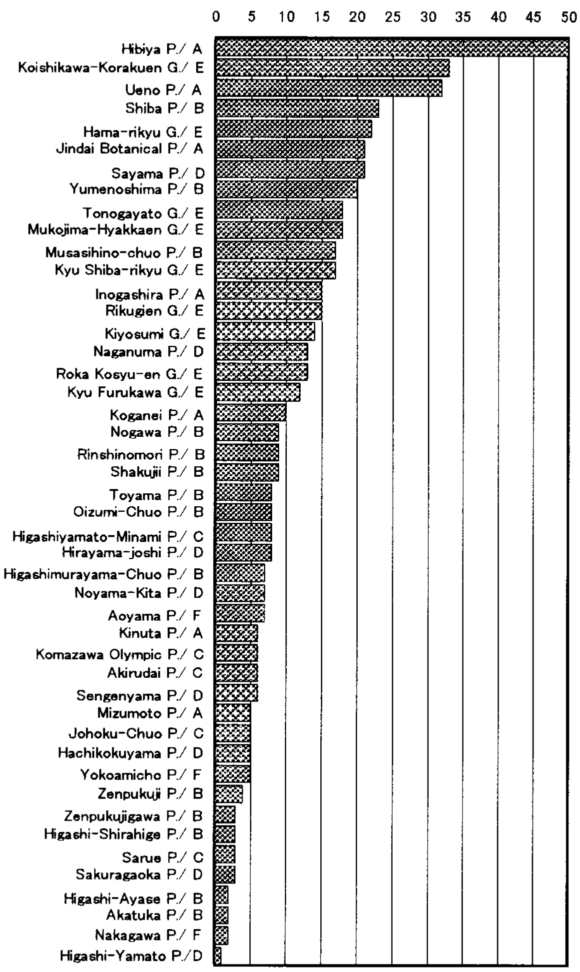


Fig., Density of visitors

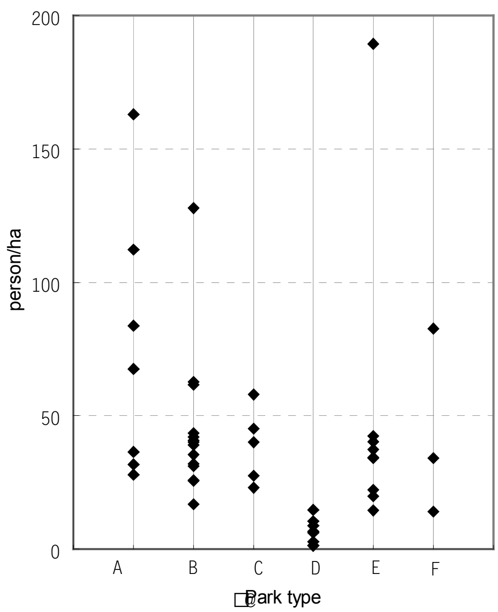


Fig. 4 Distribution of Inducement sphere by park type

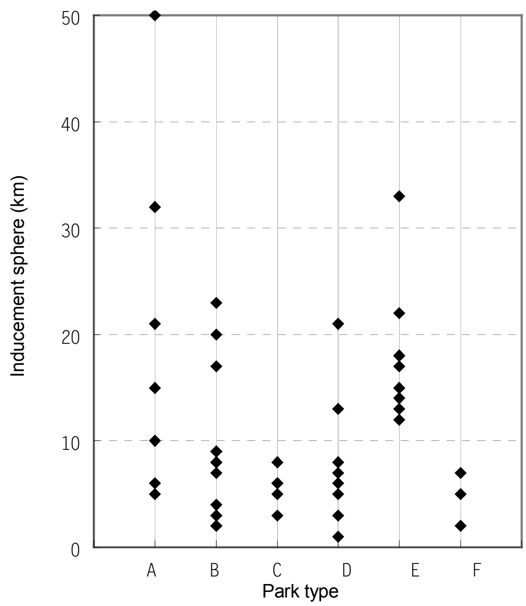


Fig. 5 Fluctuation of visitors' arrival

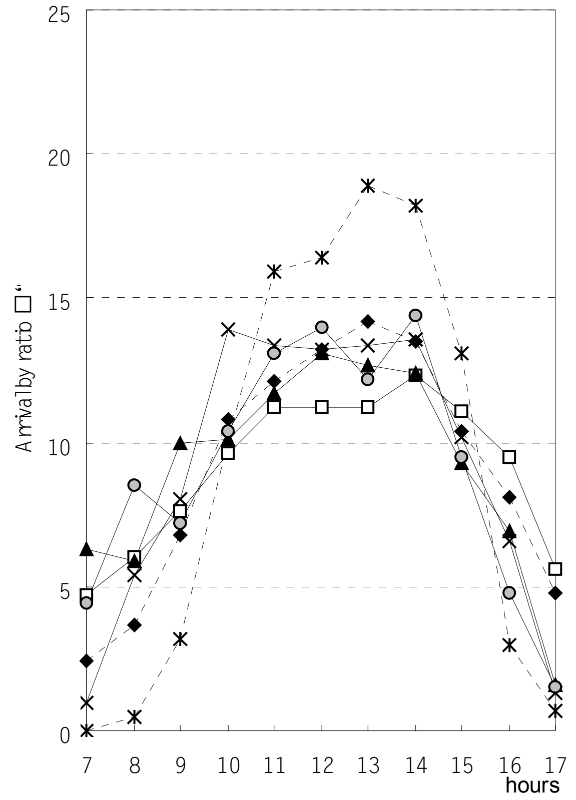


Fig. 7 Fluctuation of park visitors

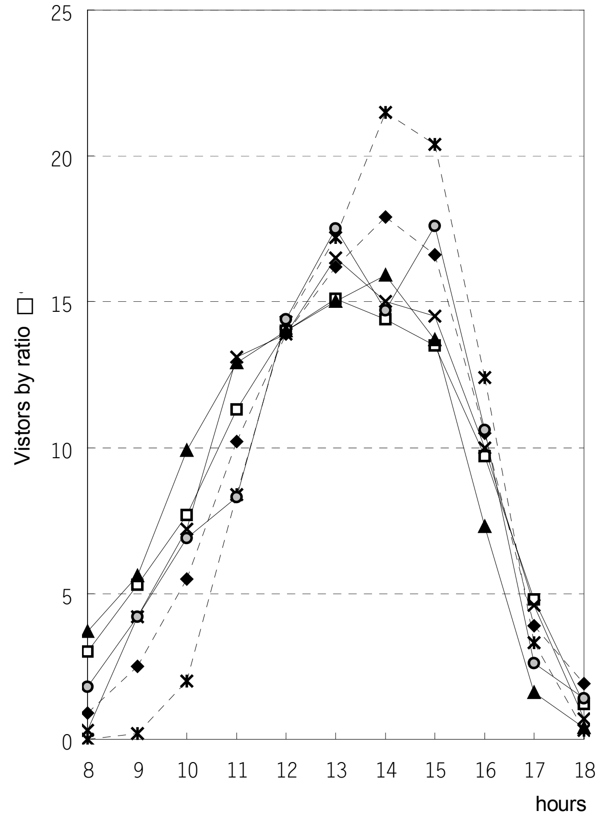


Fig. 6 Fluctuation of visitors leaving

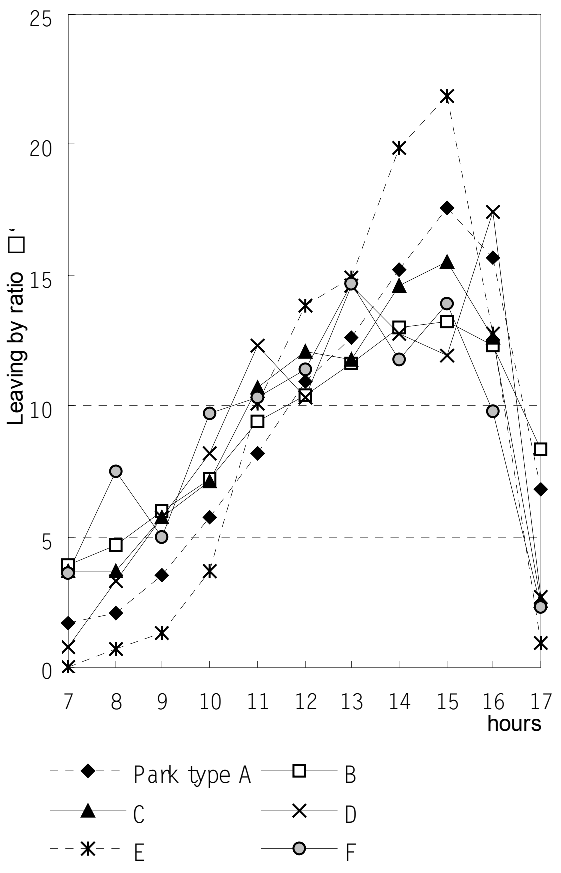


Fig.8 Relationship between visitors' number and park area

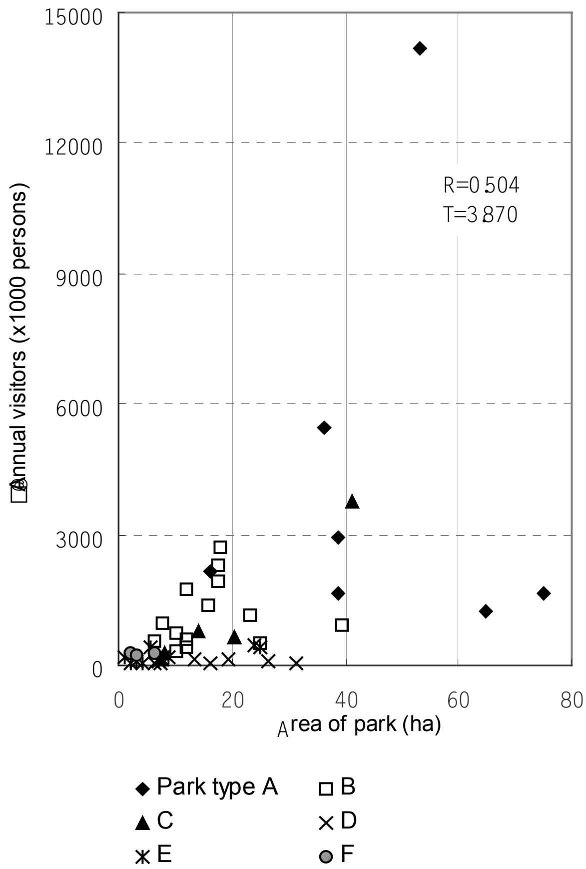


Fig.9 Correlation between visitors' number and park area (smaller than 20ha)

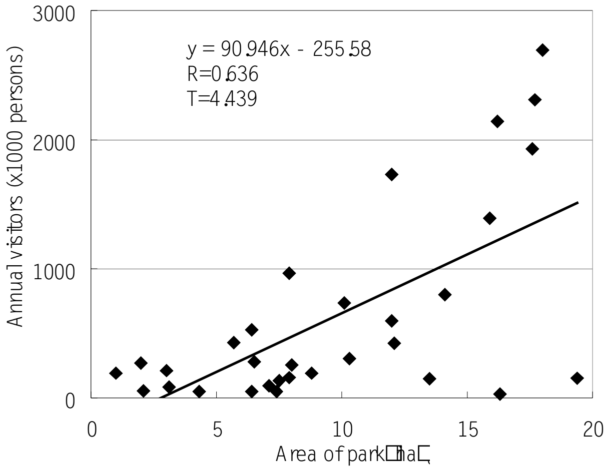


Fig. 10 Relationship between average residence time and park area

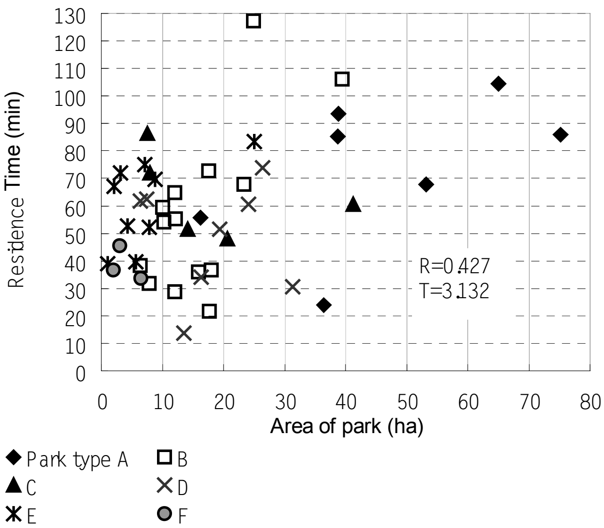


Fig. 11 Average residence time by park type

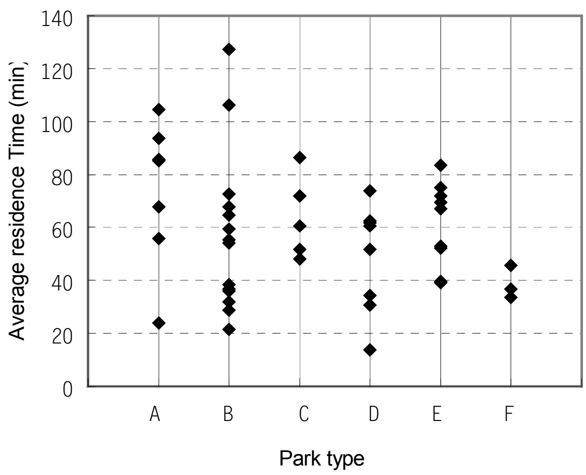


Fig. 12 Correlation between average residence time and park area (type B park)

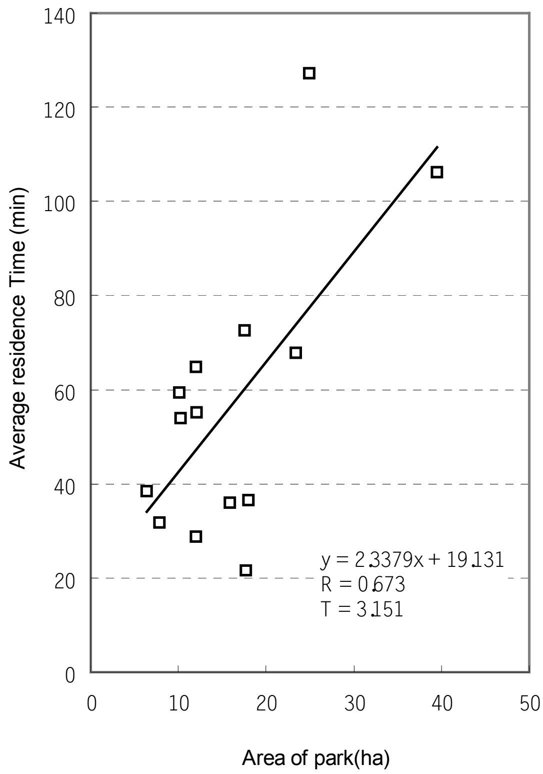
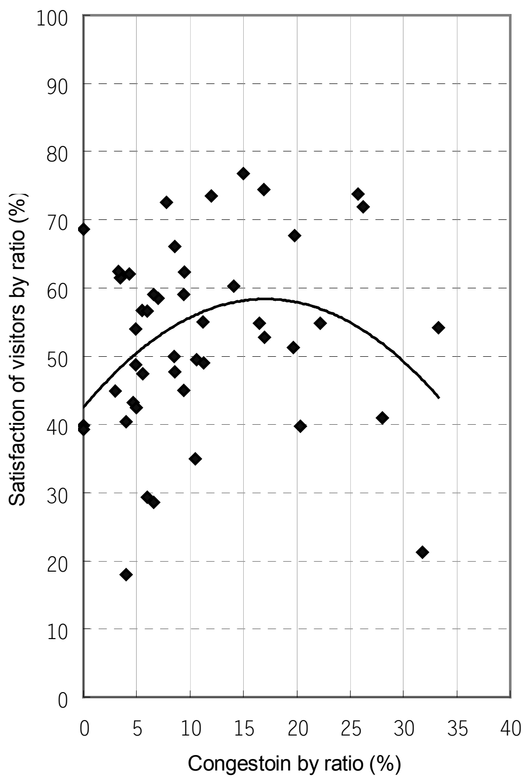


Fig.13 Relationship between satisfaction of visitor and congestion



Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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The Planning of User Flows in Istanbul Groves for Sustainability in Natural Structure

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Abstract: The greenness of Istanbul Bosphorus, except its natural vegetation, is gathered in its parks, gardens and groves. The greenness of the Bosphorus identifies itself with the groves that also have great monumental value. Today, in Istanbul, there is a great number of groves that belongs to either governmental or private institutions. Recently, these groves have experienced increasing pressure from the great number of visitors and their potential use. The latest inventories indicate that existing use patterns of the natural resources of groves affect the trees and plant diversity negatively. Overuse of specific sites causes damage to vegetation especially for exotic plant species that are rarely found in Istanbul. This paper is aimed to describe progress on a system that enables optimal dispersion of use patterns and sustainable use of the groves for future protection. The "User Inventory for Istanbul Groves" was developed to include periodic user observation and user survey in order to maintain groves effectively. For this reason, the computer technology is used as an evaluation tool for examining the user survey results and physical data of the groves that concentrate especially on Yildiz Grove. For the purpose of the study, Yildiz Grove is divided into different zones based on the physical conditions and potential use patterns of the grove and a system is developed that depends on sensitivity for usage.

INTRODUCTION

The metropolis of Istanbul is located in the northwestern part of Turkey. The Bosphorus that divides the city into two parts lets the European and Asian continents meet together.

Istanbul comprises the 9.7 % of the country's total land surface and it has significant importance on presence of the population. According to the year of 2000 population census, the total of the city's population reached to 10 041 477 and the annual increase is estimated to be 0.035 (Anonymous, 2000).

The amount of the active green space of Istanbul is 1.9 m²/per person including playgrounds, sport areas, public groves, forest and picnic areas. The amount of the passive green space is 3.1 m²/per person including afforested areas, nurseries and forests, green spaces with scenic values, public squares, refuges, cemeteries, etc. based on the 2000 census (Aksoy, Y. 2001).

According to this situation the total amount of the green space for per person is 5.2 m² in the city and there are certain efforts to raise this number of urban open spaces. But because Istanbul has always led in urbanization in the region, high immigration and the density of construction in the city center have limited these efforts.

The vegetation formation of Istanbul summarized maquis that represents the Mediterranean along the slopes and ridge of the Bosphorus and islands of Istanbul, and this vegetation type forms very dense and high vegetation cover in non-damaged areas. The other vegetation covers of Istanbul that form the green space of the city are comprised of groves, parks and residential gardens. Especially the Istanbul groves represent the greenness of the Bosphorus with natural appearance and monumental value.

In this study, the Yildiz Grove is selected as a sample area in the Besiktas District that has dense population and movement. The amount of the green space is 5.5m²/per person for the Besiktas district. In spite of the fact that the number is higher than the city average, the amount is accepted as "lower" because of the size of the population during day times.

The reasons for the selection of Yildiz Grove as a sample area for this research are its charming potential for the people with the magnificent Bosphorus view, its historical importance and the monumental trees that the grove has.

After examining the physical data of the Grove, questionnaire surveys named "User Inventory for Istanbul Groves" have been distributed to the user groups of the area.

In the light of this inventory, the Yildiz grove was evaluated depending on its sensitive structure, using style and density, and certain decisions were made for keeping its sustainability in a natural structure.

ISTANBUL GROVES

The word "grove" is described as a small wood, a big group of trees or forested area located in or near the city.

Today, in Istanbul, there are a great number of groves that belong to either governmental or private institutions. And they have a very important role in the city because of their recreational capacities and potential of green spaces. (Table 1).

Grove Name	Area (ha)	Main characteristics
Cubuklu	23	Old garden of Ottoman Pavillion
Buyukcamlica	12.4	"
kucukcamlica	24.8	"
Abrahampasa	27.9	"
Fethipasa	16	"
Harem	3.2	Natural grown urban forest
Yildiz	46.7	Old Garden of Ottoman Pavillion
Emirgan	47.3	"

Table 1. The important Groves belong to governmental Institutions

Recently, these groves have experienced increasing pressure because of overuse of these areas. In the last few decades, there have been certain damages, especially on vegetation, depending on the overuse. Parallel to this dense usage, compaction occurred on the soil coverage of these areas and knocking down of trees, drying or dying of trees or growing problems were determined. There is no chance for natural succession like in the forest in these areas and it necessitates usage sensitivity and protection.

THE CHARACTERISTICS OF THE RESEARCH AREA

The most important one of all these groves is Yildiz grove in the Bosphorus area because of the natural structure and historical value. The ownership of the grove is the Istanbul municipality and it covers an area of 46.7 hectares. Opened to the public in 1950, the grove was restored and the historical Malta and Cadır Kiosks were opened for public use in 1979. The historical ceramic factory has also been run in the area (Yaltirik, Efe, Uzun, 1997).

The grove has very important potential for attracting people with its magnificent view open to the Bosphorus and Marmara Sea, cafés, sitting places, ornamental ponds, small lakes and monumental trees.

According to our study of the natural structure, 120 natural and exotic woody plant species were determined to be in the area. With natural vegetation structure in non-damaged areas, the grove has an important value for the protection of biological diversity in the city.

The user density of the area is very high because of district of Besiktas where the grove is located is very populated. Especially on spring and autumn days, the weekend use of the area has reached as high as 10,000 people. The area has two entrances and the one at the south is the most popular one. The daily average of cars that prefer the main entrance on summer season weekdays is 150 and this number can reach 1200 on weekends. During the winter season, the daily average of cars at the main entrance is around 100, but this number exceeds 400 during weekends. The number of the cars at the east entrance is more than 1/3 times bigger than the one at the south entrance. According to official recording and counting of the cars between January 1st and October 31st the total number of the cars is 53 000 in the year of 2001. There is no entrance fee for pedestrians but cars must pay a fee.

Figure 1. The location of the research area

THE CASE STUDY OF THE RESEARCH AREA

The fieldworks of the area have been subjected to a detailed study. All the physical data related to the area have been transferred to the computer in order to reach efficient and easy results for further studies.

Classification of various forest covers defined as individual inventory units were realised by using analogue topographic maps, the orthophotos having 1/5000 scale. First of all, the analogue data were transformed to the digital form by means of a wide-

Figure 2. The vegetation map of the Yildiz Grove

format scanner and a large-format digitiser. The cadastral boundaries of each planning unit were transferred onto the digital orthophotos, which were overlapped onto the topographic maps by using GIS software package NETCAD. Compartment boundaries were drawn first based on the roads, streams and mean ridges of the hills as a first step, and then the inventory units were placed into compartments (Yesil, et.al.,2001) (Figure 2).

After examining the physical data of the Grove via prepared maps, the area was evaluated based on the interferences and changes caused by land-use differences until today. According to natural data and land use relationships of the Yildiz Grove, the area is divided into four sections showing different characteristics.

- Maximum Interferenced Areas (Management Building and surroundings, nursery-garden and greenhouses, historical ceramic factory, Fire Department Building)
- Interferenced Areas (Malta and Cadır kiosks and surroundings, the pond and the surroundings)
- Minimum interferenced areas (the trees are protected but natural ground cover removed for the intensively cultivated areas with lawn)
- Protected Areas (the trees are healthy and protected, the natural ground cover is somewhat damaged but easily renewable)

THE PREPARATION AND APPLICATION OF THE DATA GATHERING

The methods of data gathering for the Yildiz grove were formed with long-term visitor observation, selective questionnaire conduction and official car registration and counting. After long-term observation of the area between May 2000 and September 2001, the important sub-groups and the relevant ratios between them were determined as following in order to determine the sample size for the questionnaire.

i. Main Entrance at South: East Entrance. 2:1
ii. Male: Female 1:1
iii. Pedestrians: Car Drivers
Main Entrance 2:1 East Entrance 1:1

TOTAL SAMPLE (240)

MAIN ENTRANCE AT SOUTH(160)	EAST ENTRANCE (80)
MALE (80) FEMALE (80)	MALE (40) FEMALE (40)
FOOT (60) CAR(20)	FOOT(20) CAR(20)
FOOT(60) CAR(20)	FOOT(20) CAR(20)

Figure 3. Determining sampling size

The primary purpose of the questionnaire was to explore the relationship between the area resources and usage of people. For the planning of user flows in Yildiz Grove to sustain its natural structure, visitors to the area were chosen by a systematic sampling method to complete an on-site questionnaire. These surveys included questions meant to determinate reasons in choosing to come to the area, including what they prefer to do in the area and which part of the area they prefer to be in. Additional items included on the surface related to the area quality and the problems that need to be solved.

The questionnaire was given to 240 people with 16 questions. And for the data analysis of the questionnaire, the SPSS Statistical package and excel programs were used.

THE OBJECTIVES OF THE QUESTIONNAIRE

The objectives of the questionnaire can be summarized in five subjects as following:

- The characteristics of the grove and the user groups

Asking the gender, age groups and occupation groups of the users, the social structure of the users

- The relationships of the grove and the user groups

The density of the crowd according to seasonal change, the main form of transport that the visitors prefer to use to get to the area, the time they spent at the area, which region they live in Istanbul and the well-known characteristics and their view of the grove.

- The using type and the facilities of the grove

The entrance points of the grove, the reason for preference of the grove, the areas preferred the most, and the activities that take place in the area

- Expectations of the users

The improvements or new developments that the users would like to see in the grove or the suggestions that they would like to see made to the appearance of the grove

- Expectations of the nature scientists

The improvements that the nature scientists would like to see in the grove or their suggestions to protect the area that have very important and sensitive issues that relate to the area

QUESTIONARIE RESULTS

After evaluation of the data received from the questionnaire, the findings could be summarized as follows:

Between the people visiting the area, 82.5 % of the respondents' have been the area before and 67.5% of the total think that the area needs some improvements and new developments especially on outdoor and parking facilities and educational provisions.

Respondents'experience about the reason for choosing to visit the grove and the activities that they prefer to perform at the area are summarized at the following tables.

Opinion	Number of person	Percentage %
For walking	156	65.5
Meeting place	46	19.2
On my way	8	3.4
Use a special facility	18	4.5
Getting fresh air	130	54.2
other	20	8.3

Table 2. Respondents' Reasons for Preference of the Area

Activities	Number of people	Percentage %
walking	226	94.2
eating at the kiosks	40	16.7
jogging	16	6.7
picnic	42	17.5
Dog walking	8	3.3
Child walking	18	7.5
Accompanying others	42	17.5

Table 3. The activities Respondents' have participated during the day

THE PLANNING OF USER FLOWS IN ISTANBUL GROVES FOR SUSTAINABILITY IN NATURAL STRUCTURE

Because there is a need to change existing use patterns for sustainability in natural structure, we suggest the voluntary dispersal through either information programs or changes in physical design of the setting. Compared to permit or regulation enforcement, make some changes in the physical design of setting and educational programs are non-confrontational. Limiting parking space, make some changes in road access, close to some areas to the vehicle traffic and direct people concentrate at particular attention within the landscape especially around Malta and Cadir kiosks.

Information programs at the grove level can be aimed at direct visitor contact through signing, information centers, on-site contact, and brochures. By making specific information available to users, the distribution of people over the area could be influenced and by making information available on existing patterns and points of overuse, the redistribution of visitor use could be effected.

The decisions related to urban planning

In order to control the visitor crowd, the planning needs to be considered in an urban planning scale. The renovation and improvements of the district parks adjacent to the grove will decrease the demand for the grove especially with children and teenagers.

The decisions related to planning of the grove

The operation and further development of the facilities and their functions and objectives will be determined one by one. The carrying capacity of each grove will be determined and concentrated on nature friendly usage. The parking problems adjacent to entrance points will be solved and the entire grove will be closed to vehicle traffic and pedestrilized. The road access passing through the protected areas will be controlled and redirected in the interferenced areas of the grove. The sitting and gathering places will be designed in short-time service.

The decisions related to visitor management

The management system needs to be developed considering user demands and it also will be supported by public relations efforts. Especially at the entrance points, the users need to be informed about some restrictions of using the area.

- An efficient signage system and directions at certain points will enable people to get oriented to the area.
- There must be some restrictions about the time that the people spend at certain points and some places need to be protected from overuse.
- People who prefer to have a traditional picnic in the area need to be directed away from the groves.
- The number of the personnel who work in the groves ought to be increased dependent on the area of the grove, usage density and land-use behaviours.
- Education programs for users ought to be held in order to make users conscious of the natural structure of groves and such topics as how to act in the area and how to benefit from the area.
- The user groups need to be informed via communication devices about the groves before visiting the areas.

In order to plan the user flows in Yildiz grove for sustainability in its natural structure, the grove was grouped as subsections based on the evaluation of land-use behaviours and recent use of the sections before conducting the questionnaire.

After examining the questionnaire results, the grove was divided into different zones based on recent use of the grove, characteristics of the user groups, the relationship between the land and the users, and the expectations of the users and nature scientists. Dependent on the selected zones, some very important decisions were made for each zone for the sustainability of the natural structure.

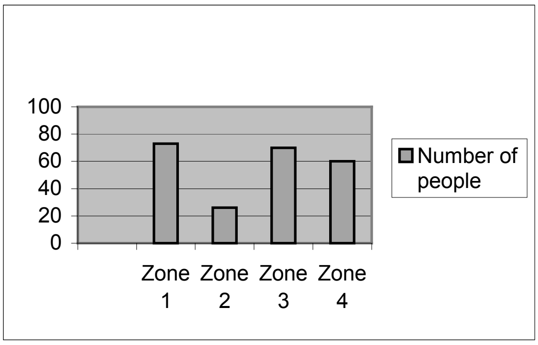

Table 4. The use percentage of zones that respondents' have visited during the day

ZONE 1. Having an average of 60-70 % slope, this area is maintaining a collection of mature trees and intensely cultivated areas with lawns. Building a natural history and information centre provides information and includes educational exhibits in this area. This will be a helpful decision in order to publicize the biological diversity and richness of the area. Additionally, the usage of this zone must be under control and the information about every plant and natural object will be presented. The existing pond in the zone has an advantage of increasing the biological diversity.

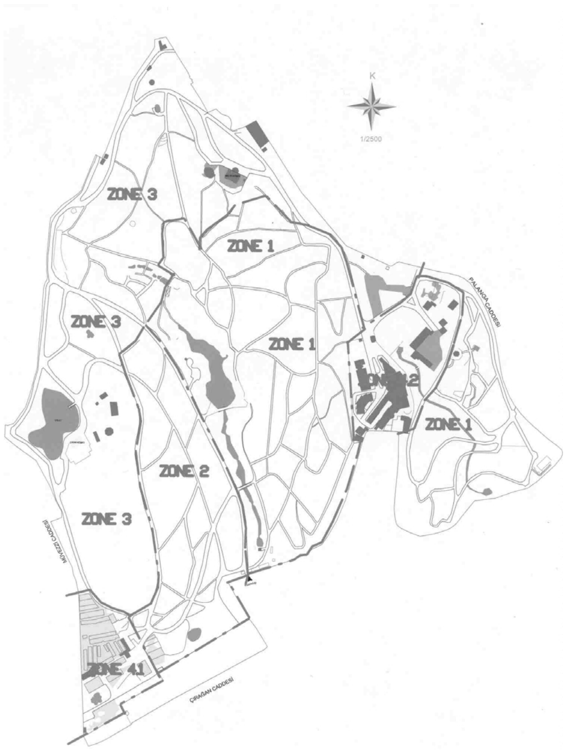

Figure 3. The Yildiz Grove land-use plan

ZONE 2. In this zone, the needle-shaped trees form the dominating vegetation and the ground cover is intensely cultivated with lawns. The usage of this zone needs to be considered as follow up of zone 1. The area has a potential for plant shows.

ZONE 3. This area, including the historical Malta and Cadır kiosks serving as a restaurant today, reaches the highest visitor potential with its unique scene. Especially on upper slopes, the undergrowths were damaged and somewhere natural ground cover replaced with lawns. This zone is mostly preferred by picnic users and it needs to be controlled and planning for short time usage will be promoted.

ZONE 4.1.The Istanbul Municipality, Chapter of Parks and Gardens Management Building and greenhouses that serve the plant requirements for the grove are located in this zone. The greenhouses need to be improved with modern technologies and should serve as demonstration houses. The greenhouses could be transferred into educational centres that provide information about plant growing techniques and nature.

ZONE 4.2. The historical ceramic factory is located in this zone and it ought to be protected and renovated. The existing sale pavilions should also be supported and improved for continuity.

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Recreation in Urban Forests: Monitoring Specific User Groups and Identifying their Needs with Video and GIS-support

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Abstract: In the urban forest of Stuttgart the forest roads are used by a growing number of people looking for recreation for their leisure activities. To manage and channel the different user groups within an optimized forest road network needs a lot of information: Number and composition of visitors, demands of different user groups concerning standard of roads and trails they use for their activities, conflicts that may rise between different users using the same road at the same time, dedication of roads to special activities (e.g. fitness trail, hiking trail...). Personal interviews with "experts" were made to obtain information about the specific demands of the different user groups, a new method of video monitoring was used to collect longtime information about number and composition of visitors, and analysis of road network was done with the help of GIS. The results show that these tools complement one another quite well and the combination of obtained data may help to channel visitor flows and to minimize conflicts between different user groups

INTRODUCTION

Forest roads, in former times planned and constructed for the needs of wood harvesting and transport, are the key factor for recreational access to and activities in forests. Leisure activities in urban forest include hiking, biking, horse-riding, jogging and inline-skating. The different user groups may have different demands and impacts on the roads they use for their activities and on the surrounding environment. Using the same roads at the same time may lead to increasing conflicts between the different users. Managing the increasing number of visitors in urban forests needs information about the number, composition and temporal distribution of visitors as well as a profound knowledge of their demands. These information may help to channel visitor flows and to minimize conflicts between users by establishing roads that meet the special requirements of the different user groups.

This paper discusses some methodical aspects and results of an investigation dealing with the analysis and optimization of a multiple use forest road network in the urban forest of Stuttgart (v. Janowsky, 2001). This forest is managed as a multifunctional forest. The objectives are to produce wood for industrial use in an efficient and sustainable way, and to provide opportunities for all kind of recreational activities and outdoor use for the more than 500,000 inhabitants of the town and the region. The objective of this study is to derive an optimized forest road network that meets the requirements of forest management as well as the needs of recreation and outdoor use most effectively. Compared to the status quo, this optimized forest road network should also be characterized by lower maintenance costs and reduced impact on the forest ecosystem. For analyzing the status quo as basis of further optimization the following methodical tools were used (see also fig. 1):

- Video monitoring
- Personal interviews
- Geographic Information Systems (GIS)

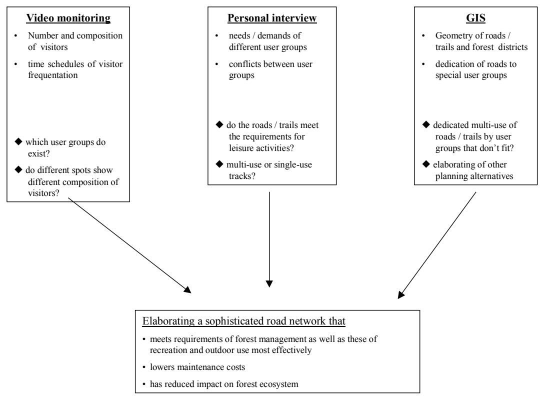

Figure 1: Methodical tools for optimization of multi-use forest network

METHODS

Collecting data about number, composition and time schedules of visitors by video monitoring

Some areas of the urban forest of Stuttgart show a heavy frequentation by the city-dwellers, but up to now actual and exact numbers of long-range studies do not exist. In former counts around Stuttgart visitors were counted only on single days by a couple of people (e.g. school classes) standing at different points - mostly entrances – in the forest. Because of the serious disadvantages of that method – high manpower resulting in data for only a few days that can’t be extended for a longer period– a new method was developed and tested: an automatic video-supported long-range study of visitor number and composition.

This method should fulfil the following technical requirements:

- limited need for service
- no waste of videotapes by recording at times when nobody comes by
- enclosed information about date and time of recording
- no personal related information as faces or number plates of cars
- small and inconspicuous camera for outdoor use (i.e. water resistant and shockproof) that can be fastened easily at different points

Based on these preconditions a system of several electronic components was composed: A water resistant case contains the hen’s egg sized camera and a radio transmitter. Operation power of the camera is ensured by a car battery. The camera sends a radio signal to the receiver which is attached to a movement registering sensor. A signal of this sensor activates the recording control station and the video recorder starts recording for a defined period of time (5 seconds). A time-date generator inserts time and date of the recording. Collecting of personal information is excluded by the focal length of the camera.

By this setting continuing recordings up to one week without need for change of videotape become possible. The necessary service and control measures is limited to check the operation of the system and the regularly change of car battery (once a week) and videotapes (depending on frequentation every 2 to 6 days).

The recording unit is not powered by battery, it has to be connected to the electricity mains. This limits the position of the recording set and so the camera can only be installed at spots within a distance up to 50 meters (range of radio signal) to electric cables.

In this research two such camera systems were posted at four different spots. One camera should provide data for a long-range study and therefor stayed at the same spot for one year, while the other camera was set up at three different spots for shorter times (6 weeks to 3 months).

Personal interviews to identify the needs of specific user groups and conflicts between them

Based on the video recording data and on discussion with the local forest management, following user groups could be identified:

- “traditional” cyclists
- mountain-bike-cyclists
- jogger (using fitness trails as well as normal roads and trails)
- walkers
- hiker
- horse-rider
- forest operations

For forest roads which are constructed and used for the purpose of forest operations as wood harvesting and transport, precise standards for technical design are established. Similar standards for recreation trails are lacking in most cases. To obtain a better knowledge and understanding of the demands of the different user groups and the conflicts that may arise between them using the same roads and trails at the same time for their activities, personal interviews with a panel of experts were made. Because of their specific experience these experts represent the opinion and express the demands of many other people of their user group (Atteslander & Bender, 1993). A total number of 13 experts were chosen, for example leader of jogging groups or riding schools and other representatives and stake holders.

The oral interviews based on a written questionnaire which served as a guideline. The questions are open questions, that means they have no fixed categories for answering but the asked person may articulate her point of view oneself. The order of the questions depends on the course of the interview, often some of the planned questions don’t have to be asked expressively, because the answers were already given before.

Regarding the content, the interview guideline is structured in three parts. The first part is dealing with general questions about the position of the interviewed person, about the type and size of the user group he represents and about the frequency and time of activities in the urban forest of Stuttgart. The second part contains the questions about recreation road standard and road density, and the third part deals with possibilities and limitations of overlapping use of different user groups.

Interviews lasted about 90 minutes each and were documented by notes during the interview that were worked out to a detailed protocol afterwards.

Use of GIS for visualisation of roads and trails

The visualisation and analysis of the overlapping use of the roads and trails by the different user groups can be done most effectively by the use of Geographic Information Systems.

Geometry of roads, trails and forest districts was digitized in the Software package ArcView 3.2. For roads and trails information about their length, type (logging road=1, skidding trail=2, footpath=3) and their dedication to recreational activities were added.

Additionally, the forest roads which are necessary for wood harvesting and transport were marked as dedication to logging.

Each dedication to a special activity was saved in a single column of the database (see table 1). This data structure makes it much easier to locate road segments with high potential for conflicts, because every combination of the different activities can be used for a query.

type	length	hike	bike	ride	fitness	edu-cation	log-ging
1	124.7	y	n	y	n	n	Y
2	256.1	n	y	y	n	n	n
1	189.7	y	y	n	n	n	n
3	45.8	y	n	n	y	y	n

Table 1: Example for attribute table of feature theme "roads".

RESULTS

Video monitoring

The results presented in this paper do primarily refer to technical / methodical aspects of the video surveillance. For a close look at the results of the statistical analysis of the data see Mutz et al. (2001).

The used method of video monitoring enables management of recreational areas to count visitors over a long period of time with limited input of manpower and costs. Statistical analysis of this data shows cyclical patterns and determinants of visitor behavior that may serve as an input for statistical simulation of visitor flow (Mutz et al, 2001).

Although the main methodical requirements pointed out above are fulfilled, the method still has some disadvantages and weak points that should be mentioned and discussed in the following:

To ensure a continuous operation with low failure times of the system in outdoor use the single components of the system have to be coordinated very well. Failure times may be caused by technical reasons (functional disorder of video camera or connected components) or by delayed change of video tapes or battery. The ratio between days without any failure times and total number of recording days varies at the different spots between 28 % and 80 %. The lowest availability value of 28 % is probably caused by interference to the radio signal at this special location. Frequent monitoring of the video tapes during the first days of recording may show such problems early.

While the data capture on video tapes can be done automatically and therefore is very easy, the analysis of the tapes requires a lot of time. Automatic movement / picture analysis seems to be possible but has not been applied until now. Visual analysis takes – depending on the frequency of use of the roads – between 18 and 210 minutes per recording day (daily recording times from 6 a.m. to 10 p.m.). A simplification of visual analysis was tried by determining the number of movements that trigger recording by the parameters recording time per day and time of a single record (5 seconds). The number of events can be calculated this way, but unfortunately, this leads to a significant loss of information: the object that triggered recording can't be identified. It could have been a single person as well as a group of people of two or more persons or a logging truck. Recording can also be triggered by the change of light and shadow (e.g. caused by wind moving twigs) because the movement registering sensors react on differences in brightness. This loss of qualitative information makes it impossible to differentiate the user groups and to make statements about the exact number of visitors. So that kind of simplification of data analysis had to be dropped.

Because of the geomorphology of the forests of Stuttgart, a statistical valid sampling of all visitors of a given area over time requires a systematic counting at many spots.

Caused by

- the recording unit's dependeny on electricity mains, which makes only a limited number of locations available for video surveillance
- the high costs of the recording system (5,000-7,000 DM) and
- the time consuming visual analysis of video tapes

only a few camera sets can be used at the same time. This makes the setting of a systematic sample survey for a complete registration of visitors in a defined area quite difficult or impossible.

So this kind of video monitoring is up to now suitable for correct determination of the frequentation of single roads, but it can not be used to obtain a correct spatial distribution of all visitors. Further development in technical means that ensure more independence of electricity and in analysis methods – e.g. using picture analysis software based on identification of patterns - may allow to obtain results about spatial distribution by a flexible spatial-temporal change of recording locations.

Personal interviews

The interviews were suitable to obtain precise information about standards for recreation trails and about possible conflicts between the different user groups.

	Horse-rider	Hiker	Walker	Jogger	Keep-fit trail
Road length	10-20 km	no statement	1-5 km	12-25 km	3.5-6 km
Width	> 3 m	< 2 m	> 3 m	>1.50 m, better > 3 m	> 1.50 m
Surface	reinforced for go at walk or trot, not reinforced for gallop	not reinforced	reinforced, asphalt if possible	reinforced, no asphalt	reinforced
Condition	good no soft, loamy soil	walkable	very good	good	good
Grade	in general up to 6 %, sections up to 10 %	rough terrain, no maximum gradient	flat, max. 5 %	slightly rough terrain, max. 15 % (60-80 m)	1.5 km flat, slightly rough terrain, max. 20 % (50-100 m)
Route	circular route, not along roads, motorways or tramlines	with regard to scenery, along meadows and vantage points, no roads / cars	towards vantage points or restaurants, sufficient resting benches (every 100 m), starting from parking lots		no steps, starting from parking lots, circular route, signs

	"Normal" cyclists	Mountain-bike cyclists (competitions)	Mountain-bike cyclists (leisure time)	Forest company
Road length	no statement	4.5-6 km		45 – 50 m/ha
Width	> 3 m	< 2 m	predominantly > 3 m	3.50 m
Surface	reinforced, asphalt or fine crushed gravel	max. 15 % asphalt 95 % without asphalt, natural or artificial obstacles	mostly reinforced with some not reinforced sections	reinforced, subgrade and pavement
Condition	good	no long, very muddy sections	good / passable	good
Grade	max. 6 %	no maximum gradient, difference in altitude: 130 – 140 m on the whole distance	rough terrain with different levels blue: up to 6 % red: 6-15 % black: >15%	2-8 (10) %
Route	with regard to scenery, along meadows or vantage points	circular route, Single trails have to be cut free	avoiding sensitive areas and popular hiking trails	max. opening-op effect, regarding terrain, curve radius: 50 m plain country 20 m mountainous country 12 m serpentines

Table 1: demands of different user groups

The standards for different kinds of recreation trails concerning width, surface, condition, grade and route are listed in table 2. A normal logging road is suitable for most of the leisure activities. Some logging trails and footpaths should as well be dedicated to special user groups to ensure attractiveness also for these user groups that prefer that kind of roads for their activities.

In principle a parallel use of different user groups seems to be possible at least on logging roads wider than 3m. On more narrow roads and trails the conflicts may increase. Especially mountain-bikers show a high potential for conflicts. This is mostly caused by their relatively high speed and their nearly noiseless moving resulting in sudden appearance in front of other people. Theoretically the user group of the horse-riders shows a similar potential for conflicts. Because of the legal requirements in Baden-Württemberg that limit riding on specially dedicated trails, other users can avoid this trails and so much less conflicts do arise. Quite conflict-free user groups appear to be the joggers and the walkers and hikers as long as they don't have unleaded dogs with them. Figure 2 shows the potential for conflicts between the different user groups as it is seen by the interviewed people.

with / seen from		Hiker with dog	Hiker with-out dog	Walker with dog	Walker with-out dog	Cyclists	MTB	Horse-rider	Jogger	Edu-catio	Forest company
Hiker	with dog		-	-	-	+	++	+	-	-	+
	without dog	-		-	-	+	++	+	-	-	+
Walker	with dog	-	-		-	++	+++	++	-	-	++
	without dog	-	-	-		++	+++	++	-	-	++
Cyclists		+++	-	+++	-		-	+	-	-	+
MTB		+++	-	+++	-	-		+	-	-	-
Horse-rider		++	-	++	-	++	+++		-	-	+++
Jogger		+++	-	+++	-	-	++	+++		-	+
Education		+	-	+	-	+	++	+++	-		++
Forest company		-	-	-	-	-	+	+	-	-	

+++ heavy conflicts
++ middle conflicts
+ slight conflicts
- no conflicts

Figure 2:conflicts between user groups

The personal interviews do not only result in general statements about demands and conflicts but may also address specific local problems. Furthermore, the integration of local protagonists leads to a better acceptance of management measures.

Analysis of the road network with Geographic Information Systems (GIS)

Based on the results of the interviews it is possible to locate road segments that have a high probability for conflicts. In this context not only the overlapping use of different leisure activities but also the type of the road / trail have to be taken into account. Logging roads that are usually wider than 3 m can be dedicated to different leisure activities without causing heavy conflicts, while on small footpaths multi-use dedication should be handled very carefully.

A simple query in the GIS-database may show for example all footpaths that are dedicated for riding and as fitness trail. If this multi-use is assessed as not acceptable, one of the special dedications has to be shifted to nearby roads, taking into account the demands cited by the experts in the interviews. This shifting can be done easily in the GIS by changing the attributes in the attribute table. The more information about the road sections (concerning parameters as grade, surface, etc.) are stored in the database, the better the demands of the different user groups can be met.

CONCLUSIONS AND OUTLOOK

The use of Geographic Information Systems, video monitoring and personal interviews for monitoring different user groups may be very promising because these tools can be used in combination and are complementary to each other.

The Geographic Information System contains not only the information about the location of the forest roads. Additional attribute information as a dedication to certain activities, grade of the road, width, surface, etc. enable the management to compare the actual status of the road network with the demands of the different user groups, which were articulated by the experts in the personal interviews. The more information about the roads are available, the better the requirements of the users can be met.

Improved information could be gained of the GIS by adding information about terrain, i.e. by a digital terrain model.

It was shown that dedication of roads and trails to special activities which fulfil the requirements of the specific user groups in combination with the technical design and condition of the single roads seems to be a suitable way to channel visitor flows and to minimize conflicts between different user groups.

As the interviews showed, many people avoid forest roads that don't meet their demands, so a "bad" condition of a road may be understood as an intentional instrument to keep certain types of visitors apart from this special road. A parallel dedication of roads as alternatives for the specific user groups is necessary to obtain this effect. As results from other investigations (Wöhrstein, 1998) and experiences with new dedicated mountain-bike routes show, a dedication of suitable roads to a special activity leads to decreasing conflicts.

A further development of the methodology of video surveillance in the direction pointed above resulting in the possibility to obtain statistically valid data of spatial distribution of visitors in time may link the results of this surveillance with the GIS. The spatial distribution of the visitors could then be visualized and analyzed in the GIS.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Recreational Forest Management: Sustainably Protecting and Improving the Recreational Function of the Vienna Woods

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The City of Vienna stretches from 16°11'13" to 16°34'43" Eastern longitude, and from 48°07'06" to 48°19'23" Northern latitude, covering a territory of 41,495 hectares. At an altitude of 150 to 580 metres above sea level, Vienna is traversed by the Danube river for a length of over 20 km.

URBAN TERRITORY BROKEN DOWN BY UTILISATION

Population (2000): 1,615,500.

Today, Vienna is an environmental model town that offers its people a high quality of living, thanks to its location on the eastern fringe of an extensive forest range known as the Vienna Woods.

VIENNA WOODS

Geographical extension

- More than 135,000 hectares to the west of Vienna (only a small part 6 % is located on actual Viennese territory).

Geology

- 52% of the region Vienna Woods is covered by forest.
- Two rock types can be distinguished:

Flysch (sandstone):

- Extends over most of the Vienna Woods in the northern and western parts.
- Marl, clay slate and sandstone, heavy and deep soil.
- Gently rolling hills with elevations of not more than 500 metres.
- Terraces descending towards Vienna, characterised by the deposits and erosions of the Danube.
- Vegetation: Deciduous forest (oak & hornbeam, beech & fir, red beech).

Limestone:

- In the south.
- Limestone or dolomite rock, dry, oligotrophic soil.
- Precipitous rock faces, hills with elevations of up to 900 metres.
- Prominent timber: Austrian pine (Pinus nigra; planted in the 18th and 19th century to obtain resin).
- Vegetation: Austrian pine & hornbeam, Austrian pine & beech, downy oak, sessile oak & hornbeam, red beach.

Climate

- Western part: Atlantic climate (precipitation: c. 1000 mm, cool summers).
- Eastern part: continental climate (precipitation up to 600 mm, hot summers).

CITY OF VIENNA FOREST MANAGEMENT

One fifth of the areas managed by the Municipal Department 49 (Forestry Office) of the City of Vienna is located within the conurbation (8,230 hectares of mostly forested areas).

- Management of the city forests.
- Ongoing participation in urban development, by planning, designing and maintaining attractive green spaces.
- Preservation and maintenance of recreational areas and facilities (hiking paths, benches, grill spots, cycling and walking paths, etc.) in Vienna.
- Afforestation for the public benefit.
- Maintenance and preservation of meadows.
- Layout of ecological zones and wind screens.
- Information for forest visitors.
- Maintenance of paths and roads in the Forestry Office’s administrative territory.
- Upkeep of the buildings of the Forestry Office.
- Activities to control game population.
- Timber sale.

	hectares	percent
Building space	13,600	33
Green space	20,250	49
of which:		
forest	7,840	18
agriculturally used	6,800	16
parkland	1,620	4
meadows	2,290	5
private gardens	1,270	3
sports grounds	770	2
Water	1,930	4
Traffic space	5,700	14
Total	41,495	100

OWNERSHIP STRUCTURE

Most of the forests in Vienna (about 72%) are owned by the Municipality. The Austrian Federal Forests hold about 13%; church forests make up some 8%, and about 5% are in private hands and in the hands of the Federal Republic of Austria.

URBAN FOREST MANAGEMENT

The forests of Vienna are the "green lung" of the city, an ecological compensation and important recreational space for the population of Vienna. Measures taken in and for the recreational forests aim to preserve and improve existing forest stands, based on the following principles:

- no clear felling, only spot clearing;
- regeneration through seeding by the trees;
- rare tree species of ecological value (e.g. Sorbus torminalis, Sorbus domestica) are encouraged;
- space set aside for special habitats (wetlands, dry meadows and grasslands);
- ban on chemicals (artificial fertilisers, herbicides, insecticides);
- visitor flows are directed to suitable paths and recreational facilities to protect ecologically valuable forests;
- old forest stands, trees and deadwood are not removed unless they constitute a danger to visitors;
- natural forest reserves are set up in near-nature forests.

Recreational facilities: Suitable recreational infrastructure needs to be provided for the hikers and strollers. The Forestry Office cares for more than 50 playgrounds in the forests and adjoining open spaces, large picnic meadows, three observation towers, five grill spots, several thousands of benches, garbage bins, signposts, information signs and two animal enclosures.

The newly popular sports of running, mountain biking and walking have conquered the forests, and runners and walkers can use the extensive network of paths without friction. For the mountain bikers, separate cycling paths, which quickly get them from the more urban parts of the forests to the quieter sections of the Vienna Woods, had to be laid out in the forests to avoid conflict with other users. The network of cycling paths was developed jointly with the Province of Lower Austria, the Austrian Federal Forests and the neighbouring communities in 1998.

Nature protection: Vienna owns more than 2,800 hectares of national park, of which more than 2,500 hectares are set aside as a nature reserve within the boundaries of Vienna. The other parts of the Vienna Woods and the vineyards are mostly dedicated as protected areas. Nature protection in Vienna nevertheless is not limited to areas specifically designated for protection, but encompasses all habitats including those in the core of the city, and it spans efforts to raise awareness of the concept in the population.

Soil protection: The City of Vienna has planted more than 50 km of wind breaks within the territory of Vienna to shelter agricultural land, which are managed by the Forestry Office of the Municipal Department 49. By introducing these screens, an additional valuable component has been created in an urban environment which offers recreational space next to residential areas.

Timbering is fostered by the rigorous implementation of a concept to regenerate near-nature forest stands. Utility forests make up 7,800 hectares in Vienna, producing a timber stock of 311 cubic metres per hectare, an annual growth of 6.3 cubic metres per hectare and an annual utilisation of 3.8 cubic metres per hectare. Some near-nature stands (about 160 hectares in Vienna) are completely banned from timbering due to their scientific importance of being a natural forest reserve.

VIENNA WOODS MANAGEMENT – FOCUS ON RECREATIONAL FUNCTIONS

Recreational areas in the immediate vicinity of a conurbation such as Vienna are expected to cover a number of requirements. Forests and open spaces contribute more than their share in terms of recreation, supply of fresh air and protection of habitats. In view of the large number of (potential) users, it is necessary to identify and allocate individual interests while at the same time ensuring that the forests and green areas can still function as a high-quality recreational space, suppliers of fresh air, air filters and water reservoirs.

In terms of managing urban recreational areas, be they in Budapest, Vienna, Athens or elsewhere, similar approaches are used. An international comparison can analyse various strategies, from which solutions can be adapted for other regions.

In order to evaluate the current use of recreational forests in Vienna, a survey and analysis was made of their condition and infrastructure(100 square kilometres

New offers of infrastructure and information are developed from suggestions and requests made by visitors through direct contacts or surveys. In addition, emerging conflicts may call for the need to find particular solutions. Rapid action is required in such cases and experience from other urban forests can be put to good use.

The findings obtained from this urban forest analysis and comparison between cities are intended to facilitate harmonious (conflict-free) utilisation of recreational forests and to explore further ways and means to utilise unused potentials. Special attention is being given to target-group specific information programmes and timely educational efforts.

EDUCATIONAL FACILITIES OFFERED BY THE FOREST OFFICE OF THE MUNICIPAL DEPARTMENT 49: APPRECIATION IS THE FIRST STEP TOWARDS PROTECTING OUR NATURAL ENVIRONMENT

Forest school: experience the forest with all your senses

The Vienna forest school offers school children an opportunity to relate to nature by using their senses. Opened in 1998, it welcomes more than 5,000 children per year, who, from 9 am to 4 pm on a "forest day", learn to feel trees, taste plants, smell soil, hear animals and open their eyes to discover their surrounding by experiencing nature with all their senses. They obtain their information directly from the forest ranger who is the epitome of a person of acknowledged environmental competence. http://www.wien.gv.at/ma49/

The Lainz game preserve is a nature preserve of some 2,500 hectares in size which counts more than half a million visitors a year. One of its major attractions is the Hermesvilla once used by Empress Elisabeth and now the site of art exhibitions. In spring 2000, a visitor information centre was built at the main entrance to the preserve, which offers basic insights into this natural habitat. The preserve organises guided tours for groups specialising in a number of subjects, as well as guided forest tours for school classes and groups.

Nature trails: learning under the open sky

The Vienna Forest Office has laid out nature trails and "forest classrooms" in all forests of the city to furnish nature heritage information that can be freely used by all comers at all times or alternatively included specifically in a half-day guided tour with the forest ranger.

National Park: a pristine forest at the boundaries of a capital city

In addition to the Vienna Woods, the City of Vienna can also boast of its riverine forests along the Danube to add to its green spaces. These forests became part of the Donauauen National Park in 1996. In view of its great potential as a nature preserve, the National Park features a number of visitor attractions, such as a boat trip from the centre of the city to the Park, followed by a guided tour. Green Tours – a walking experience in the National Park.

National Park camp: a school under the stars

As the owner of the National Park, the Vienna Forest Office opened a youth camp at the edge of the National Park in early 2000, organising camp stays for children and youths for several weeks. During school holidays, the camp is also open to family and youth groups.

With ever changing and growing demands and focal points of environmental interest, the Municipality is constantly faced with new challenges in identifying targets and objectives in environmental education. In order to respond to new trends in the public interest in the environment, concepts are already being developed for new ecological education programmes.

SUMMARY

Management of urban recreational forests

Forests located in the vicinity of cities should cover a number of requirements: they must offer a great variety of complex services, such as supplying fresh air, meeting recreational needs and protecting habitats. Considering that many different interests are involved in the use of forests, it is imperative to prioritise conflicting interests and to ensure that the forest's main functions as a supplier of fresh air, air filter and water storage medium will not be impaired in their quality.

Regarding the size and geographical distribution of forests and their usefulness, Vienna and Budapest show quite similar forest structures. The Natural Resources Project, which focuses on the afforestation of patches in the Pannonian region with a sparse wood cover, offers an opportunity to compare conflict solving strategies at an international level, and thus to address principles of recreational forest management in urban environments. The Management of Recreational Forests includes an analysis of how the recreational potential is utilised, a study of the network of forest paths, information facilities and transport systems. The conflict analysis will be used in the

management plan to identify parameters of relevance to the recreational value of forests.

The findings will facilitate conflict-free utilisation of forests and identify potential usage gaps. Conflict resolution will also be helped by information and awareness-raising programmes as well as efforts to educate children and young people on the benefits of forests.

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How Much is Too Much? Carrying Capacity of National Parks and Protected Areas

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Abstract: Increasing recreational use of national parks and protected areas can impact natural and cultural resources and the quality of the visitor experience. Determining how much recreational use can ultimately be accommodated in a park or protected area is often addressed through the concept of carrying capacity. Contemporary approaches to carrying capacity – including the Visitor Experience and Resource Protection (VERP) framework developed by the U.S. National Park Service – rely on formulation of indicators and standards of quality of natural/cultural resources and the visitor experience. This paper describes the VERP framework and its application in the U.S. national park system, including a program of research designed to help formulate indicators and standards of quality.

INTRODUCTION

As the name suggests, national parks are resources of national and, increasingly, international significance. The United States national park system, for example, contains natural and cultural resources of great importance to the nation, and in many cases, the international community. Given the significance of this resource base, public demand to see and experience these areas should not be surprising. And data on national park visitation in the U.S. dramatically support this premise: the national park system now accommodates nearly 300 million visits annually.

The increasing popularity of national parks presents both an opportunity and challenge. The opportunity is to fulfill the mission of the national parks "to provide for the enjoyment of the people." The accompanying challenge, of course, is to fulfill the complementary component of the national park mission "to conserve the scenery and the natural and historic objects and the wildlife therein." This can prove difficult under conditions of high visitation.

Implicit in this dual mission of national parks is the issue of the quality of the visitor experience. The quality of visitor experiences must be maintained at a high level for national parks to contribute their full potential to society. Moreover, high-quality visitor experiences are more likely to develop public appreciation of, and support for, conservation of national park resources.

It is ironic that one of the greatest threats to national parks is commonly seen as their increasing popularity. To many observers, national parks, at least in some places and at some times, are crowded, and this detracts from the quality of the visitor experience. Moreover, natural and cultural resources can be degraded by excessive visitor use. In more formal terms, use of some national parks, or portions thereof, have exceeded their carrying capacity (Mitchell, 1994; Wilkinson, 1995).

This paper explores the theory and application of carrying capacity to national parks and related areas. Emphasis is placed on development and application of Visitor Experience and Resource Protection (VERP), a framework developed for managing carrying capacity in the U.S. national parks. The first section briefly traces the theoretical development of the carrying capacity concept. The second section describes development of the VERP framework, and the third section describes application of VERP to Arches National Park and other units of the U.S. national park system. A final section suggests that the conceptual framework underlying VERP and other contemporary approaches to carrying capacity can be applied to a variety of parks and protected areas, but that this will require a commitment to park planning, management and research.

THE CONCEPT OF CARRYING CAPACITY

The question of how much public use can ultimately be accommodated in a national park or related area is often framed in terms of carrying capacity. Indeed, much has been written about the carrying capacity of national parks. The underlying concept of carrying capacity has a rich history in the natural resource professions. In particular, it has been applied in wildlife and range management where it refers to the number of animals of any one species that can be maintained in a given habitat (Dasmann, 1964). Carrying capacity has obvious parallels and intuitive appeal in the field of park management. In fact, it was first suggested in the mid-1930s as a park management concept in the context of national parks (Sumner, 1936).

However, the first rigorous applications of carrying capacity to park management did not occur until the 1960s.

These initial scientific applications suggested that the concept was more complex in this new management context. At first, the focus was placed on the relationship between visitor use and environmental conditions. The working hypothesis was that increasing numbers of visitors causes greater environmental impact as measured by soil compaction, destruction of vegetation, and related variables. It soon became apparent, however, that there was another critical dimension of carrying capacity dealing with social aspects of the visitor experience. An early and important monograph on the application of carrying capacity to parks and related areas reported that it was:

> *"initiated with the view that carrying capacity of recreation lands could be determined primarily in terms of ecology and the deterioration of areas. However, it soon became obvious that the resource-oriented point of view must be augmented by consideration of human values." (Wagar 1964, preface)*

Wagar's point was that as more people visit a park, not only can the environmental resources of the area be affected, but so too can the quality of the visitor experience. Again, the working hypothesis was that increasing numbers of visitors cause greater social impacts as measured by crowding, conflict, and related variables. Thus, as applied to national parks, carrying capacity has two components: environmental and social.

The early work on carrying capacity has since blossomed into an extended literature on the environmental and social impacts of outdoor recreation and their application to carrying capacity (Lime & Stankey, 1971; Stankey & Lime, 1973; Graefe, et al., 1984 Manning, 1985; Shelby & Heberlein, 1986; Kuss, et al., 1990; Manning, 1999; Manning, 2000). But despite this impressive literature base, efforts to determine and apply carrying capacity to areas such as national parks have sometimes failed. The principle difficulty lies in determining how much impact, such as soil compaction and crowding, is too much. Theoretical development, backed up by empirical research, generally confirms that increasing use levels can lead to increased environmental and social impacts (Hammitt and Cole, 1998; Manning, 1999). But how much impact should be allowed in the national park? This basic question is often referred to as the "limits of acceptable change" (Lime, 1970; Frissell & Stankey, 1972). Given substantial demand for public use of national parks, some decline or change in the quality of park resources and the visitor experience appears inevitable. But how much decline or change is acceptable or appropriate before management intervention is needed? How much use and associated impacts are too much?

This issue is illustrated graphically in Figure 1. This figure addresses the social impact of crowding. In this figure, a hypothetical relationship between visitor use and crowding is shown. It is clear from this figure that visitor use and crowding are related: increasing numbers of visits cause increasing percentages of visitors to report feeling crowded. However, it is not clear at what point carrying capacity has been reached. The hypothetical relationship in Figure 1 suggests that some crowding is inevitable, given even relatively low levels of visitor use. Thus, some level of crowding must be tolerated if national parks are to remain open for public use. For the hypothetical relationship illustrated in Figure 1, X1 and X2 represent levels of visitor use that result in differing levels of crowding as defined by points Y1 and Y2, respectively. But which of these points – Y1 or Y2, or some other point along this axis – represents the maximum amount of crowding that is acceptable? Ultimately, this is a value judgment. Again, the principal difficulty in carrying capacity determination lies in deciding how much crowding (or of some other impact) is acceptable. Empirical relationships such as that in Figure 1 can be helpful in making informed decisions about carrying capacity, but they must be supplemented with management judgments.

To emphasize and further clarify this issue, some writers have suggested distinguishing between descriptive and evaluative (or prescriptive) components of carrying capacity (Shelby & Heberlein, 1984; Shelby & Heberlein, 1986). The descriptive component of carrying capacity focuses on factual, objective data such as the type of relationship in Figure 1. For example, what is the relationship between the number of visitors entering an area and the number of encounters that occur between groups of visitors? Or what is the relationship between the level of visitor use and visitor perceptions of crowding? The evaluative or prescriptive component of carrying capacity concerns the seemingly more subjective issue of how much impact or change in resource conditions and the quality of the visitor experience is acceptable. For example, how many contacts between visitor groups are appropriate? What level of perceived crowding should be allowed before management intervention is needed?

Recent experience with carrying capacity suggests that answers to the above questions can be found through development of management objectives and formulation of associated indicators and standards of quality (Stankey, et al., 1985; Stankey & Manning, 1986; Graefe, et al., 1990; Shelby, et al., 1992; Manning, 1997; Manning, 1998). This approach to carrying capacity focuses principal emphasis on defining the degree of resource protection and the type of visitor experience to be provided and maintained.

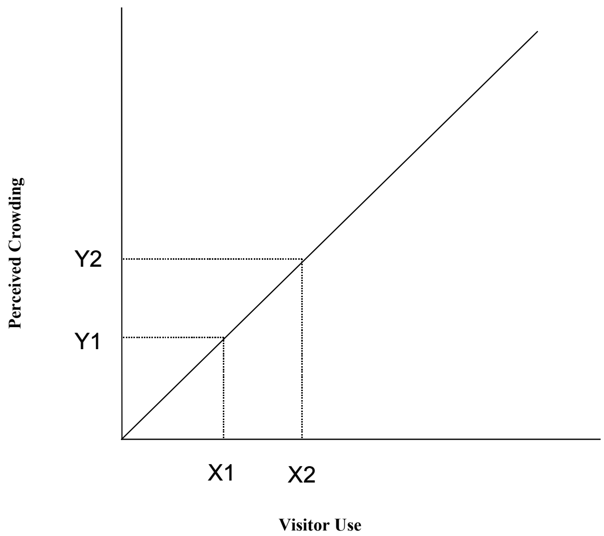

Figure 1. Hypothetical Relationship Between Visitor Use and Crowding

Management objectives are broad, narrative statements that define desired future conditions: the degree of resource protection and the type of visitor experience to be provided. They are based on review of the purpose and significance of the area under consideration. Development of management objectives may involve review of legal, policy and planning documents; consideration by an interdisciplinary planning and management team; historic precedent; local, regional, national or international context of the park; and public involvement.

Indicators of quality are more specific measurable variables that reflect the essence or meaning of management objects; they are quantifiable proxies or measures of management objectives. Indicators of quality may include elements of both the resource and social environments. *Standards of quality* define the minimum acceptable condition of indicator variables.

An example of management objectives, indicators and standards may be helpful. Review of the U.S. Wilderness Act of 1964 suggests that areas of the national park system contained in the National Wilderness Preservation System are to be managed to provide opportunities for visitor solitude. Thus, providing opportunities for solitude is an appropriate management objective and desired future condition for most wilderness areas. Moreover, research on wilderness use suggests that the number of visitors encountered along trails and at campsites is important to wilderness visitors in defining solitude. Thus, trail and camp encounters become key indicators of quality and help to make operational the general management objective of providing opportunities for solitude. Further research suggests that wilderness visitors may have standards about how many trail and camp encounters are acceptable before the quality of the visitor experience declines to an unacceptable degree (Heberlein, et al., 1986; Vaske, et al., 1986; Whittaker & Shelby 1988; Roggenbuck, et al., 1991; Shelby & Vaske, 1991; Manning, et al., 1996b; Manning, et al., 1999a; Manning, et al., 1999b). Such data may help to define standards of quality.

By defining indicators and standards of quality, carrying capacity can be determined and managed through a monitoring and management program. Indicator variables can be monitored over time and management actions taken to ensure that standards of quality are maintained. If standards have been violated, carrying capacity has been exceeded. This approach to carrying capacity is central to contemporary park and outdoor recreation planning frameworks, including Limits of Acceptable Change (LAC) (Stankey, et al., 1985), Visitor Impact Management (VIM) (Graefe, et al., 1990), and Visitor Experience and Resource Protection (VERP) (National Park Service 1997), recently developed by the U. S. National Park Service.

Visitor Experience and Resource Protection (VERP)

The U.S. National Park Service has long recognized the need to apply the concept of carrying capacity to parks that have been experiencing dramatically increasing public use. In fact, the 1978 U.S. General Authorities Act requires each park's general management plan to include "identification of and implementation commitments for carrying capacities for all areas of the unit" (U.S. Congress, 1978). Although National Park Service management policies and planning guidelines acknowledge this responsibility, historically there has been little direction or agreement on an approach or methodology for setting or managing a park's carrying capacity. Park planners and managers have often been reluctant to state that parks, or areas within parks, are receiving inappropriate or excessive use because they have lacked the rationale and empirical data to make such determinations.

Element

Framework Foundation

1. Assemble an Interdisciplinary Project Team
2. Develop a Public Involvement Strategy
3. Develop Statements of Park Purpose, Significance, and Primary Interpretive Themes

Analysis

4. Analyze Park Resources and Existing Visitor Use

Prescriptions

5. Describe a Potential Range of Visitor Experiences and Resource Conditions (Potential Prescriptive Zones)
6. Allocate the Potential Zones to Specific Locations in the Park (Prescriptive Management Zoning)
7. Select Indicators and Specify Standards for Each Zone; Develop a Monitoring Plan

Monitoring and Management

8. Monitor Resource and Social Indicators
9. Take Management Action

Figure 2. Elements of the Visitor Experience and Resource Protection (VERP) Framework

In the early 1990s an interdisciplinary team of National Park Service planners, managers, and researchers began developing a framework to identify and manage carrying capacity in the national park system. Called Visitor Experience and Resource Protection (VERP), this framework includes nine steps or elements (outlined in Figure 2), and is described in a recently developed handbook (National Park Service 1997). In keeping with the theoretical and historical development of carrying capacity as described in the previous section, VERP focuses on formulating indicators and standards of quality for desired future conditions of park resources and visitor experiences. A program to monitor indicator variables is then designed, and management actions are undertaken to ensure that standards of quality are maintained.

APPLICATION OF VERP

The VERP framework described above was initially applied at Arches National Park, Utah, USA (Hof, et al., 1994; Manning, et al., 1995; Manning, et al., 1996a; Belnap, 1998; Manning, 2001). The purpose of this application was to refine the VERP framework and provide a model for the rest of the national park system. Planning and research aimed at formulating indicators and standards of quality for the visitor experience are described in this section. Complimentary research addressed indicators and standards of quality for natural resource conditions such as soil disturbance and compaction and destruction of vegetation (National Park Service, 1995; Belnap, 1998).

Arches National Park comprises 73,000 acres of high-elevation desert with outstanding slick rock formations, including nearly 2,000 sandstone arches. Many of the park's scenic attractions are readily accessible through a well-developed road and trail system. Visitation to Arches has been increasing rapidly, and the park now receives over three-quarters of a million visits annually.

Following the VERP framework, an interdisciplinary project team was created, comprised of planners from the National Park Service's Denver Service Center, Arches National Park staff, and NPS scientists and consultants (Element 1), and a public involvement strategy was developed (Element 2). Workshops were conducted to develop statements of park purposes, significance and primary interpretive themes (Element 3). Authorizing legislation and the current General Management Plan provided important reference sources. Park resources and existing visitor experiences were then mapped (Element 4) and a spectrum of desired resource and social conditions was constructed using a matrix format (Element 5). Based on this analysis, a system of nine zones ranging from developed to primitive was created and overlaid on the park (Element 6).

Element 7 requires selecting indicators of quality and specifying associated standards of quality for each zone. This required a research program that was conducted in two phases. Phase I was aimed at identifying potential indicators of quality (Manning, et al. 1992). Personal interviews were conducted with visitors throughout the park. In addition, focus group sessions were held with park visitors, park staff, and local community residents. Findings from Phase I research suggested several social and environmental indicators of quality for the park, including the number of people at frontcountry attraction sites and along trails, the number of visitor groups encountered along backcountry trails and at campsites, the number of vehicles encountered along roads, the number of social trails and associated soil and vegetation impacts, the level of trail development, and visitor knowledge of regulations regarding off-trail hiking.

Phase II of the research program was designed to gather data to help set associated standards of quality (Lime, et al., 1994). A survey of park visitors was conducted, covering all nine park zones. The survey was administered to representative sample of over 1,500 park visitors by means of both personal interviews and mail-back questionnaires. Five indicator variables received special attention: 1) the number of people at one time at major frontcountry attraction sites, 2) the number of people at one time along frontcountry trails, 3) the amount of environmental impact caused to soil and vegetation by off-trail hiking, 4) the number of visitor groups encountered along backcountry trails and at campsites, and 5) the number of vehicles encountered along unpaved roads. The first three of these variables were addressed by a series of photographs that illustrated a range of impact conditions (Manning, et al., 1996b). Photographs were developed using a computer-based image capture technology (Chenoweth, 1990; Lime, 1990; Nassauer, 1990; Pitt, 1990). Base photographs of park sites were taken, and these images were then modified to present a range of impact conditions (e.g., number of visitors present, amount of environmental impact). A set of 16 photographs was developed for each major attraction site and trail, presenting a wide-ranging number of visitors present. Representative examples of photographs for Delicate Arch are shown in Figure 3. An analogous set of photographs was developed for a range of environmental impacts caused by off-trail hiking. Respondents rated the acceptability of each photograph on a scale of –4 (very unacceptable) to +4 (very acceptable). Questions regarding encounters in the backcountry and along unpaved roads were asked in a more conventional narrative and numeric format.

Earlier in this paper, it was noted that park visitors may have standards (or norms) for judging the appropriateness of park conditions. Methodological techniques have been developed and refined to measure such norms of park visitors (Manning, 1985; Heberlein, et al., 1986; Shelby & Heberlein, 1986; Vaske, et al., 1986; Whittaker & Shelby, 1988; Shelby, et al., 1992; Manning, et al., 1999a; Manning, et al., 1999b). The research program at Arches National Park was based on these techniques. Findings from Phase II research provided data to help formulate standards of quality for each of the nine park zones. Where appropriate, at least one resource and social indicator of quality was chosen for each zone and standards of quality were set for each indicator variable. For example, the “pedestrian” zone of the park contains several of the most prominent attraction sites in the park, including Delicate Arch. Visitors reported that the number of people at any one time at such attraction sites was important in determining the quality of their experiences. Thus, the number of people at one time (PAOT) at Delicate Arch was selected as an indicator of quality for that zone. Moreover, findings from the series of 16 photographs of Delicate Arch (as shown in Figure 4) suggested that visitors generally find up to 30 PAOT to be acceptable. (It can be seen from the figure that the line tracing visitor evaluations of the 16 photographs crosses from the acceptable range into the unacceptable range at about 30 PAOT). Based on these findings, 30 PAOT was selected as the standard of quality. Indicators and standards of quality were set for all zones in a similar manner. A companion set of resource-based indicators and standards of quality was formulated based on a program of ecological research (National Park Service, 1995; Belnap, 1998).

A monitoring program focused on indicators of quality has been designed and is now being implemented in the park. This will allow park staff to address Elements 8 and 9 of the VERP framework. This monitoring program will determine the extent to which standards of quality are maintained. The VERP framework requires management action if standards of quality have been, or are in danger of being, violated. Primary management actions being undertaken at Arches include adjusting the size of trailhead parking lots, issuing backcountry camping permits, and educating visitors about the impacts of off-trail hiking.

Computer simulation modeling of recreational use can be employed as a substitute or complement to monitoring. Such models can be developed to estimate PAOT at attraction sites, the number of encounters between recreational groups along trails, or other indicators of quality. Moreover, such models can estimate the maximum number of visitors that can be accommodated within a park or protected area without violating standards of quality. A computer simulation model of recreational use was developed for Arches National Park and was used to estimate the maximum number of vehicles per day that could enter the park without violating the standard of quality of 30 PAOT at Delicate Arch. Development and use of this model is described by Manning et al. in a companion paper in this proceedings.

Following its initial application at Arches, VERP has been applied at a number and variety of areas contained in the national park system. A concerted effort has been made to address the diversity of environments and issues within the national park system. For example, indicators and

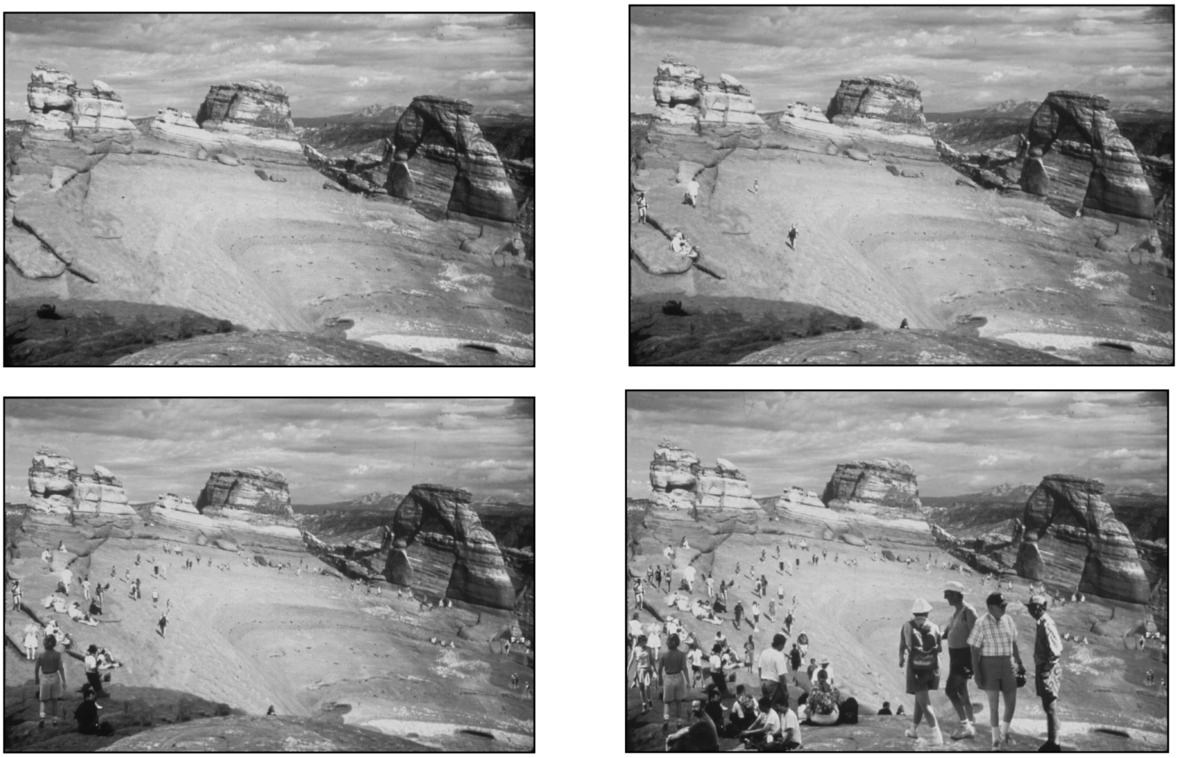

Figure 3. Representative Photographs of Delicate Arch Showing a Range of Visitor Use Levels

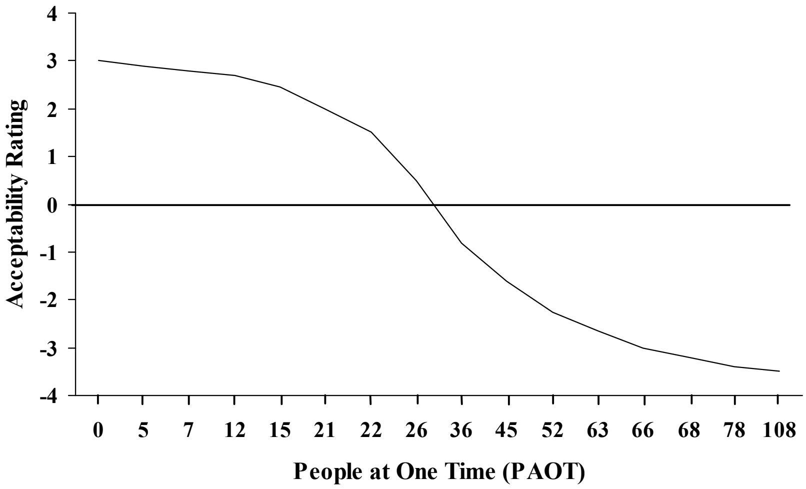

Figure 4. Visitor Evaluations of 16 Photographs of Delicate Arch Showing Alternative Levels of Visitor Use

standards of quality have been established for both crowding and conflict on the carriage roads of Acadia National Park (Jacobi, et al., 1996; Manning, et al., 1997; Manning, et al., 1998; Jacobi & Manning, 1999; Manning, et al., 1999b). These indicators and standards of quality address both the number of visitors using the carriage roads and visitor behavior. The carrying capacity of this system of multi-use trails has been estimated using a computer simulation model of carriage road use (Wang & Manning, 1998).

Application of VERP to Alcatraz Island, a unit of Gloden Gate National Recreation Area, found the number of people at one time in the prison cellhouse to be an important indicator of quality, and research findings provided a basis for setting an appropriate standard of quality at this key site. Other applications of VERP have addressed maximum waiting times at Statue of Liberty National Monument, persons per viewscape on trails at Grand Canyon National Park, the number of boats seen on the Colorado and Green River in Canyonlands National Park, the number of snowmobiles encountered in Yellowstone National Park, and the number of people at one time along trails and at attraction sites in Yosemite National Park.

CONCLUSION

Over 30 years of research and experience has led to development of several frameworks for analyzing and managing the carrying capacity of parks and related areas. All of these carrying capacity frameworks rely on a similar series of steps or elements. VERP is specifically designed to identify and manage carrying capacity in the U.S. national park system. Carrying capacity is managed by defining desired resource and social conditions by means of a series of indicators and standards of quality. Indicator variables are monitored over time to ensure that standards of quality are maintained. If standards of quality are violated, the VERP process requires that management action be taken.

VERP provides a theoretically sound and rational process for determining and managing carrying capacity in national parks and related areas. It provides a structured framework within which to conduct a systematic, thoughtful, traceable, and defensible carrying capacity analysis. An associated research program can provide a strong empirical foundation for applying the VERP framework.

VERP has been applied in a number of units of the U.S. national park system. These applications have resulted in development and implementation of carrying capacity plans for these areas, the first such carrying capacity plans in the U.S. national park system (e.g., National Park Service, 1995; Jacobi & Manning, 1997). A VERP handbook has been developed (National Park Service, 1997) along with a workbook of management actions designed to support the VERP framework (Anderson, et al., 1998). Additional applications of VERP in the national park system are on-going or planned.

Despite development, testing and refinement of VERP and related carrying capacity frameworks, application across the U.S. national park system and related areas will be challenging. The number and diversity of parks suggests that a wide variety of indicators and standards of quality will have to be formulated. This will require a substantial investment in park planning and related natural and social science research. It will also require a long-term program of park monitoring and a commitment to implementing management actions designed to maintain standards of quality.

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Managing Commercial Recreation on Crown Land: The Commercial Recreation Transition Plan for the Sea to Sky Corridor, BC

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Abstract: Monitoring and management of visitor flows in parks and recreational areas has traditionally focused on public recreation. However, there is a growing need to find management tools to address commercial operations as well as public recreation, and to manage activities outside of protected areas as well as within them. The implementation of a program to manage previously unregulated commercial recreation operations in the Sea to Sky Corridor, north of Whistler, British Columbia is described. It is argued that commercial recreation (CR) is not only different in kind from public recreation, but also offers significantly different challenges and opportunities with respect to visitor management.

INTRODUCTION

While a great deal of work has been devoted to developing management tools for public recreation in protected areas, rather less attention has been given to recreation that takes place outside of a formal protected or recreation area, or to recreation organised on a fee-for-service basis. In the case of the Sea to Sky area, north of Vancouver, British Columbia, a pressing need arose to develop a management framework for the rapidly developing commercial recreation industry.

However, as a result of a number of management challenges, the route taken to develop and apply a management framework was in many ways different from the standard models used for public recreation in protected areas. The focus of this paper on the implementation of a program to monitor and manage commercial recreation activities outside of a formal protected areas is therefore likely to form a contrast with many of the other case studies presented at the conference. It is hoped that this will prove valuable, for the following reasons:

- As networks of protected areas approach completion in many countries, there is a growing need to find ways to manage recreation outside of those networks, to better protect both environmental and experiential values.
- Commercial recreation outside of a protected area can nonetheless have considerable impacts on an adjacent protected areas, so management activities outside the park will likely also have an impact on the park.
- Commercial recreation inside protected areas is also increasing in many countries, reflecting both trends towards finding non-tax revenues to support park management, as well as demands from business and local communities for economic benefits from protected areas. Lessons learned from management programs outside of protected areas may prove useful for similar programs implemented inside protected areas.
- The demand for economic diversification in remote areas is increasing the need for models for the development and support of resource-based tourism, along with the need for management tools to protect the resource base it ultimately depends on.

LOCATION

The Sea to Sky Corridor in its strictest definition refers to a transport corridor running north from Vancouver through Squamish, Whistler and Pemberton in BC's Coast Mountains, a distance of approximately 120 kilometres. In the initial stages of planning for commercial recreation, this definition was expanded to include terrain extending some 50 kilometres west of the railroad and highway, and a narrower strip to the east of the valley bottom abutting the 200,000 hectare Garibaldi Provincial Park.

In later stages of CR planning, however, the area was further extended to include all Crown (public) land except parks in 100,000,000 hectare Squamish Forest District. In a practical sense, therefore, the Sea to Sky area has simply become an alternative term for the Squamish Forest District.

CONFLICT IN THE CORRIDOR

Tourism and recreation have developed rapidly in the Sea to Sky area, as a result of three main pressures. First is Whistler's continued growth as a ski resort and more recently as a four-season resort. Second is the continuing growth of tourism to the city of Vancouver, which includes its role a major hub for the Northwest Coast's cruise ship industry. Finally is the growing pressure from residents of the Lower Mainland, and increasingly also from north-western Washington State, for wilderness recreation opportunities.

As defined by the Commercial Recreation on Crown Land policy from which the Commercial Recreation Strategy was developed, commercial recreation includes 'all forms of outdoor recreation activities ... on provincial Crown land ... on a fee-for-service basis'. The policy implies that water-based activities on both tidal and freshwater should be included in the definition[1], and also spells out that commercial hunting and fishing should be included. In practise, the most useful element of the definition was 'guided services', which helped distinguish the types of operation that need and need not apply for tenure under the policy.

The commercial recreation industry in the Squamish Forest District is very diverse, and this diversity was naturally reflected in the mix of operators applying for tenure under the program. However, since many operators offer a range of different recreational activities, it is not possible to simply list the number of operations in each category. Instead, table 1 is intended to give a flavour of the range of activities offered.

Finally with respect to defining the nature and scope of the commercial recreation industry in the study area, it should be noted that while commercial alpine ('downhill') skiing is in many ways the basis for the area's international popularity as a recreation area, it is not itself covered by the CR on Crown Land policy. Instead, that sector is covered by the Commercial Alpine Ski Policy, once again administered by the Land Management division of BC Assets and Land Corporation.

Table 2 summarizes some of the main conflicts apparent in the Sea to Sky Corridor prior to the implementation of the Transition Plan. These include the frequently reported conflicts between conservation and recreation goals, and conflicts between different user groups.

CR Conflicts in the Sea to Sky area
Conservation goals (environmental carrying capacity)
'Wilderness' versus mechanized users, and commercial versus public users
Degradation of the 'Whistler experience' (social carrying capacity)
Impacts on adjacent protected areas, including helicopter overflights and increased access
Overlapping operations, both for existing tenures and for new applicants
Protecting First Nations interests in the absence of treaty agreements

Table 2: Commercial recreation conflicts in the Sea to Sky Corridor

Conflicts more particular to the Sea to Sky Corridor include commercial pressures for increased development and the need to protect the resource base ultimately behind Whistler's exceptional success as an international destination, and the different land-use values for the Crown land inside and outside of Garibaldi Provincial Park, which lies to the east of the transport routes along most of the corridor. Conflicts between unresolved First Nations claims to the land base and provincial development strategies also continue to be a feature of most backcountry developments in British Columbia.

MANAGEMENT CHALLENGES

In developing a management approach to the conflicts outlined above, a number of challenges were apparent. Many of these are particular to British Columbia, but the lessons learnt in implementing the program may nonetheless prove useful in other areas.

Absence of a planning framework

The Commercial Recreation on Crown Land policy covers only with lands outside of protected areas. Therefore, the integration of commercial recreation planning into broader parks management plans was not an option. Furthermore, while many areas of British Columbia have been the subject of Land and Resources Management Plan (LRMP) processes, providing a master plan for subsequent development, the LRMP for the Squamish Forest District is only now starting and may take several years to complete.

Jurisdictional complexity

While the land in the study area is almost entirely Crown (public) land, it is not exclusively administered by any one agency. Table 3 shows

Previous CR policies

Further complications arose due to the fact that several attempts had been made in the past to implement management regimes.

Pre-existing CR operations

Finally, a fundamental challenge for the Sea to Sky Commercial Recreation Strategy was the pre-existing base of CR operations. Land managers were not working from a 'clean slate', and it was not politically acceptable to close operations and ask them to apply over again.

[1] The term 'Crown land covered by saltwater and freshwater' is used in the policy. However, it has proved difficult for provincial agencies to manage water-based activities due to jurisdictional divisions with federal agencies.

Non-motorized	Water-based	Animal-based	Winter motorized	Summer motorized	Helicopter-based
• Nordic ski • Backcountry ski • Nature tours • Hiking • Rock climbing • Mountain-eering • Paragliding • Snowboard camp	• Kayak tours • Canoe tours • Raft/float tours • Jetboat tours	• Dogsled tours • Horseback tours	• Snow-mobile tours • Snowcat skiing	• ATV tours • 4x4 tours	• Heli-ski • Heli-bike • Heli-picnic

Table 1: Summary of commercial recreation activities in the Sea to Sky area

some of the main provincial and federal agencies relative to commercial recreation.

Area of responsibility	Government agency
Commercial recreation	BC Assets and Lands Corporation
Public recreation	BC Ministry of Forests
Commercial forestry	BC Ministry of Forests
Tourism policy[2]	BC Ministry of Small Business, Tourism and Culture
Tourism planning[3]	BC Ministry of Small Business, Tourism and Culture
Whitewater raft safety licensing[4]	BC Parks – BC Ministry of Environment, Lands and Parks
Wildlife protection[5]	BC Ministry of Environment, Lands and Parks
Air and water navigation	Transport Canada

Table 3: Jurisdictional responsibilities relating to commercial recreation on Crown land in British Columbia

THE TRANSITION PLAN

To tackle the conflicts outlined above within the confines of these management challenges, a Transition Plan was developed requiring all commercial operations in the Sea to Sky area to hold a permit to use Crown land for business. The plan was to be implemented over a 14-month time period.

Prior to the launching of the Transition Plan, however, two important management and policy developments took place. First was the announcement of the new Commercial Recreation on Crown Land policy by BC's Ministry of Environment, Lands and Parks[6]. This policy was developed from the previous interim Commercial Backcountry Recreation (CBR) policy that had met with only limited success in implementation.

The second development was the formation of British Columbia Assets and Land Corporation as a Crown corporation to administer BC Land Act tenures and sales in the province. BCAL replaced the functions of BC Lands, a ministry department that had been significantly downsized in 1995, leading to the curtailment of efforts to implement the CBR policy across the province. In the Sea to Sky area in particular, hopes were high that the new organization and the new policy would prove effective in finally tackling the growing conflicts in the area.

A consultant was hired to develop Strategic Planning for Commercial Recreation (Leavers 1999, 2000) for BCAL's Lower Mainland Region office. Through a two-phase process of literature review and stakeholder involvement, a proposed zonation for commercial recreation was developed.

A new BCAL field office was established in Whistler and a staff compliance and enforcement officer was hired to increase BCAL's profile in the area. A further consultant was hired to develop a communications plan, and a series of community media briefings was initiated.

The key terms of the Transition Plan were set out in an announcement circulated in October 2000:

- Existing commercial recreation operations without a permit to use Crown land were given a deadline of December 29 to submit an application.
- Applications already received (for existing as well as proposed operations) would also be considered under the plan.
- Decisions on applications for summer activities would be made by spring 2001, and for winter activities by fall 2001.
- No new applications would be considered until the end of the Transition Plan in November 2001.

Preparing for the applications

Meetings were held between BCAL land managers and key stakeholders and government agencies to explain the initiative, and to set deadlines to meet objectives. At the same time, contact with the media was initiated, and letters were distributed to all commercial recreation

[2] Now BC Ministry of Competition, Science and Enterprise
[3] Now BC Ministry of Sustainable Resource Management
[4] Now BC Ministry of Water, Land and Air Protection
[5] Now BC Ministry of Water, Land and Air Protection
[6] Now split into two ministries, the BC Ministry for Sustainable Resource Management and the BC Ministry for Water, Land and Air Protection.

operators identified in an inventory-building exercise. The standard BCAL application package was refined to explain what was required of the applicants, including a management plan outlining the nature of their activities, and mapping to illustrate the extent of those activities.

Some of the key issues to emerge at this stage are outlined below:

- GIS and data management capabilities of the management agency are crucial from the outset. The nature of commercial recreation activities is so diverse that techniques that may be appropriate for other program areas are stretched to their limit.
- Applicants were unclear exactly what was required of them, reflecting the difficulty of communicating with unpermitted operators, the diversity of operations, and the fact that CR operators may be drawn to the industry for lifestyle rather than business reasons.
- Many of the applications were of a lower standard than for other program areas administered by BCAL. In part, this reflects the issues outlined above. However, it is also likely that the fact that most applicants were already existing operators had a significant impact on their willingness to participate in the process, particularly given the background of uneven implementation of previous policy initiatives.

Initial review of the applications

A total of 53 applications were received by BCAL in advance of the first deadline. A first review of applications was intended to filter out inappropriate or incomplete applications prior to review by other agencies. An enormous amount of work was required to check all applications were complete, and to follow up with operators to provide missing information. A further logistical issue was the need to provide multiple copies of all management plans and mapping, which was greatly complicated by multiple revisions to plans during the process. After initial review, 7 applications were either cancelled, transferred to other regions or considered under alternative policies.

Some of the issues arising at this stage are outlined below:

- Already at this stage, human resource issues were becoming apparent. Administration of the Transition Plan involved almost every staff member of the regional office, and meant that other management priorities had to take a back seat for a while.
- Given the tight timelines and the political imperative to accommodate existing businesses as far as possible, not all applications that progressed to the next stage were entirely complete. This created management problems later on in the process.
- Provision for electronic submission of plans is being considered, including a proposal for BCAL to develop suitable base mapping to be provided to applicants free of charge.

Evaluating the applications

At this stage, responses from provincial agencies, local governments, First Nations and other organisations were assessed. Main participants in the referral process are listed in table 4.

Provincial agencies

- Ministry of Forests
- BC Parks
- Fish & Wildlife

Local government

- Squamish District
- Resort Municipality of Whistler
- Village of Pemberton
- Squamish and Lillooet Regional District

First Nations

- Squamish
- Mount Currie
- In-Shuck-ch / N'Qatqua

Table 4: Main participants in the Transition Plan for commercial recreation.

Broader public consultation was provided through advertisements in four community newspapers, and the placing of copies of management plans and mapping in community libraries. Finally, the status of the land covered by the application was checked for ownership and possibly conflicting tenures, before the application was progressed to a decision.

Issues arising at this stage are once again summarized below:

- Human resources challenges within BCAL were mirrored in similar challenges for referral agencies and other organizations.
- Incomplete applications continued to plague the process, and the fact that operators were already in existence meant that the option to simply reject the application was not available.
- Response times and the level of detail provided in responses varied greatly between different organisations. Additional complexity was introduced by the requirement for some operators to substantially modify their proposals, and the need to process these changes through the referral process again.
- Genuine involvement of First Nations in the process was limited. Engagement above and beyond formal ministerial and provincial guidelines, particularly face-to-face

negotiations, was necessary to provide any level of meaningful input.

- Jurisdictional issues were particularly important with respect to applications using Forest Service Roads (the management responsibility of the provincial Ministry of Forests) and those involving water-based activities (water transport being the responsibility of the federal Transport Canada).

Decision on the applications

After the information collected at the evaluation stage was collated, a decision on the application was made by BCAL, and the applicants were notified in writing. 32 applications were approved at the first phase, for those operations including summer activities in their proposals. A formal tenure offer was then prepared, taking into account the comments made at the referral stage in the form of conditions to the permits. While the Commercial Recreation on Crown Land policy allows for tenures to be granted for up 20 years, the majority of the tenures offered were limited to three and five-year periods due to the concerns of participating agencies, and the upcoming sub-regional Land and Resource Management Plan process for the Squamish Forest District.

Responses to the offers were varied, and while some were accepted quickly, other operators expressed surprise at the conditions, at the pricing method, and at the need to make payments for a year in advance. Some offers required renegotiation to more closely meet the needs of the operator. The terms of the offers proved most challenging for water-based and heli-based activities, reflecting jurisdictional issues with the federal government.

Other key issues becoming apparent at this stage included:

- Greater outreach may be necessary to educate potential applicants about the program if it is to be extended to other areas of British Columbia.
- Greater efforts may also be required to communicate with applicants during the application process.

Monitoring and enforcement

The final stage in the Transition Plan consists of ongoing monitoring of both tenured and untenured operations, and enforcement efforts to counteract non-compliance. As mentioned above, a dedicated compliance and enforcement officer was hired as part of the plan, and this move has undoubtedly had a major impact on the program's effectiveness. An interesting development has been the strengthening of field-level linkages with enforcement officers of other agencies, particularly the conservation officers of the provincial Ministry of Forests and fisheries officers of the federal Department of Fisheries and Oceans.

Other issues of importance at this stage include the following:

- The definition of commercial recreation adopted in the Commercial Recreation on Crown Land policy appears not to apply to rental operations (for example, snowmobile rentals). Lack of compliance efforts against these operators has led to a perception in the community that BCAL efforts are not as comprehensive as they might be.
- The role of the compliance officer should, however, be seen as one of liaison and outreach as to one simply of policing.

NEXT STEPS

In terms of it narrowest aim, to ensure all commercial recreation operators using Crown land, the Transition Plan has proved broadly successful. While negotiations are continuing at the time of writing, the majority of operators who have been made tenure offers have accepted them, and monitoring efforts indicate that there are very few operators still outside of the Transition Plan.

However, a number of key issues remain outstanding, some of which are being tackled at present, and some of which remain as challenges for the future.

Evaluation of the Transition Plan

An evaluation of the Transition Plan is currently in progress, based on stakeholder responses to a questionnaire structured to reflect the objectives of the Commercial Recreation on Crown Land policy. Among these objectives are environmental stewardship, public access and First Nations considerations.

Outstanding policy issues

Several areas of the new policy require some clarification, probably in the form of policy directives. Some of the main issues include BCAL's ability to tenure Forest Service Roads (currently administered by the Ministry of Forests under the Forest Practices Code Act), and sector-specific guidelines on how to interpret the policy, particularly with respect to rental operations and water-based and airborne activities.

Resolving conflict between commercial and public users

A 'Backcountry Forum' is currently in progress to attempt to reach consensus on how to allocate Crown lands between conflicting recreational uses. This multi-stakeholder negotiation process was initiated by BCAL, with the prime intention of resolving winter conflict between skiers and snowmobile users. Interestingly, the key focus of the forum has become the tensions between mechanized and non-mechanized recreation, rather than simply between commercial and public recreation.

Extension of the program to other recreation sectors

The original intention of the policy was to convert pre-existing hunting and fishing tenure agreements to commercial recreation tenures. This was not attempted in the Sea to Sky area, due to the complexity of dealing with the non-tenured operators, and it is not clear whether attempts will be made in the future to incorporate those tenures into the CR program. The policy also makes a provision for activities on 'Crown land submerged by water' to be incorporated. However, extension of the reach of the transition plan to the growing 'eco-tour' operations on tidal waters may be limited by jurisdictional issues between the federal and provincial governments.

Carrying capacity

While a broad framework for initiating a carrying capacity study and a pilot application were developed as in the period immediately prior to the Transition Plan (Leavers 2000b, 2000c), work on implementing these plans has not progressed. One factor may be the change in government during the Transition Plan, and a guidance that BCAL is not a planning agency. Planning functions from a number of ministries have been relocated into the new Ministry of Sustainable Resource Management, although the shape of future planning initiatives remains to be seen.

LRMP for the Squamish Forest District

One of the challenges of implementing the Transition Plan was the absence of a district-wide plan within which to assess commercial recreation applications. The Sea to Sky LRMP process has since been launched, and it remains to be seen how well CR tenures issued through the Transition Plan can be integrated into that initiative.

Extension of the CR program across the province

A final issue with respect to the Transition Plan is its possible extension into other Forest Districts in the Lower Mainland Region, as well as across British Columbia. While it is expected that the majority of districts will not present the complexity of issues found in the Sea to Sky, thanks to its proximity to both Whistler and Vancouver, it is hoped that many of the lessons learned in the Transition Plan will be applicable to land managers in those areas.

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Developing a Visitor Management Framework for WWF's PAN Parks Project – Case Study of a National Park in France

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Abstract: The purpose of this presentation is to discuss the visitor management planning process in progress at the *Parc National du Mercantour* in France. Park administration wishes to achieve World Wildlife Fund for Nature's (WWF) designation as a PAN Park. Details concerning the development of a visitor management framework for WWF's PAN Parks project will be given. Results will reflect practical aspects of Visitor Management Planning and monitoring in protected areas.

INTRODUCTION

WWF is the world's largest and most respected independent conservation organisation. Since 1985, they have invested over US$ 1,165 million in more than 11,000 projects in 130 countries. Consequently, tourism has been noted as one of the largest and fastest growing industries and has significant environmental, cultural, social and economic impacts, which significantly effect WWF locations. WWF aims on optimisation of the positive impacts whilst minimising, and wherever possible, eliminating the negative impacts. Thus, in 1997 WWF and the Molecaten Group developed the Protected Area Network (PAN Parks) concept as a means to encourage synergy between nature conservation and tourism in Europe's protected areas. The aim of the PAN Parks project is to change tourism from a threat (attracting visitors could lead to negative impacts on nature) into an opportunity by building relationships with nature conservation organisations, travel agencies, the business community and other groups on a local, national and international level (WWF 1999).

In order to become a PAN Park, a park must meet PAN Parks principles (Table 1) and criteria. Mercantour National Park does not yet meet all the criteria, namely a visitor management plan.

PAN Parks principles	
Principle 1:	Protected areas with rich natural heritage
Principle 2:	Nature Management
Principle 3:	***Visitor Management Plan***
Principle 4:	Sustainable Tourism Development Strategy
Principle 5:	Business Partners
Principle 6:	Sponsors

Table 1: Principles PAN Parks

This presentation will allude to the researcher process of synthesising the literature pertinent to visitor management frameworks to further clarify a framework for PAN Parks. Secondly, an overview of the visitor management planning process at Mercantour National Park is given. Results of this research will assist park managers in Europe in understanding and applying the concepts of WWF PAN Parks principles and criteria in developing Visitor Management

METHODS

Methods reported here are part of the those conducted as part of an MSc thesis sponsored by WWF to further develop visitor management criteria. The combination of related literature, PAN Parks criteria and structure of the thesis report serve as a form of self-assessment for both WWF and the park setting in France. The literature provides concepts of visitor management along with management recommendations. The PAN Parks criterion provides the organisational guidelines from which to relate and assess the visitor management/framework literature to further clarify the PAN Parks criteria. Results of the comparative analysis, can then be used within a practical setting to identify problems and alternative solutions to deal with visitor management problems

A literature study/content analysis on subjects related to visitor management resulted in a theoretical background for the PAN Parks visitor management principles. Four forms of literature were examined:

1. The visitor management philosophy supported by literature (Borrie et al., 1998; Hall & McArthur; 1993; McCool, 1996).
2. Visitor management frameworks available online, namely The Tioram Castle Conservation Project Scottish Highland, The Nut State Reserve Tasmania, the Norfolk Coast AONB

UK and the Waitakere City Council Visitor Strategy for the West Coast UK.
3. Visitor management subjects, explained, supported and complemented in the literature (Cole, 1987; Ceballos-Lascurain, 1996; Black, 1998; McArthur, 1998; Giongo et al., 1993, Wight, 1998; Schouten, 1999).
4. Visitor management strategies including frequently used systems like LAC (Limits of Acceptable Change), CC (Carrying Capacity), VIM (Visitor Impact Management), VERP (Visitor Experience and Resource Protection Programme), ROS (Recreation Opportunity Spectrum), VAMP (Visitor Activity Management Programme) TOMM (Tourism Optimisation Management Model) and VRM (Visitor Risk Management)

Figure 1 depicts graphically the steps involved in this research process.

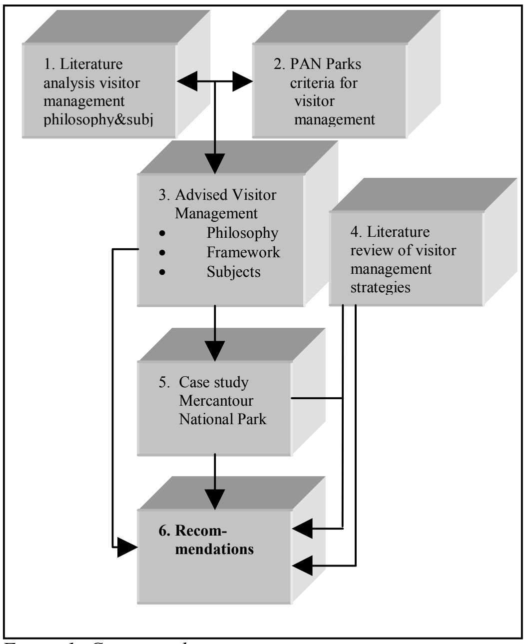

Figure 1: Conceptual map

Based on the analysis of the first three elements (number 1 in figure) eleven-visitor management subjects were identified. For each subject goals and objectives must be formulated in the visitor management plan. The PAN Parks principle about visitor management comprises criteria and indicators for eight of these subjects. Together with the literature background this step provides an overview of the desired situation (number 3 in figure). The PAN Parks' criteria and indicators is the evaluation tool while the literature review serves an explanatory, support and complementary role.

In the analysis of the fourth element (number 4 in figure) the different strategies were compared. Apart from the VRM strategy all systems were compared on basis of applicability, satisfaction of users, and on improvements made from one strategy to another. The VRM system is not included in the comparison because it deals with different visitor management subjects (different subjects appointed in the analysis of element 1-3). After this analysis only those systems that integrate both the nature oriented and the visitor oriented approach were evaluated against the PAN Parks criteria. The results of this analysis were positive indicating that these systems can be recommended by the PAN Parks organisation to be used for managing the visitor management subjects that PAN Parks sites deal with.

The case study (number 5 in figure) conducted in Mercantour National Park, France, consisted of an evaluation of the visitor management philosophy and visitor management subjects of the park. This step was based on secondary data analysis, informal interviews and personal observations conducted summer 2001. Results provided an overview of the points needed for further VM development and where the park meets the PAN Parks principles and criteria. For recommendations, results from the literature review are used (number 6 in figure).

CONCLUSIONS

The PAN Parks criteria and indicators are not formulated in a uniform or consistent format. Sometimes, a criterion is posed as a question or as an inventory task. How each should be interpreted is not explained and the level to which it should be implemented is not clear (see Appendix A for an overview of the PAN Parks criteria and indicators for visitor management). Literature and case study examples clarify the different visitor management elements (Figure 2) necessary in the present context of visitor management; thus, should be considered as elements of the PAN Parks criteria and indicators as well. In this paper only the suggested additions to the existing PAN Park criteria will be given. The structure of the conclusions is based on the relationship between the elements.

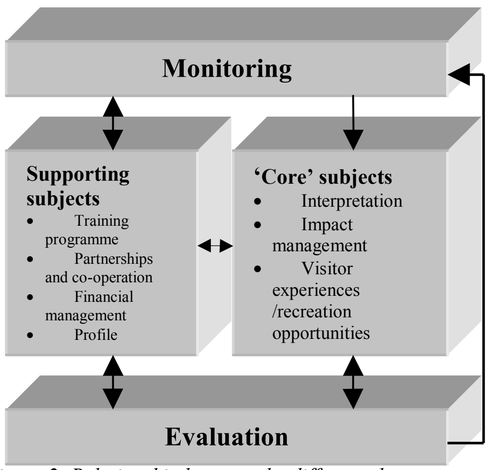

Figure 2: Relationship between the different elements

The ten visitor management elements depicted in Figure 2 (nine bulleted items and 'Monitoring and Evaluation') are placed in a philosophical context. This context refers to the visitor management philosophy of a park which influences the decision making process. The principles and criteria of WWF are restructured so that these reflect the requirements for the different subjects identified in the literature. Key words that reflect the contents of the criteria and indicators are listed for each subject [Criteria (CR); Indicator (I)].

Visitor management philosophy

The PAN Parks criteria and indicators indirectly refer to WWF's visitor management philosophy. The criteria and indicators are grouped in two: 'Structure and strategy criteria and indicators' and 'indicators for sustainability'.

Cr. 3.1	Implementation, monitoring and evaluation of effectiveness of visitor management plan
I. 3.1.2	Long and short term goals
I. 3.1.4	Systematic monitoring and revision
I. 3.2.2	Describe measures to avoid negative impact (provide description and map of zoning)
I. 3.3.1	Different target groups
I. 3.3.7	Partnerships on use, improvement and widening the offer
I. 3.3.8	Active role in development sustainable tourism strategy?
I. 3.4.1	Segmentation

The literature research clarified the concept of a visitor management philosophy. Secondly, another group of indicators was identified: managerial principles. The research by McCool (1996) on visitor management principles was a valuable addition and support for the PAN Parks philosophy.

Category	Criteria
Managerial	Recognise the considerations of visitor use (eleven principles McCool 1996)
	Ease of implementation; • Time consuming • Desired education
	Integration possibilities with other strategies
Structure and strategy	Process oriented structure • Analysing and documenting; Identification of problem conditions • Goals and objectives setting • Strategic plan • Financial resources • Monitoring and evaluation of management actions
	Differentiated approach; • Different zones • Different target groups
Sustainable approach	Pro-active approach vs. re-active approach; Future oriented
	Cause solving vs. problem solving; Cause solving
	Local involvement integrated in process
	Beyond nature orientation: Social, economic, cultural, environmental, and visitor oriented

Table 2: Overview of visitor management philosophy indicators

Interpretation

Different PAN Parks criteria and indicators are defined for interpretation summarised as follows:

I. 3.3.2	Interpretation programmes for different target groups
Cr 3.4 (3.4.1)	Create understanding and support for conservation goals
3.4.2	Different messages and techniques for target groups
3.4.3	Communication of code of conduct
Cr 3.5 , (I 3.5.1, 3.5.2, 3.5.3, 3.5.4)	Visitor centres • Availability and accessibility of information • All year • Visitor centre target groups • In English and relevant languages

The analysis on this subject resulted a clear distinction that interpretation is more than information provision but reveals concepts, meanings and the interrelationship between natural phenomena. Interpretation educates visitors about the environment and adds to what we hope is a positive experience for visitors in nature (Ceballos-Lascurain,1996). The need for interpretation increases, as visitors demand more environmentally responsive services, products and information. They want to learn and understand their own connections with a broader environment (Black 1998). Hall & McArthur (1998) indicate that objectives of good interpretation are multiple but often fail to reach its full potential (Hall & McArthur (1998); therefore indicating that this subject area needs further clarification and development in protected areas.

Minimising Impacts

For this subject element, PAN Parks principles and criteria are not very descriptive or clear.

Cr. 3.2	Visitor management safeguards the natural values
I. 3.2.1	Carrying Capacity is assessed
I. 3.2.2	Measures to avoid negative impact: Zoning: access, allowed activities, time period

The literature review for this subject resulted in additional advisable requirements:

1. Structured analysis of impacts by categorisation (Giongo et al., 1993)
2. Different measures to avoid negative impacts (Cole, 1987; Hall & McArthur, 1993)
3. Decide whether change is a real damage or an inevitable consequence of human use (Wight, 1998; McCool, 1989)
4. Recognise principles of visitor management defined by McCool (1989)
5. Carrying Capacity as an initial concept is somewhat limited in guiding VM planning. Strategy frameworks such LAC, VIM, etc. should be considered as well.

Visitor experience/recreation opportunities; facilities-services-activities

PAN Parks requires high quality nature based experiences to assure visitor satisfaction. In order to realise this visitors should be offered an experience that contains the UNIQUE elements: *U*ncommon, *N*ovelty, *I*nspiring, *Q*uality, *U*nderstanding and *E*motions (Schouten 1995). These experiences should be specified on different target groups (Mill & Morrison, 1992) because not all visitors need the same type of experience.

Mazursky's model of experience explains that visitor satisfaction is dependent on the expectations of the visitor (Mazursky in Beunders and Boers 1996). This concept underlies the strong relationship with the visitor management subject 'Profiling'.

Cr. 3.3	Wide spectrum of experiences
I. 3.3.1- 3.3.2-3.3.3	Activity services and facilities for different target groups
I. 3.3.4	ortunities to observe natural features
I. 3.3.5	Monitoring visitor behaviour and satisfaction
I. 3.3.6	Visitor oriented facilities (quality)

Risk management

Accidents can happen but some accidents can be prevented. Communication is an important aspect of this element. What are the responsibilities of managers for risk management? This subject needs to be considered further by many parks. In some countries managing risks is a legislative obligation (Parks Canada). Parks Canada has developed a Visitor Risk Management handbook intended to help managers develop a consistent set of guidelines to manage visitor risks (Parks Canada). For parks willing to obtain the PAN Parks certification only one indicator has been defined resulting in two key elements: safety regulations and monitoring.

I. 3.3.9	Safety regulations concerning activities and the use of facilities Monitoring and updating

Monitoring

For all decisions taken in the visitor management process background information is necessary. This type of information is described as the basic input information necessary for developing a visitor management strategy. Information about visitors and the environment form the basis for all different subjects for which goals and objectives must be set for management. Effects of management actions must be monitored as well. A third element is that of monitoring and evaluation of the overall management plan. This is were questions such as "Have the right decisions been taken?"

PAN Parks recognises the importance of monitoring and has included many criteria and indicators about this subject.

Cr. 3.1 I3.1.4, I3.3.5, I3.3.6, I3.3.9, I3.6.4	Regular monitoring and updating of all elements of the visitor management plan explicitly mentioned are: • Effects of visitor management actions • Number of visitors • Type of visitors • Use of facilities services and activities • Visitor satisfaction • Visitor safety regulation • Training programme • Trends and developments Take actions based on obtained information and evaluate progress

Partnerships and co-operation

The definition of the WTO (1998) makes clear that partnerships and co-operation are essential elements of sustainable development. This subject is part of the visitor management philosophy. Partnerships can be established for different subjects of the visitor management elements.

I3.3.7	*Co-operation with local actors* Establishment of relationships
I3.3.8	Proactive attitude towards sustainable tourism strategy

Training programmes

The need for training programmes varies from park to park. Important is the knowledge managers and/or rangers have on the various subjects of visitor management. For the visitor experience a visitor oriented attitude from personnel, the way in which facilities, services and activities are offered are important to visitor satisfaction. Knowledge of park personnel must be assessed through monitoring/assessment, then training programmes can be developed accordingly.

Cr. 3.6	Training programme is element of visitor management
I 3.6.1	Available
I 3.6.2	Goals, target groups, methods and time schedule
I 3.6.3	Training need assessment
I 3.6.4	Monitoring and revision

Financial management

Expenditures and revenues must balance. Visitor management is an ongoing process; thus a line item should be included in the annual budget. Obviously, visitor management subjects vary in priority and importance, therefore, annual budget funds should be allocated accordingly. The sole PAN Parks indicator referring to budget/financial related as an aspect is the availability of resources.

I3.1.3	Adequate resources for implementation of visitor management plan available

Profile and infrastructure

These two subjects are not included in the PAN Parks criteria. However, these elements appeared in visitor management plans from other national parks

(The Tioram Castle Conservation Project Scottish Highland, The Nut State Reserve Tasmania, the Norfolk Coast AONB UK and the Waitakere City Council Visitor Strategy for the West Coast UK).

Profiling an area is about presenting the park in visitor information; it is about creating an image and expectations. By doing this visitor flows can be controlled (Cole, 1987; Hall & McArthur, 1993, 1998) and appropriate expectations can be created in the minds of the visitor leading to an increase in visitor satisfaction.

The possibilities to increase visitor satisfaction and minimise negative impacts are multiple. Infrastructure can be used as a means to differentiate in service provision which leads to the desired outcomes. For example, making access to problem areas more difficult and/or improve access to alternative locations (Cole 1987) or by encouraging/discouraging use by selective service provision (many signs or the opposite: no signs). Site design, reinforcing areas of known impact, coupled with zoning of experience opportunities are other means as well.

Different strategies have been developed that deal with visitor management subjects described briefly in this paper. Table 3 summarises the various strategies we discussed.

Abbreviation	Strategies
VRM	Visitor Risk Management
CC	Carrying Capacity
LAC	Limits of Acceptable Change
ROS	Recreation Opportunity Spectrum
VIM	Visitor Impact Management (National Parks and Conservation Association)
VERP	Visitor Experience and Resource Protection (National Parks Service)
VAMP	Visitor Activity Management (Parks Canada)
TOMM	Tourism Optimisation Management Model

Table 3: Strategies analysed

In conclusion, we determined that the latest strategies focused on in the literature are all integrated systems that combine ecological and visitor oriented approaches (namely VIM, VAMP, VERP, TOMM). These integrated systems all deal with and/or include some aspects of the PAN Parks criteria that have been formulated for the subjects they deal with (e.g. VRM- criteria about risk management). We conclude that the systems are very similar to each other and any one of them could be suitable for a park to use. Results imply that PAN Parks criteria are not specific enough and by adopting one or a combination of the aforementioned strategy frameworks, a park setting would not only meet the PAN Parks criteria, but develop a more complete visitor management plan as well. Therefore, we advise park management to select any one of the strategies if it needs to improve (or develop) their strategy on the subjects that the strategy deals with specifically.

MERCANTOUR NATIONAL PARK CASE STUDY

Study setting

Mercantour National Park is situated in the department *Alpes Maritimes* in the south of France. The park borders on the east with the *Italian Parco Regional d'Argentera* with which they are co-operating (see map). Different management policies are jointly executed. The vicinity of the Atlantic Ocean creates a unique climate in an area that has an altitude difference from 490m to 3143m. Because of these characteristics a wide diversity in plant and animal species can be found. Many of these species have a protected status. Apart from natural features a valley in the park possesses the richest ensemble of open-air engravings in Europe.

The park is divided in two different zones: the core zone and the buffer zone. In the core zone activities and behaviour are restricted, the regulations of the park have to be obeyed. In the buffer zone a wide offer of tourist facilities and services can be found. The core zone covers an area of 68.500ha and the buffer zone and area of 136.500ha. In the buffer zone 28 communities can be found (fact sheet 2000). The park is divided in six sectors. These sectors have their own management team located in the area. This research is carried out in core zone of the sector La Vésubie, situated 65km from Nice.

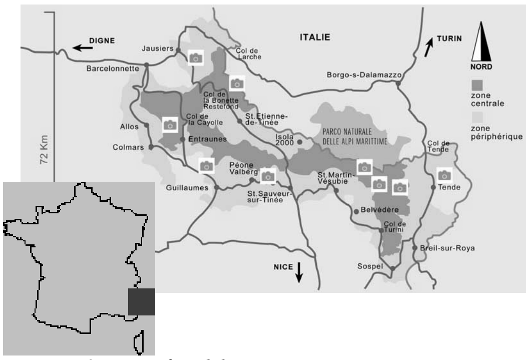

Figure 2: Map of park location

Results

The visitor management practices from the management in La Vésubie have been analysed based on the PAN Parks criteria. Table 4 shows the results. Table 5, presents an overview of the evaluation of the PAN Parks criteria and indicator assessment for the core zone of La Vesubie, sector of Mercantour National Park.

Results of analysis in core zone La Vésubie- Mercantour National Park
Interpretation: Information, education • The possibilities and opportunities interpretation makes possible are not used optimally. In the visitor centres, in the brochures, and in the park and its entrances this could be further developed. • No visitor segmentation is used to differentiate services, facilities and activities. • Interpretation does not increase understanding and support • Visitor centre is only open in high season which makes information difficult to access (apart from interpretation panels and trails in the park)
Impact management • no impact assessment or strategy that deals with managing impacts • few different measures are used to minimise impacts • No limits of acceptable change have been defined (nor Carrying capacity levels), no indicators have been identified
Visitor experience/recreation opportunities • In core zone visitor experiences are nature based • No zoning system is applied • Good opportunities to experience wildlife
Risk management • Mercantour has a non-communicating attitude towards visitor risks
Monitoring • The input of visitor management is being monitored: Visitor surveys have been conducted this year. These deal with various subjects. National and departmental organisations monitor the existing situation. Rangers monitor while on duty and special research is conducted on specific subjects. • No systematic monitoring programme is available for visitor management subjects
Partnerships and co-operation • The park has an active approach towards co-operation • Different partnerships exist
Training programmes • Training programmes are available for all employees on yearly basis • A wide range of topics is offered • Training needs are not assessed
Financial management • The park has different financial resources • A yearly budget line item should be allocated for visitor management
Profile • External-happens from headquarters in Nice, France • Has to be communicated with the sector to utilise the opportunities
Infrastructure • The current situation offers possibilities which need further analysis • Infrastructure in the park is very well developed

Table 4: Results analysis La Vésubie- Mercantour National Park

Visitor management subject	**Meets PAN Parks criteria**	**Needs further development**
Interpretation		x
Minimising impacts		x
Visitor experience/ recreation opportunities		x
Training Programmes	x	
Monitoring		x
Partnerships	x	
Safety		x
Financial management	x	
Profile	x	
Infrastructure		x

Table 5: Analysis results of core zone La Vesubie-Mercantour

The literature that describes the visitor management philosophy, the structure and the different subjects also provides recommendations for managers to consider. When the PAN Parks criteria and the literature study are used to analyse the situation, it pinpoints problem areas and gives examples on how these can be dealt with in the situation. In essence, this thesis project combining a literature review in accord with PAN Parks criteria and the structure of the thesis itself provides an assessment tool as a form of monitoring. An integration of literature study and the onsite analysis is shown in Table 6.

Visitor management subject that need further development to meet PAN Parks criteria	**Strategies that can be used:**		**Other sources used for visitor management subjects**
	VIM VERP VAMP TOMM	**VRM**	
Interpretation	X		McArthur 1998 Hall, & McArthur 1998 Ceballos-Lascurain 1996 Black 1998
Minimising impacts	X		McCool 1989 Wight 1998 Berle 1990 Giongo et al., 1993 Hall Mc Arthur, 1998
Visitor experience/ recreation opportunities	X		Schouten 1995 Cole 1987 McCool 1996
Monitoring	X		McCool 1996
Safety		X	VRM plan Parks Canada

Table 6: Integration of literature and self assessment

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APPENDIX A. OVERVIEW OF PAN PARKS PRINCIPLE VISITOR MANAGEMENT; CRITERIA AND INDICATORS

Principle 3: Visitor Management

PAN Parks visitor management safeguards the natural values of the area and aims at offering the visitors a high quality nature-based experience.

3.1. Protected area must have a visitor management plan. Implementation, regular monitoring and assessing its effectiveness should be secured. Based on the assessment the management will be adapted and the plan updated.

3.1.1 Do you have a visitor management plan? Provide an English summary and a copy (if available).

3.1.2 Provide information of the plans long- and short-term goals.

3.1.3 Are there adequate resources for the implementation of the visitor management plan?

3.1.4 Are the effects of the visitor management plan's actions being monitored systematically? Can the plan be revised accordingly?

3.2 Visitor management safeguards the natural values of the protected area.

3.2.1 The protected area's ecological carrying capacity is properly assessed/ estimated, making use of the best available method.

3.2.2 Based on ecological carrying capacity, describe the measures to avoid negative impacts by visitors on the protected area. Add description and map of zoning system (or similar system), specifying visitor access, allowed activities and time period of each zone.

3.3 Visitors are offered with a wide spectrum of high quality nature-oriented experiences based on the visitor management plan.

3.3.1 List and specify activities (such as hiking, canoeing, cross-country skiing) for different target groups.

3.3.2 List and specify services (such as education and interpretation programmes) for different target groups.

3.3.3 List and specify facilities (such as observation towers and nature trails) for different target groups.

3.3.4 List opportunities offered to visitors to observe and experience wildlife and other natural features of the protected area.

3.3.5 Indicate how number and type of visitors, their use of activities, facilities and services and the visitor satisfaction are being monitored. Indicate estimations on future trends on development of number and type of visitors.

3.3.6 Based on visitor satisfaction, describe how the quality of the activities, services and facilities are monitored and improved.

3.3.7 Describe existing and planned partnerships with communities and other partners on the use, improvement and widening the offer of nature-oriented expediencies.

3.3.8 Does the protected area management play proactive role in setting up and implementing sustainable tourism development strategy (as defined in principle 4)?

3.3.9. Indicate safety regulations concerning activities and the use of facilities and specify how these regulations are monitored and updated.

3.4 Visitor management creates understanding and support for the conservation goals of the protected area.

3.4.1 List target groups that need to understand and support conservation goals of the protected area.

3.4.2 Specify messages and different techniques used for the target groups.

3.4.3 Do you have a code of conduct? Indicate how it is communicated.

3.5 The protected area has a visitor centre, for which clear goals and a policy are being defined within the visitor management plan.

3.5.1 List visitor centres target groups that need to understand and support conservation goals of the protected area.

3.5.2 Specify messages and different techniques used for the target groups.

3.5.3 Is the availability and accessibility of information guaranteed during all periods of the year that visitors can be expected? Indicate opening dates and hours of visitor centre and other places where information is available and specify which information is available.

3.5.4 Are information, education, interpretation and communication in the visitor centre available in English and, in case that monitoring of visitor flows shows many visitors from other countries come to the area, other relevant languages?

3.6 The visitor management plan includes training programme for staff and others involved in offering activities, services and facilities to visitors.

3.6.1 Do you have a training programme for the staff and others involved in offering activities, services and facilities to visitors?

3.6.2 Specify goals, target groups, methods and time schedule of the training programme.

3.6.3 Are training needs of staff and other people involved assessed on a regular base?

3.6.4 Is the training programme monitored systematically? Can the plan be revised accordingly?

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The Effectiveness of Wayfinding Systems with Forest Users

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Abstract: Forest wayfinding systems include the sources of information, content and presentation, that potential visitors use to find forest sites and maximise their experience of forest recreation. This paper presents original research from an on-going user-led study of signage at forest recreational sites across the UK, and is part-funded by the Forestry Commission. Research methods used in the study included structured interviews with forest users, a signage audit, observation-based behavioural studies and exploratory work with space syntax. The starting point for the study was an apparent low rating of satisfaction with road signs by visitors to Forestry Commission sites in annual visitor surveys. Signs are "…the most visible manifestation of corporate face" and function to "…provide reliable and accessible information to encourage and welcome visitors" (Forest Enterprise Signs Manual, 1997). Good signs also form part of a positive perception of woodlands (Burgess, 1995) and may be considered within the context of removing barriers to the use of the countryside by disabled people and socially excluded groups.

The research found evidence that there were some problems with forest wayfinding, but that these problems are related more to the context, content and location of signs, rather than the materials and details of sign design. More consideration needs to be given to identifying the minimum but key information needs of users at key locations within the forest site. Signs are costly to design, construct, install and maintain, and a crucial concern must be to provide the minimum information for maximum benefit, based on what the user needs to know at each stage of the journey and forest experience. The study also highlighted the role of signage in site promotion, visitor expectations, conflicts between different user groups and accessibility of information. A model for signage to satisfy visitor information needs was developed. The results presented here cover phase 1 of the project and it is anticipated that the methodology developed during the research will have practical applications in evaluating and developing new signage systems, and the training of forest and other recreational site managers.

INTRODUCTION

The starting point for the study was an apparent low rating of satisfaction with road signs and information boards by visitors to Forestry Commission sites. Against this background, a research project was commissioned by the Forestry Commission to consider issues of forest wayfinding and to develop methodologies for assessing wayfinding systems. The first phase of the study, which is presented here, was a scoping study to consider whether:

1. users (who want to) were finding their way to Forestry Commission recreational sites,
2. the information provided on site enabled visitors to use the site effectively once they were there.

A key aim of the study was the development of a pilot methodology for FC and public participation in the evaluation of signage procedures.

Wayfinding is '…the ability to identify one's location and arrive at destinations in the environment, both cognitively and behaviourally' (Prestopnik & Roskos-Ewaldson, 2000), or, more simply 'spatial problem solving' (Passini, 1992). Wayfinding ability appears to differ between individuals depending on gender, sense of direction, familiarity with environment and wayfinding strategy (Prestopnik & Roskos-Ewaldson, 2000; Lawton, 1996). In the context of the present study of forest recreation, wayfinding was defined as the search processes and sources of information used by visitors to locate, arrive at and maximise their experience of recreational sites. Signs are a key source of wayfinding information, often supplemented by leaflets, maps, personal contacts and word of mouth.

Signs are a visual means of conveying information or messages from site managers to potential users of that site. Beazley (1969)identified the function of signs, the first to "…provide a visual target that is quickly seen; the second, to convey a message. An additional objective… is that it should impinge as little as possible on its surroundings while fulfilling the first two requirements." Various types of signage messages and information are suggested in the literature (Brown, 1974; US National Parks Service, 1988;

Burgess, 1995; Forest Authority, 1996; Forest Enterprise, 1997; Winter, 1998). These include site promotion and directions, visitor welcome, information about the site and its facilities, visitor orientation, education and interpretation, advisory and warning signs, and corporate image and promotion.

Visitor information needs can be perceived as arising out of a series of actions and decisions that occur in sequence according to what the user wants to know at each point. Accordingly a hierarchy of sign types has been developed by (See Table 1).

Sign type	Definition
Pre-arrival	Advance roadside warning
Threshold	Marking the main entrance to the area of management or ownership
Orientation	Helping people to locate themselves, before deciding where to go and what to do
Direction	Guiding traffic and pedestrian navigation
Identification	Labelling a feature of object
Information	Displaying details of opening hours, events, facilities
Interpretation	Revealing the significance of the landscape or an aspect of it
Regulation	Displaying rules and warnings.

Table 1.Signage hierarchy for outdoor recreational sites (Scottish Natural Heritage, cited in Bell, 1997).

The significance of pre-arrival signs was recently highlighted in a report to the Countryside Agency (1998) which suggested that a lack of signs and directions was a significant barrier to potential users of the countryside. Pre-arrival signs take the form of roadside warnings such as tourism brown signs and other highway signs. In the UK, standard white-on-brown tourism signs function to: "...guide visitors along the most appropriate route at the latter stages of their journeys [to places they were already intending to visit], particularly where destinations are difficult to find…or to generate impromptu visits by supplementing marketing initiatives" (County Surveyors Society, 1996). Tourism brown signs are administered by the Traffic Authorities, who seek to balance tourism development with road safety, traffic management and environmental objectives. Destinations must meet the basic quality standards of the Tourist Board Visitors Charter to qualify for Tourism brown signs. Alternative signing systems are offered by commercial organisations such as the Automobile Association (AA) and the Royal Automobile Club (RAC).

Visitor surveys carried out by the Forestry Commission indicate that most people arrive by car. However, the National Trust (2000) identified the needs of the 'transport poor' and stated that it was: "…not acceptable [for major developments] to be designed and located on the assumption that the car will represent the only realistic means of access to the site for the majority of people." At present most wayfinding signs to recreational sites are aimed at car users.

Threshold signs announce that a special area has been arrived at, welcome visitors, and also raise awareness of the organisation or landowner responsible for managing the site (Bell, 1997; Forest Enterprise, 1998; Winter, 1998). Threshold signs, are often "…the most visible manifestation of corporate face" (Forest Enterprise, 1997) and suggest the type of experience to be found on the site, as well as the standard of facilities on offer. Burgess (1995) studied the perceived fears and risks of various ethnic and social groups about visiting urban fringe woodlands. She considered that good signs formed part of a positive perception of woodlands, and that by encouraging more people into woodlands, a wider and more varied mix of users might be attracted, thus in itself helping vulnerable users to feel safer. She also suggested that by identifying and highlighting woodland character (such as open, middle or wild-woods) users might be able to assess whether they would feel comfortable using a particular site.

Once on site, visitors require additional wayfinding information in order to "…find their way around the site without getting lost, straying into danger or missing the best features" (Bell, 1997). Burgess (1995) observed that although men tended to be afraid of becoming lost or trespassing, women were more fearful of attack, and felt vulnerable when lost. Good maps and signage were important to let people know where they are and also where to go in times of anxiety.

Interpretation and education about the site is another vital area of visitor information which should provoke, relate and reveal as well as be accessible (Bell, 1997). A recent study by Gibb (2000) concluded that although 31% of the sites surveyed had wheelchair access, less than 3% of interpretation had facilities such as large print, Braille or an induction loop, for people with disabilities. The Disability Discrimination Act of 1995 has given added incentive to improving the inclusiveness of wayfinding systems in order that disabled people, particularly those with visual impairment do not experience 'information deficit' (Barker & Fraser, 2001).

METHOD

The approach chosen for the study was user-led and multi-disciplined. It comprised a series of site-based case studies, consisting of semi-structured interviews with visitors, a signage audit of the site and its environs, and route analysis using a combination of spatial and behavioural analysis techniques. The sites chosen for the case studies were: Queen Elizabeth Forest Park (OS map reference NN520014); Glencoe Lochan (NN104596); Cannock Chase (SJ 019171); Dalby (SE875874) and Hafren (SN 857869), which encompassed a range of geographic locations, size, and foret experiences, as well as different levels of visitor satisfaction with road signs (see Table 2).

The first time user experience.

Researchers set off for each site with the minimum of information to hand, normally no more than the AA 2000 road map and an FC leaflet, and approached the site using only visual prompts, whether signage or symbols on the road map, and written directional instructions on the relevant FC leaflet.

Interviews with forest users

Structured interviews were carried out with visitors at the sites. The interviews were divided into sections, designed to follow the sequence of arriving and spending time on the site:

- About your visit here today
- About your journey here today
- About your arrival at the forest
- About the information and directions provided

Route Analysis

The nature and complexity of potential routes into each of the forest site was examined from the nearest population centres or holiday locations. Techniques included a signage audit, behaviour-environment analysis and a brief exploration of Space Syntax.

A, Signage audit

Actual signs locations as *experienced* by the user on their journey to the site were then catalogued and mapped using the following categories:

- Environs: the route to the site, up to the entrance, including significant major/minor road junctions, tourist brown signs, FC advance, threshold, and entrance signs.

- Local*:* the entrance up to the main information point, whether visitor centre or information board, including traffic flow directional signage, car park, signs to VC/information board, directions to start of trails or other facilities.

- Signs were recorded and assessed for:
- Location and appropriateness
- Visibility, legibility, accuracy
- Understanding/comprehension
- physical condition, confusion and clutter.
- Conformity to best practice guidelines.

B, Environment-behaviour analysis

This was carried out on an informal basis to assess signage effectiveness, and also to help put visitor comments into context. Two approaches were combined: observation records and spatial analysis. Observation points were selected in locations previously identified by the researchers as information 'trouble spots.' Visitor behaviour and interactions with the environment were recorded in the form of movement maps and annotated sketches. Spatial analysis encompasses a range of techniques frequently employed by Landscape Architects to evaluate the spatial experience of a route or landscape, by breaking it down into a sequence of visual images such as photos and sketches. These two approaches were used to analyse the 'goodness of fit' between user information needs and the information provided by the environmental setting.

C, Space Syntax

Space syntax is an exploratory technique used in spatial analysis (Hillier & Hansen, 1984). Its basic model is a transformation of the total spatial system of an urban situation in axial lines, which are defined as the fewest and longest set of lines of accessibility and visibility that can be drawn. The model is then analysed according to the connectivity of each axial line to all others in the system. In wayfinding, these intersections may be interpreted as locations where decisions are required. Lines are then analysed for global and local integration. Global integration - a measure of accessibility from all other parts of the spatial system – can then be used to identify suitable routes. Local integration – a measure of the accessibility of an axial line from its neighbouring lines – reflects the number of choices at junctions and the potential points of confusion. Due to time limitations and the exploratory nature of applying the technique in an open landscape context, it was only possible to use Space Syntax on one of the sites used in the present study (Hafren). Axial lines of accessibility were derived from roads on Ordinance Survey (OS) maps.

RESULTS

Full results from all the case studies which amalgamate all the techniques mentioned in the above methodology, are available in the final project report (Findlay et al., 2001). In this short paper it is only possible to present a selection of the data obtained.

Route analysis

The key approach routes used by visitors were identified from interviews with Forestry Commission personnel, forest users, Tourist Information, maps and 'scouting' by the researchers (see Table 3.). At Hafren route identification was reinforced by space syntax, which highlighted a local town which spatially dominated the area, a natural route to the forest through this town, and intersections which might cause confusion.

Site	Road sign rating	Size (ha)	Annual visitors (000's)	Main Visitor type	Use	Transport	Other considerations
Queen Elizabeth Forest	74.5% (1998)	20,000	1,000	Tourist	Walk Cycle	Car Coach	Proposed National Park. Major tourist route.
Glencoe Lochan	44 .0% (1999)	137	30	Local Tourist	Walk Fish Disabled access	Car Walk	Emphasis on disabled people. Local amenity within a major tourist destination area
Cannock Chase	62.0% (1999)	2428	106	Local	Walk Cycle	Car Walk	Close to large population of people from ethnic minorities. Forest in a country park
Dalby Forest	81.3% (1997)	3642	300	Tourist	Walk Cycle	Car	Within National Park. A forest drive
Hafren Forest	38.3% (1998)	3000	20	Tourist Local	Walk	Car	Bilingual issues

Table 2. Matrix of site factors for sites used in study.

Site	Possible routes	Road type
Queen Elizabeth Forest	2	'A' class roads
Glencoe	2	'B' class or minor roads
Cannock Chase	5	Minor roads
Dalby	2	Minor country lanes / 'B' Class roads
Hafren	4	Narrow country lanes

Table 3. Site approach routes

Three of the sites (Hafren, Glencoe and Cannock Chase) had no road signs; the only signage was that provided by the Forestry Commission at the forest threshold. Queen Elizabeth was signed using generic tourism brown signs as part of the 'Trossachs Trail'; Dalby had tourist brown signs, 'repeater' signs (a brown-on white pictogram) and highway signs. On-site Forestry Commission signage was recorded onto site plans and matched with comments from the visitor interviews.

Examples of environment-behavioural analysis included a comment that there was no information at the entrance to Queen Elizabeth, with the observation that, in reality, however, most information was obtained by talking to the man responsible for collecting parking fees. At Glencoe, visitors treated the car park and information board like a drive-through, travelling in circles while deciding whether to stop and park. At Cannock Chase, the technique was used to identify potential information needs around the entrance.

Visitor interviews

In all 68 structured interviews were carried out with users across the five sites. User groups were predominantly couples (n = 29) or families (n = 20), with fewer miscellaneous small groups (n = 11), lone males (n = 5) or females (n = 1). There were also 2 accompanied parties of users with learning disability. All visitors were White Caucasian; no visitors from other ethnic groups were encountered. Most visitors travelled to the sites by car (n = 60); very few cycled (n = 3), walked (n = 3), or came by coach or minibus (n = 2). Nearly half of the visitor were making their first visit to the sites (n = 33), while some made regular (n = 17) or occasional visits (n = 18).

Awareness of site

At Cannock Chase the site itself is called Birches Valley Forest Centre, however local visitors referred to the site variously as Birches Valley, Beeches Valley, the Deer Centre, Brindley Heath and Cannock Chase. The latter two references suggested confusion with a nearby visitor centre run by the local council, and which had more dominant road signs. This example gives some indication of the difficulty in finding information about a site when there are problems of site identity. Across all sites, most visitors first heard of the sites through word of mouth (n = 14), had 'always known' (n = 13), or from guidebooks (n = 12). Few had found information from Ordinance Survey maps (n = 7), Tourist Information offices or leaflets (n = 6), or 'by accident' while driving past (n = 5). Only 4 visitors mentioned signs; the remainder of reasons for first finding out about sites included looking for a café, by prior research or from a magazine.

Finding the site.

Visitors cited a number of wayfinding strategies including the use of maps, verbal directions and landmarks. Some were not able to explain: 'I just followed my nose' or used 'instinct'. On signage, one visitor claimed to have followed signs to Glencoe, when in fact there were not any. At Cannock Chase a visitor remarked that '..you don't stand a chance of finding it as there are no signs', and at Dalby '..it's well-signed – you can't miss it'. At Hafren, visitors identified particularly difficult junctions where signage would have been helpful. Problem junctions were often reinforced by Space Syntax analysis.

Arrival and finding out what to do

There were criticisms of the information boards on several of the sites, particularly the map representations and details of trails. At both Hafren and Glencoe, the car parks were small and laid out in a way that visitors could see at a glance that they had arrived at the right location, and any information boards were immediately obvious. At Glencoe, visitors commented on a lack of information e.g. about the fishing. This information was available on the site but not immediately obvious.

At both sites the map representations on the information boards were criticised. Several visitors remarked that details of the difficulty and duration of trails given on the information boards was over-estimated. One visitor was also confused by the site motif used on all the trailheads[7]. At Cannock, the site entrance was obvious, but there was no formal information board to indicate what was on offer at the site. Visitors were also confused by the pictograms on some of the directional signs at this site. At Dalby, information was available from the toll booths, but only when they were manned, and the road layout indicating car parking was not immediately clear to visitors. Queen Elizabeth Forest Park had long-standing problems with signage and design of the site entrance. where the requirement to remove traffic quickly from a busy 'A' road did not allow visitors time to absorb entrance information and directions. Once parked visitors were then unsure where to go for further information about the site. Site information was centralised at the Visitor centre, however this was neither visible nor clearly signed from the car parks.

Visitor conflicts

The intention to attract visitors to the site by signage and promotion was not always matched by site carrying capacity, ability to cope with diverse user needs, and possible conflicts between user groups. Although the actual forests can absorb large visitor numbers, this was not always the case with visitor facilities such as car parking and toilets.

None of the sites visited were accessible by public transport, and no visitors from ethnic minority communities were encountered at any of the sites, even though one site (Cannock) was within commuting distance of Birmingham with its large and mixed ethnic population. Visitors with some disabilities such as people who use wheelchairs were catered for with a specially designed boardwalk at Hafren, and boat for disabled people at Glencoe. However people with a visual impairment, limited mobility or learning disability were not catered for. Conflicts between visitor groups were particularly apparent at Cannock, where there was obvious tension between cyclists and pedestrians using the same trails. However at Dalby, cyclists and walkers were segregated and so this was not an issue.

DISCUSSION

The first phase of this scoping study highlighted a number of general issues, which will help determine key areas for future work. It was also useful in the development of a methodology to be used in future phases of the study, as well as in training packages to those responsible for sign design and assessment. The general issues were site promotion and encouraging more visitors to the site, site location and context, visitor wayfinding strategies, visitor expectations and accessibility of information.

Site Promotion

Road signs were generally located within a 5 mile radius of the site and, although they may to some extent attract visitors passing through the area, wider promotion of the site appeared to be necessary to inform potential visitors about the site. Site promotion included Tourist Information Offices, leaflets, local radio and newspaper, other published references to the site, and word of mouth. The last often revealed special and long-term attachments to particular sites.

Encouraging more visitors to the site.

The study began by asking whether visitors *who wanted to* were managing to find the sites. This entailed some consideration of whether both *quantitatively* and *qualitatively* more diverse categories of visitors might wish to use the site. It was noticeable that certain user groups were under-represented in the visitor samples, including non-car users, disabled people, people from ethnic minority groups or areas of social deprivation. These groups are currently the focus of government policy on social inclusion. Such policies raise questions such as: if more visitors are attracted to the site – can the site cope given the limitations of its present facilities e.g. car park capacity, toilets, size of visitor centre, as well as potential user conflicts?

Site location and context

The visitor survey highlighted widely differing ratings of satisfaction with road signs, which to some extent may be related to intrinsic - and therefore difficult to alter - site factors such as road hierarchy and layout, as well as site topography.

Visitor wayfinding strategies

Visitors cited a range of wayfinding strategies which included following road signs, using road maps, OS maps, verbal directions from friends and family, landmarks and the less conventional. Awareness of the diversity of wayfinding strategies can be used both to evaluate and inform wayfinding systems.

[7] All forestry Commission sites have a motif which evokes the sense of place e.g. red feathers at Glencoe to suggest the connection with British Columbia.

Visitor expectations

Arrival signage sets the scene for visitor expectations of the site and should be designed to give some indication of the kind of forest experience and standard of facilities that visitors are likely to encounter. With few exceptions, visitors were pleasantly surprised by the range of forest experiences on offer, and associated the Forestry Commission brand with a high standard of car-parks, toilets and other recreational facilities. This suggests that good provision is not matched by good information prior to arrival.

Accessibility of information

Despite the limitations of visitor sampling in this first phase of the project, some observations and comments may be made about the accessibility of information, particularly when viewed within the broader issue of social inclusion. Information boards did not appear to cater for the needs of the full spectra of disabled people's needs, for example those with restricted mobility or visual impairment. The issue of language accessibility was also highlighted. Dual language signing in Welsh or Gaelic appeared to be a policy issue, even though this doubled up the quantity of visitor information. Some visitors queried the increasing use of symbols and pictograms, many of which were poorly comprehended, suggesting this is not a straightforward answer to language accessibility.

Development of methodology

The development of a pilot methodology comprised

A, The FC perspective

Exploratory interviews with FC personnel – Forest District Managers, recreation officers, rangers and others such as toll collectors, shop staff and car park attendants – were useful in building a 'picture' of the wider social, historical and political context of the site, and potential problems. FC experience was a valuable source of information about the sites, and the recreation officers in particular had considerable insight into site issues and user profiles. However, it was sometimes appropriate for the researchers to experience the site themselves before consulting with FC personnel, in order to contribute a fresh perspective.

B, The user perspective

An early determinant of the study was that it should be user-led, and so a key element of the study was that user perspectives and behaviour were considered first and foremost. In-depth qualitative interviews, loosely based on a Personal Construct Theory approach (Kelly, 1955) were used. This involved probing the responses of interviewees on their experiences of wayfinding to and within forest sites. By continually probing " how?…in what way…?" considerable insight could be gained into the user perspective of issues that might be overlooked by forest managers and FC personnel. In addition, by using the interviewees' own words, rather than constraining their responses to the fixed vocabulary of questionnaires, a deeper rapport was possible.

C, Observation

It was also useful to observe visitors' behaviour – how they responded to signage and how their behaviour appeared at times to contradict their responses. At QEFP, drivers were clearly observed hesitating at the main entrance from the road. At Dalby, a woman complained that there was no information in the shop, although she did not actually ask shop personnel for assistance. FC personnel at Dalby remarked that by observing visitor behaviour at 'problem' areas they were able to fine tune signage and experiment by moving or subtly changing the existing signage.

D, Route Analysis.

Using an OS map, camera, sketch book and the landscape architect's training in spatial analysis, a visual map of all the signs and the context in which they occur, was built up. This necessitated an assessment of the experience of signage at driving speed in the specific landscape setting, whether urban or countryside. Signs that appear obvious at walking speed, may not be assimilated at driving speed. A helpful approach was to study signage as a series of questions:

- at a given time what is the most important thing people need to know?
- is the sign at the right place? – visibility and legibility?
- is a sign appropriate? – content and style.

Eventually this approach led to the creation of a number of illustrative plates which analysed the experience of signage in a visual way.

E, The first-time user approach

The sites were investigated by the researchers using a 'detective-style, under-cover' approach. The researchers were provided with the same level of initial site information as the first time visitor – an AA Road Atlas and an FC leaflet (where available). This deliberately naïve approach enabled the researchers to experience sites from a user perspective.

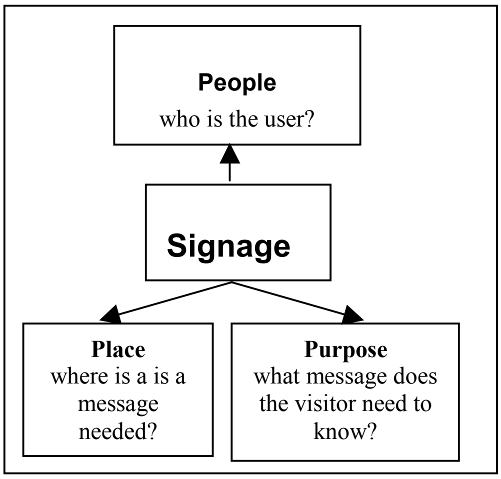

Figure 1. A signage model

Towards a signage model

A signage model (see Figure 1) was proposed to demonstrate the inter-relatedness of the various aspects of signage and wayfinding:

Recommendations for future work.

At the start of the present study it was acknowledged that this was the first phase of a larger project on forest wayfinding systems. The key issues in need of more in-depth investigation have been identified and a methodology developed that can be refined and applied to a wider range of sites. These key issues would appear to be :

- People - identifying existing, potential and 'missing' users of forest wayfinding systems within the context of social inclusion
- Purpose - identifying user information needs
- Place - identifying key locations where information is needed or can have maximum effect.

It is anticipated that the next phase of the study will comprise an 'experimental approach' and be the main data-gathering stage of the investigation seeking to address the challenge of :

i) Delivering minimum visitor information at key locations to maximum effect, in a cost-effective and appropriate manner

ii) Developing guidelines and training packages based on a refined, user-led methodology, for Forestry Commission personnel responsible for designing, implementing and evaluating wayfinding signage systems

iii) Identifying discrepancies in perception between users and providers of signage – i.e. 'goodness of fit' between the perceived information needs of forest users and FC personnel

iv) On-site signage experiments to investigate user responses to changes in signage, such as removing, moving or simplifying existing signs.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Willingness to Pay for Rural Landscape Preservation

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Abstract: In this paper we present welfare estimates from a contingent valuation (CV) study, which investigates the potential benefits derived by tourists from the implementation of a programme aimed at preserving the traditional agricultural landscape in the Protected Landscape Area Bílé Karpaty. This area belongs to the most species-rich of the Central Europe. Since 1996 Bílé Karpary has been a biosphere reserve. Our hypothesis is that the agricultural working landscape is a visual resource that is an important attraction to tourists. Here due to the current market conditions arises a danger, that farming activities will be gradually abandoned. The supply of traditional agricultural landscape, which is characteristic for this area, generates economic benefits for which farmers receive little if any remuneration. Any policy aimed at correcting this market failure and providing a socially optimal level of landscape supply needs to be informed about the social demand for this peculiar public good. In this study we estimate the value of rural landscape in the area of Bílé Karpaty for tourism. The magnitude of this form of social benefits turns out to be sizeable and would probably justify – at least in part – a conservation policy aimed at correcting current market tendencies which cause the abandonment of traditional farming practices.

INTRODUCTION

In the recent years, there has been a steady and marked growth of interest in the contribution of farming to the supply of positive externalities. In this category of agricultural outputs the provision of valuable landscapes appear to assume a particular connotation, especially when these are representing values linked to cultural heritage and regional identities that are threatened to disappear under current market conditions. In the OECD countries one of the main sources of interest in rural landscape preservation has certainly been the deep and relatively quick transformation of the countryside that took place in the post war period. As a consequence the agricultural landscape was also under transformation in this period. In the Czech Republic traditional shape of rural countryside was changed drastically due to collectivisation of agriculture. After market liberalisation in the 1990s, as a consequence of decrease of profitability of agriculture, arises danger of progressive abandonment of agricultural land in economically marginal areas, most of which are characteristic by their high value of landscape. In the recent years the attention of the general public toward the issue of rural landscape preservation has increased and generated an intense policy debate. In Europe it has been fuelled by the reform of CAP that recognised the importance of the European agriculture as a producer of positive externalities (environmental, cultural, historical and scenic). In the Czech Republic the conservation of nature is governed by the Nature and Landscape Conservation Act (No. 114/1992).

This creates the need for rural landscape studies aimed at deriving estimates of social benefits from selected agricultural landscapes in various countries. In a cost-benefit analysis should be compared with the estimated cost of supporting preservation by means of public programmes to inform public decision-making with regard to the issue of economic efficiency.

Our study presented in this paper contributes to this discussion by supplying some results from a contingent valuation (CV) survey, which investigates tourists' willingness to pay (WTP) for landscape preservation in the typical extensive rural area of the Landscape Protected Area Bílé Karpaty. In the CV scenario respondents were proposed to contribute to the special fund – exclusively destined to support those agricultural activities contributing to landscape preservation. As an alternative to this scenario respondents were proposed the landscape resulting from abandonment of the traditional agricultural activity in the Landscape Protected Area. Analysing the observed sample responses derives estimates of expected willingness to pay (WTP). From these estimates we infer the magnitude of benefits to the population of tourists in the Landscape Protected Area produced by the existing level of provision of agricultural landscape.

CHARACTERISTICS AND THE ROLE OF AGRICULTURE IN STUDY AREA

Protected Landscape Areas (PLA) are extensive areas with harmonically formed landscapes. There are 23 PLAs in the Czech Republic. Altogether they cover 13% of the territory. The conservation of nature and landscape is governed by the Nature and Landscape Conservation Act. It is implemented:

- by performing special state administration in combination with assessment activities (this gives the opportunity to make decisions in the spheres that involve landscape and nature of the area);
- by dividing the area into zones of differentiated conservation (this makes it possible to distinguish between the regime of each zone);
- by the management plan of the PLA, which formulates the actual conservation strategy and is a basis for land planning, forest management plans and other planning documents;
- programmes funded by the state (Programme for Landscape Management, River System Revitalisation Programme).

International Importance of the study area is given by the fact, that Bílé Karpaty is one of five PLA included in the world network of biosphere reserves of the MAB Programme of UNESCO. It is also included in the concept European Ecological Network as one of core areas in this network (Administration of the Protected Landscape Areas of the Czech Republic).

LPA Bílé Karpaty covers area of 715 km^2 (forest 42%, grassland 21%, arable land 28%, water land 1,2%).

The most beautiful and characteristic elements of Bílé Karpaty are flower meadows with orchids, solitary oaks and shrubs. It belongs to the most species-rich of central Europe. The picturesque landscape of Kopanice with sparse settlements in a patchwork of fields, meadows, orchards and woods is unique.

Although from the private viewpoint farming is at the margin of economic performance, it still has an important role from the social viewpoint in terms of ration of actively farmed area over the total territory of the LPA. Environmental activities of farmers considered essential for the prosperity of tourism include mowing grassland (important for protection of orchids), care for rural trail along rivers and brooks, care for pastures, preservation of species through diversified arrangement of groups of trees, hedgerows and brushwood and maintaining of typical settlements surrounded by fields and orchards. Through these activities the agricultural sector provides intermediate goods for the tourism sector, for which they are not always being compensated (Hackl and Pruckner, 1997).

HYPOTHESIS AND OBJECTIVES

Our hypothesis is that the agricultural landscape is a visual resource that is important attraction to tourists. For the purposes of this study, ”agricultural landscape” is defined as a land that is currently in use for farming. This is landscape that has been shaped by agricultural activities and includes the pattern of cultivated fields and pastures, interspersed with farmsteads and woodlands that is typical for the area of Bílé Karpaty.

Our objectives are to

- assess the importance to tourists of the landscape scenery in this area;
- identify the elements of the agricultural landscape and their importance for tourists;
- tourist willingness to pay (WTP) for the conservation of agricultural landscape;
- comparison of CVM results with TCM study conducted for assessment of validity of results.

METHODOLOGY

A variety of methods have been employed in the assessment of the recreational or user benefits derived from protected rural environments. In this paper we apply two of these – the contingent valuation method (CVM) and the travel cost method (TCM). As the CVM and TCM estimates reported are the pilot systematic evaluation of this particular site, they are important for the further study.

The logic of CV studies is that of inferring the distribution of economic benefits in a target population form statements of willingness to pay elicited from a random sample of respondents. These are asked to compare and choose hypothetical landscape scenarios described in the survey instrument. In the CV scenarios respondents were proposed to choose from two alternatives:

- to contribute to the special fund – exclusively destined to support those agricultural activities contributing to landscape preservation as to ensure the conservation of the current cultivated landscape;
- the alternative scenario is associated with the inevitably degraded landscape that will ensue from the abandonment of the agricultural activity.

As conducted study is a pilot study for further broader study of amenity benefits of agriculture in LPA Bílé Karpaty, open-ended format of WTP question was employed. Although the most popular referendum format is recommended, there has been a revival of open-ended CV studies (Bohara et al., 1998).

For the purposes of a comparison, the parallel TCM based study was conducted. As a part of the survey respondents were asked:

- - the distance they have been travel in order to access the LPA;

- - their perception of travel cost to LPA Bíle Karpaty;
- - number of visits per year and purpose of their visit.

By converting these into monetary equivalents we are able to derive alternative measures of consumer surplus.

SURVEY DESIGN, DATA COLLECTION AND ANALYSIS

The collection of primary data through surveys of Bílé Karpaty tourists and data analysis using Contingent Valuation Method (CVM) and Travel Cost Method is used for the purpose of comparison.

Survey was designed to collect these types of information:

A trip characteristics (residence, number of visits, primary purpose and estimation of cost of this trip) – Apendix – Table 2;

B value and perception information (importance of agricultural landscape elements Appendix – Table 4 and willingness to pay to conserve agricultural landscape Table 1);

C socio-demographic information (such as age, education, household income, farm background and type and place of residence) – Appendix – Table 3.

In the summer 2001 a random sample of 120 tourists was randomly selected and survey was administered in person while visiting the LPA, producing 92 useful responses. The questionnaire employed as the survey instrument was designed on the basis of information from discussion with administrators of LPA. As this was a pilot survey, other purposes were employed (improving survey draft in terms of scenario perception and communication, ascertaining the credibility of payment vehicle), to be used in the subsequent full-scale survey.

After entering the data and running initial analysis we removed cases that were from residents and business travellers Table 1 provides summary of results for the final 92 responses in our pilot sample.

CONCLUSIONS

We confirmed that landscape scenery of Bílé Karpaty is an important reason for the visits of tourists to the area: 71,74% indicated it as their main purpose of the visit. When assessing characteristics of landscape scenery, each identified landscape element was indicated to have high importance for visitors. The most valued are all types of forests (scored more then 8 point from 10) and special elements of landscape of Bílé Karpaty, which tourists cannot easy substitute. Agricultural working landscape elements were evaluated also very highly (over 7 points from 10). Estimated visitor benefit derived from this pilot CVM study is 267,99 CZK (8,11 EURO) per year. If we compare user benefit estimated from TCM study 249,10CZK (7,54 EURO) per visitor per year, this supports credibility of our estimate.

However we identified a number of problems – conceptual and practical:

- Stated travel cost should include the appropriate treating of time cost. Here we assumed time spend by travelling as a part of recreation so we did not count for it.
- The dependence between number of visit per person per year and travel cost was not significant. One of possible reasons for it is location of spa in this area, which is not that easy substitutable. This needs further study.
- Need to redesign the perception travel cost value question, as respondents included in their estimates also the cost of stay in this area.

The main problem is that we are not aggregating our results to the population of tourists to this area at this pilot stage of our study. The reason is, that we identified the lack of information about number of visitors to area of LPA Bílé Karpaty. This indicates the need to monitor tourists flow.

FURTHER STUDY

Visitors are only one group of beneficiaries from visual attractiveness of agricultural working landscape in the area of PLA Bílé Karpaty. This pilot study provides us with basic information, which we will use in our full-scale study. Here we will measure the benefits to three groups: visitors, local residents and the general public. As the benefit measurement technique we will use the Contingent Valuation Method, which allows the estimation of both use and non-use values. In addition, a small experimental Stated Preference study will be undertaken, in order to measure the relative importance to people of the different attributes of the landscape.

Variables	Mean	Standard deviation	Median
Travel cost	249,10 CZK (7,54 EURO)	167,64	189
Distance	149,83 km	100,76	105
WTP	267,99 CZK (8,11 EURO)	173,88	200

1 EURO = 33,025 CZK

Table 1: Value of agricultural landscape for 1 visitor per year, N = 92

However provision of landscape is only one of many unremunerated activities provided by farmers so more research should be aimed at valuing public goods produced by farming in recreationally valuable areas and elsewhere.

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APPENDIX

N = 92

Residence	Percent
Uherské Hradiště	11,96
Olomouc	9,78
Prostějov	9,78
Praha	7,61
Zlín	6,52
Kroměříž	5,43
Brno	4,35
Vsetín	4,35
Přerov	4,35
Others	43,48
Travel distance	
< 50 km	23,91
51 - 100	23,91
101 - 150	23,91
> 150	28,27
Means of transport	
Car	81,52
Bus	3,26
Train	14,13
Trip characteristics	
One-purpose trip to BK	73,91
Multi-purpose trip	26,09
Primary purpose of visit	
Landscape	71,74
Spa	11,96
Other purposes	16,30
Number of visits per year	
One	22,83
Two	6,52
three	9,78
Five	5,43
Six or more	3,27
No answer or less then one per a year	52,17

Table 2: Statistics of Trip characteristics

Average Annual household income	18030 CZK (546 EURO)
Average Age	38,3 years
Number of persons in household	Percent
One	10,87
Two	21,74
Three	25,00
Four	32,61
Five and more	9,78
No answer	0,50
Countryside background	47,83
Gender	
male	57,61
female	42,39
Education	
Basic	7,61
Secondary	60,92
Universities	26,72
Unanswered	4,45
Place of residence Number of inhabitants	
< 2 000	7,61
2 001 – 7 000	36,96
7 001 – 20 000	23,96
20 001 – 25 000	10,42
> 25 001	16,30
Type of residence	
Family house	44,57
Flat	51,09
No answer	4,34

Table 3: Socio-demographic characteristics

Landscape element evaluation	Average assessment (points from scale 1-10)	Standard deviation
Mixed forest	8,49	1,67
Conifer forest	8,29	2,00
Green vegetation next to water	8,23	2,10
Log wall of hayloft	8,16	1,88
Broadleaves forest	8,04	2,10
Sparse settlements in a patchwork of fields	7,82	2,38
Flower meadows	7,80	2,12
Solitary oaks and shrubs	7,64	2,28
Country roads	7,62	2,36
Lines and colours of fields	7,62	2,41
Pastures with livestock	7,6	2,34
Orchards	7,07	2,52

Table 4: The importance of agricultural landscape elements

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Customer Satisfaction as an Indicator of Social Carrying Capacity – Case Heritage Centre Ukko in Koli National Park, Finland

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Abstract: The systematic and spontaneous customer feedback from nature tourism customers is studied in the context of social capital created by social welfare services within the national park, especially the visitor centre services. The feedback is considered as an indicator of social carrying capacity. A model has been developed for assessing the impact of different options for developing services in the visitor centre or giving priority to them. The reliability of the model is studied in relation to different customer profiles. As a special case we study on site the customer's reactions and attitudes about a key responsibility issue in nature tourism development– responsibility of resources. A "Partnership in Management" experiment was created in Koli National Park, in Finland, where a local supporting association (NGO) produced 18 months visitor services in visitor centre in co-operation with the official park management organisation. According to the customer feedback the majority of visitors considered this arrangement as a very positive idea. They were also willing to pay the marginal costs, which they have caused, when using the services of the association.

INTRODUCTION

Customer feedback survey is a method for monitoring the experiences, objectives and preferences of customers (Feigenbaum 1983, Juran 1988). The feedback helps the manager of the park to develop the services and environment in a direction, which the customers appreciate. If the objectives of customers conflict with the conservation of the park, the feedback helps the manager to inform and guide the customer in the correct ways.

There are good reasons to call the visitor of the national park a customer (Powers 1988). Altogether this means that a national park is today more a centre of different services than a geographic territory:

- Parks provide today many man-made services, public and private, to visitors.
- Visitors can order these services before they visit.
- Services produce environmental impacts.
- Services compete with other similar services outside the park.
- Services are produced with labour and infrastructure.

We are now developing new concepts, theories, models and applications for monitoring the economical, ecological and social development in the context of sustainable park management (Shipp & Kreisel 2001). The question is not only the carrying capacity of the nature or in the local economy, but also the carrying capacity of social welfare of customers and local people.

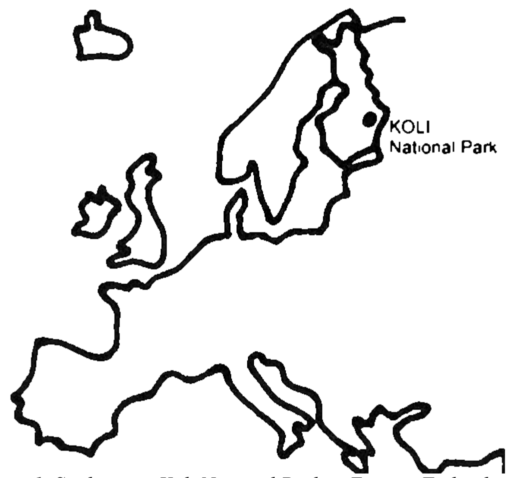

Figure 1. Study area: Koli National Park in Eastern Finland.

We try to develop and test such indicators and scales for sustainable social development of nature and culture tourism, which support the management of the park and are comparable also on similar cases in other parks. The aim is to produce a pilot model for a customer feedback system and analyse the data gathered with it as a case study. As a special case we study the impact of change and the impact of a new concept in providing services. Special attention is paid on a new approach of partnership in management and customers responsibility of resources, which is tested in the profile of a new visitor centre.

Koli National Park in Eastern Finland, with an area of 30km² including a modern visitor centre, is a site for developing methods and models for customer satisfaction monitoring. With 120 000 customers annually, it is one of the most intensively used nature tourism areas in Finland (Lovén 2000).

MAIN CONCEPTS

Customer satisfaction in the national park reflects social values created by park nature and services. These values can be seen as a part of so-called *social capital* or the collective welfare of society. Social capital is an important form of capital, which produces and indicates benefits for private persons (Burt 1992), groups of people (Coleman 1961, Coleman 1990) as well as the whole society (Putnam 1993). The maintenance and sustainable development of this capital is an important part of the strategy of a national park.

The description of a concept for the social capital produced by a national park and modelling the process is very necessary for successful planning and management for sustainable development. The feedback from customers reflects this process. Customers are in a way a group of partners within a park in the network of park management. The confidence of customers on the motives and methods of park management is an important indicator of the balance in social capital (Anttiroiko 1996, Fukuyama 1995).

The indicators used in the feedback collection can produce information at least from the following items:

- Customer satisfaction about some services produced in the park.
- Customers confidence on the values controlling the management.
- Customers willingness to act as a responsible partner in park management.
- Conflicting interests among subgroups of customers.
- Conflicting interests among visitors and locals.

The key role in developing sustainable tourism lies on the customer; how he recognises his *responsibility* as a member of society to maintain the attractions of park (Lucas 1993, Harrison & Husbands 1996, Ireland 1997). The ecological carrying capacity is higher if the customer makes efforts to save the soil on trails when hiking over eroding landscape. The responsibility or the lag of it can be seen in actions and attitudes of customers. A special case under the budget constraints, which parks are today facing all over the world, is the possible actions and feelings, which the customers have about resources. Do they consider parks as all free public goods or do they accept the idea of users responsibility of resources?

METHODS

Customer Feedback Monitoring System (CFMS) produces systematic information for monitoring the development of social capital. In Koli National Park the CFMS includes the following parts:

- Spontaneous stratified and open feedback on a questionnaire in visitor centre.
- Systematic stratified and open feedback on a questionnaire in visitor centre.
- Spontaneous open feedback received orally in visitor centre or via email through internet pages.

The frame of reference consists of a dynamic situation, where a nature tourist visits a park and uses and evaluates environments, services and information. These interactions reflect themselves in the global welfare of the customer. This state of welfare is a part of visitor's personal social capital and it is applied by using the approach of measuring customer satisfaction. The social capital produced by the park is the cumulative level of all customer satisfactions. The global level of customer satisfaction is formed through partial satisfactions, which explain or predict the global satisfaction.

The subjective features of customers, his/her activities, details of the situation and many environmental factors naturally make their impact in the final level of personal customer satisfaction. However it would be practical if the indicators of satisfaction were not too sensitive for these highly varying factors. The function for the global customer satisfaction is as follows in model 1:

(1) $GS = f(S_{1\text{-}n}, P_{1\text{-}n}, A_{1\text{-}n}, E_{1\text{-}n}) + e$, where

GS = global customer satisfaction,
S = partial customer satisfaction,
P = subjective features of a customer,
A = activities on site,
E = environment,
e = random error.

The global satisfaction of customers for the park services is a combination of different partial satisfactions to be gained through the different services, which the customer has used during their visit. All customers do not use the same combination of services. In Koli National Park these services are as follows:

- Guidance and information
- Programs
- Education
- Congress
- Accommodation
- Restaurant
- Nature-shop
- Outdoor equipment rental
- Downhill and cross-country skiing
- Transport
- Harbour
- Roads and trails
- Telecommunication

The partial satisfaction of customers can be analysed and then to be combined of smaller details. Like the service called ”guidance and information” we can find following subgroups:

- Signals and guideposts
- Oral information
- Exhibitions, (permanent)
- Exhibitions, (temporary)
- Digital databanks
- Library
- Interpretative slide programs

The indicators to be used are so called school-evaluation scores with 7 classes between 4 (minimum) and 10 (maximum). The scale is well known to visitors, who in this survey are all Finns. In psychological studies (Cliff 1966) the scale is considered as an interval scale, which supports calculations of means, variances, correlation and regressions under normal statistical prerequisites (Draper & Smith 1966).

Experiment of partnership and customer responsibility

The manager of a national park (Koli NP) makes a temporary contract for 1,5 years with an association (NGO) supporting the conservation and management of the park. The government provides funds for the technical maintenance of the visitor centre as an environment for guidance and information services. The NGO produces mainly the human services for customers. According to the contract the NGO has the right for funding the services via resources, which it may gain by collecting voluntary contributions from customers (Ukko´s Pass – passport to the Heritage Centre Ukko) or selling some services and goods (exhibition guidance, slide shows and nature-shop products) to customers. The needed resources are altogether about 200 000 €, where government takes the responsibility for 33 % and the NGO 67 %. The NGO activates voluntary work for the services, but to be able to fulfil the contract and do its part of the services, it has to pay salaries or commissions to the guides, who are local enterprises and their workers (altogether 6 people).

Information about the Ukko´s Pass focuses on the customer’s personal responsibility to support the NGO´s services as a private partner of the project. The owner of the Pass has special rights like free entrance to the centre as a partner of the network for one day up to one year. By buying the Pass the customer shows his/her moral contribution for the guidance service, which they see valuable as a partner of the process.

SOME SELECTED RESULTS

Altogether 367 spontaneous classified feedback questionnaires were received in the opening year 2000 being 1,3 % of the number of all customers (28 854), who visited the Heritage Centre Ukko, when it was running services from 15.7.2000-31.12.2000. The customers did not evaluate all the services in one time, mostly because they did not use them all during their visit. The most actively given feedback focused on the tidiness of the centre evaluated by 76 % of visitors. The library, which was under continuous development during the whole season, was evaluated by only 26 % of visitors.

The slideshow was evaluated by 62 % of feedback, but only 37 % of the customers actually watched the slide show. This means that active customers also responded actively and spontaneously.

Partial benefits

According to the feedback it is clear that customers are highly satisfied with the tidiness of the centre and the slideshow (Table 1). The library clearly satisfies less of the customers. The amount of deviation and rate of strong criticism (grades 4-5) gives us more information about the variation of customer satisfaction and the potential seriousness of conflicts to be handled in park management.

Service	Mean	Std. Dev.	Median	Grades	n
Tidiness	9,3	1,1	10	1,8	281
Slideshow	*9,0*	*1,4*	*9,5*	*4,4*	*229*
Oral guidance	*8,7*	*1,4*	*9*	*5,2*	*230*
Exhibitions	*8,6*	*1,3*	*9*	*3,5*	*259*
Internal signs	8,5	1,3	9	2,9	205
Nature Shop	*8,3*	*1,4*	*9*	*5,2*	*232*
Congress services	7,9	1,9	8	13,7	73
Library	*7,2*	*1,7*	*7*	*17,2*	*93*
Total evaluation of services	**8,8**	**0,9**	**9**	**1,3**	**230**

Table 1. Evaluation of services in Heritage Centre Ukko in 2000, school score (4-10).

SERVICE	COEFFICIENT	Std. error of coefficient	P	BETA
CONSTANT	2,853	,353	,000	
EXHIBITION	,296	,041	,000	,412
INTERNAL SIGNS	,249	,045	,000	,342
ORAL GUIDANCE	,144	,038	,000	,223
R2 = 0,647 F= 94,57, P=0,000				

Table 2. Model forecasting the total customer satisfaction for the services in the centre; stepwise regression model (n=105).

Total benefits

The total evaluation of all services is a function of partial services (benefits) and some other factors (see model 1). For better understanding of the partial benefits a stepwise regression model was calculated (table 2). Some of the services (like tidiness and the slide show) were evaluated to be of such a high quality that they did not provide any more potential for higher total satisfaction from the services. The most important partial benefits can be reached by developing the exhibition, guiding signals and oral guidance in the centre. With limited resources the investment into the quality of exhibition is the most promising potential for increasing the total satisfaction for the services in the centre. According to the beta-coefficient a small positive change in the customer satisfaction due to the exhibition produces 1,8 times stronger impact in the total satisfaction than a similar change in the satisfaction for the guiding signs.

Trends

The customer satisfaction upon some partial services developed positively from the summer to the end of the year. In midsummer several thunderstorms were attacking the area and electrical problems were disturbing the slide shows and exhibitions. These problems did not occurred in the late autumn and in the early winter. The library was under development during the whole season. These positive customer satisfaction trends were statistically significant (1-way variance analyse, F-test, p=0,013-0,035).

Customer qualities and satisfaction

The female customers evaluate the guiding services systematically higher than the men do. This can be recognised in the mean level of satisfaction and also as a smaller variance on evaluations. All the other tested customer qualities (educational background, quality of dwelling environment, earlier knowledge of the park) did not have any correlation with the evaluations.

Customer responsibility of resources; response in satisfaction

Customer feedback about the Ukko´s Pass is an expression of the suitability of the concept, but also it reflects his/hers opinion of the exchange ratio; does he/she get the right quantity and quality of benefit when supporting the guiding by the NGO association in the Heritage Centre. The question of the Pass was clearly considered an interesting issue to the customers; 86% of the customers who gave the feedback answered to this question, which is more than to any other feedback question.

The feedback about the Pass was predominately clear and positive (Figure 2). The Mean of evaluation rose to 8,3 in school grades and std. deviation was 1,78 (n=316). Median evaluation was 9. However 11 % of customers were not satisfied with the model (grades 4-5) although 58 % evaluated it as very good (grades 9-10).

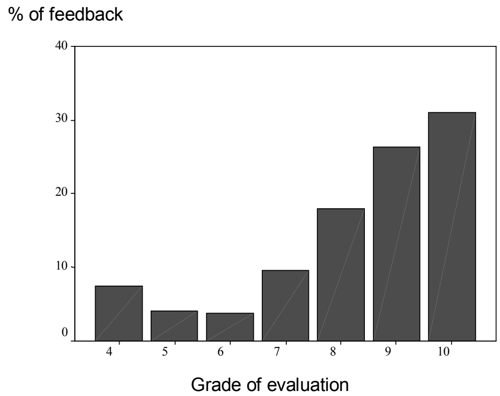

Figure 2. Feedback about Ukko´s Pass in 2000.

The trend in the Pass feedback was positive during the monitored season 2000. Also the rate of customers, who actually were willing to buy the Pass increased from 28 % in August up to 50 % in October-November. Feedback from women took the Pass concept in average more positively as the men customers (analysis of 1-way variance, F-test, p=0,015). The females accepted the idea in the very beginning and their feedback was very positive during the whole period. Feedback given by men changed during the period from slight criticism to equal positive evaluation like women (khii2-test, Pearson p=0,001, n=316). Only a few extreme customers expressed strong criticism still at the end of the year 2000.

CONCLUSIONS

When trying to make plans for socially sustainable tourism development in national parks, we need a lot of theoretical work to find the proper context and models describing the phenomenon. The right indicators for qualifying and quantifying the social capital are the critical tools in the approach to developing models for sustainable tourism planning. The valid frame of reference is the key for finding them. When developing our model we noticed that the global benefit/partial benefit -model (Kangas 1992), which is commonly used in welfare economics, can produce a valid approach for evaluating total customer satisfaction as a function of partial customer satisfactions.

Spontaneous feedback monitoring includes possible problems for right conclusions, especially when using averages, because some small active group can ruin the representative sample. Therefore a systematic sample is needed for controlling the validity of data. In our data the share of female customers in the year 2000 was significantly higher than in the 3 years before the development project. However in the year 2001 the share of women was equal in both the spontaneous and systematic sample. The difference in the year 2000 can be explained by the higher curiosity quality of women; the female customers came to test the new services more actively than men did. Later on the women took the family with them and the rate of men customer rose slightly but significantly. According to the systematic sample the feedback activity was equal among men and women.

The level of benefits gained in using visitor centre services is different for female and male customers. The female customers seem to gain higher social capital than the male customers. Later on we shall analyse the dynamics of this relation. It may be difficult to conserve the very high social capital; a hypothetical threat is that a small change of the quality of services may cause a large loss in customer satisfaction.

Also interesting was the observation of other studied background factors like education, environment of home, motive for visit or former familiarity with the site. These did not have any impact on the customer satisfaction. All the studied subgroups of customers evaluate the quality of services with similar mean and variance pattern.

All the distributions of evaluations however were statistically non-normal (Kolmogorov-Smirnov-Lillefors test, p=0,000). Some of the services were evaluated with j-curve pattern with two tops and some had almost normal distribution. The j-curve pattern informs about a possible conflict, which can cause severe losses in the social capital if not controlled carefully. According to our practical experience it seems to be possible to control the conflict if the portion of the extremely negative feedback stays below the level of 10 %. This underlines the need to also monitor carefully the extreme feedback, because there can lie the option for open and warm conflict, which ruins a lot of carefully maintained social capital.

The school-evaluation score is a practical tool for measuring the customer satisfaction. It is familiar and illustrative, that the customer can easily find the verbal connection with numbers in his/her mind and the 7 step score is effective in short-time questionnaires. For planning of sustainable development of tourism we however to make need decisions about the acceptable level of customer satisfaction. It is not possible to produce all the services for the different groups of customers under the satisfaction grade 9. In park management we have to be able to set the target to a reasonable level. For instance, we can use a set where the total satisfaction is minimum on the grade 8 (good quality) and all the services are evaluated at least to be on grade 7 (satisfactory quality) and the group of grades 4-5 (extremely critical customers) is less than 10 %.

The case study in Koli National Park is suggesting that the visitor centre is a proper concept to create and maintain social capital. Almost all the partial services in the centre are evaluated on grade 9 or higher in median. The experiment to develop a partnership-oriented service model for the visitor centre including an approach for customer's responsibility of resources turned out to be a success.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Objectives and Basis of Management of Visitor Flows in the Biosphere Reserve Vessertal/Thuringia Germany

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Abstract: The biosphere reserve Vessertal (Biosphärenreservat Vessertal) is one of the two oldest biosphere reserves in Germany and represents a characteristic part of the central European highlands. It is part of the Thuringian Forest (Thüringer Wald). In this region nature based tourism is very traditional. Since 1999 the increase of touristic offers in combination with the development of more touristic infrastructure caused a variety of activities in visitor management. A first step was the definition of the aims of visitor management. The discussion showed soon that visitor management in the Vessertal should include more aspects than the protection of species and biotops. Nevertheless the survey of sensitive habitats and species is an important basis for all further steps towards a concept of sustainable development. Finally, the first results of a project of reducing the present network of touristic trails are presented.

THE BIOSPHERE RESERVE VESSERTAL INTRODUCTION

The biosphere reserve (BR) Vessertal is located in the middle of Germany in the federal state of Thuringia. It represents a characteristic landscape of the Thuringian Forest. This densely wooded low mountain range is extending from west-northwest to east-southeast. It is part of a chain of central European highlands which are predominately covered from coniferous forests like Thüringer Schiefergebirge, Frankenwald, Fichtelgebirge, Erzgebirge and Oberpfälzer Wald to the Czech Böhmerwald. The biosphere reserve Vessertal is one of the two oldest among the 14 recognized biosphere reserves in Germany (first recognition 1979).

The BR Vessertal has a total area of 17000 hectares. To fulfill the different functions of a biosphere reserve, the BR is subdivided into a core area (279 hectares), a buffer zone (2175 hectares) and a transition area (14546 hectares).

The landscape is quite varied. It is characterized by predominately big woods, partially dominated by beech, mainly by spruce, mountain meadows in the narrow valleys and the surroundings of the villages, fens in the upper regions and a dense net of streams.

The main land use in the Vessertal region is forestry and tourism. Agriculture is on a very extensive level. Most of the greenland is subsidized by management agreement in combination with management restrictions.

Land use	Area (hectare)	Area (%)
Woods	14960	88
Grassland/Greenland	1530	9
Waters, dams	119	0.7
Fens	34	0.4
roads, settlements, tourism facilities	323	1.9
Complete	**17000**	**100.00**

Table1: Land use in the biosphere reserve Vessertal

The following table shows the main habitat-complexes in the BR Vessertal (Table 2).

Tourism has a one-hundred-year old tradition in the area. After World War II the Thuringian Forest became one of the most important vacation regions in the former GDR. A corresponding touristic infrastructure (hotels, vacation homes, hiking trails, cross-country ski trails, ski lifts) had been established at that time. The touristic accommodation in the 80´s were up to 500,000 days / year.

After the reunification (1989/1990), at first the overnight stay numbers declined significantly (ca. - 60%). Since then a specific increase can be measured.

Habitat complex	Indicator species
Intact fens, well-structured mountain greenland, woods with plenty of blueberries, cranberries, mountain ashes and birches	Black Grouse, Common Redpoll
Maturity and decline phases of woods with high share of dead wood, bright forest fringes inside the woods (e.g. along ways)	Gray-headed Woodpecker
Woods rich in structures with big old trees, cave trees, and complexes of dense undergrowth	Eurasian Nut-cracker, Black Woodpecker, European Sparrow Hawk, Teng-malm´s Owl, Pine Marten
Woods with rocks	Eagle-Owl
Large undisturbed wood-lands, wetlands and mountain creeks	Black Stork
Mountain sprucewoods rich in structures and with numerous species of birds	Eurasian Pygmy Owl
Layered beechwoods, rich in structures	Common Wood-Warbler, Salamander
Hedges rich in insects and hedgebanks in contact with open landscape	Yellowhammer, Red-backed Shrike
shores of little streams rich in insects, wetlands	Kleinäugige Wühlmaus (Microtus subterraneus) Große Wasserspitzmaus (Neomys fodiens)
Clean streams with pebble covered bottoms	Bullhead (Cottus gobio), Common Kingfisher, White-breasted Dipper

Table 2: Habitat complexes and Indicator species of the biosphere reserve Vessertal (Lange 1995; modified)

The reunification of Germany has basically changed the social framework conditions. Because of the extensive decline of workplaces in the industry (e.g. glass industry) tourism is considered to be the most important income source for the communities. At the beginning of the 90´s, the decline of tourists initiated numerous activities to improve the touristic infrastructure and to increase the number of tourists.

Numerous hiking trails were signposted. Many of these touristic activities were not coordinated adequately with each other. In many cases the required approvals were lacking. The activities also led increasingly to impairments of sensitive areas in the BR.

The protection of ecosystems, the development of sustainable land use, public relations, environmental formation, research and environmental observation, are the main tasks of the biosphere reserves. This conceptional approach of the biosphere reserves goes beyond the tasks of "classic" protected areas like landscape or nature protectorates (LSG, NSG). Therefore, different activities in tourism management had been started since 1999.

OBJECTIVES OF VISITOR MANAGEMENT

The objectives of visitor management have been discussed with communities, tourism-specialistes, local authorities, forest administration, farmers, hunters , water authorities and different NGO. The results of this discussion have been documented in a study (Kleine-Herzbruch, 2000). The extended approach of the biosphere reserves was taken into consideration.

Visitor management in the BR Vessertal should contribute to the support and further development of a sustainable tourism. This goal shall be accomplished by the following aims:

- Fixation of different types of areas, which are suitable in a different manner for the development of tourist infrastructure
  - Protection of attractive but very conflict laden and sensitive areas by rechannelling touristic flows in attractive but resilient areas
  - Disentangling and reducing of the dense network of touristic trails
- Support and creation of a traffic conducting system and an improved and well circulated public traffic system
- Development and arrangement of the tourist infrastructure and their supply on the target group of the nature and culture vacationists
- Support and creation of ecologically acceptable forms and possibilities of the education, information, and relaxation for vacationists and tourists.

The main goal (the action frame) is the common planning or coordination of measures in the biosphere reserve among all involved. In future the aspects of the traffic and the education shall be included intensively into consideration besides the interests of the tourism and the nature conservation in the biosphere reserve Vessertal. Additionally the interests of agriculture and forestry, water-management and hunting also have to be especially taken into account. By the inclusion and the cooperation with all ones involved in the region the goals formulated jointly shall be accomplished.

BASICS OF NATURE CONSERVATION AND VISITOR MANAGEMENT

Methodic Procedure

For the ascertainment of the basics of nature conservation all available documents were compiled and the newest surveys and studies have been analysed. The following method has been worked out:

Analysis and documentation of the legal bases

↓

Ascertainment of the objectives of nature conservation in the BR

↓

Ascertainment of disturbance sensitive species in the BR

↓

Ascertainment of disturbance sensitive areas in the BR

↓

Determination of the impairment intensities and the spatial effects of touristic activities

↓

Determination of conflict areas between tourism and conservation

↓

Developing of steering mechanisms for a sustainable tourism

Analysis and documentation of the legal bases

The legal bases for the complete biosphere reserve or for parts of it (BR-ordinance, FFH-areas, ordinances for nature protectorates (NSG), protected landscape parts (GLB) or protected natural monuments (FND)) deliver a first frame for the visitors' guidance. The aims formulated in these ordinances serve as orientation frames for the fixing of species and biotope protective measures. A listing of commandments and bans primarily in the core area and buffer zone but also in transition area III delivers first concrete restrictions (for e.g. there exists a way commandment in the zone II).

Ascertainment of the objectives of nature conservation in the BR

In the context of the ascertainment of the objectives of nature conservation in the BR existing reports and plannings were predominant evaluated besides the analysis of the legal bases.

The most important studies have been:

- the outlines of the species and biotope protection program (ABSP) for the administrative districts Hildburghausen and Ilmkreis (Büro für ökologische Studien, 2001, Büro Bettinger, 2001)
- the outline of the environmental quality aims for the BR (Büro für ökologische Studien, 2000)
- the outline of the subject report for the frame strategy for the BR Vessertal (Ringler, 1999)

Ascertainment of disturbance sensitive species

The ascertainment of disturbance sensitive species in the BR was carried out on the base of specialized Literatur. Furthermore new studies have been analysed:

- the Species- and biotop-protection-programm (ABSP) including all existing primary dates (species-survey-programm (AEP), biotop mapping-programms)
- the subject report for the frame strategy (Ringler, 1999)
- the botanic and faunistic publications at present available

An analysis of publications about the negative effects of tourism and outdoor-activities on disturbance-sensitive species and biotops was the basis of the fixation of sensitive areas (Ammer, U. & Pröbstl, U., 1991; Coch, T. & Hirnschal, J., 1998; Hölzinger, J. et al. 1987; Kuhn, J., 1984; Kuhn, J., 1987; Lerch, A., 1999; Mader, H.J. & Pauritsch, 1981; Münch, D., 1989; Münch, D., 1992). In a first step, all threatened species of the red data books of Thuringia and Germany had been focused. In a second step a selection of those species took place, which are threatened by tourism and outdoor-activities. The red data books hardly give answer to this kind of question, as the reasons for the endangerment of these species and biotopes aren't analyzed in detail. In many cases it is the interaction of different causes which lead to a decline of a species. Conservation experts generally assume that the current management of agriculture and forestry is the main reason for the threat of species in Germany. They also mention tourism and outdoor activities as the third important cause (Korneck and Sukopp, 1988). Since the procedure introduced here shall be practical oriented, only two grades of intensity were distinguished at the assessment of the disturbance sensitiveness.

The distribution of some selected disturbance sensitive bird species shows the difference between actual zones of the BR and sensitive sites (see fig. 1). In order to find out very sensitive sites, the selected species have been categorized relating to their disturbance sensitiveness (explanation of the categories see above):

Black grouse (2), kingfisher (1), black stork (2), sparrow screech owl (1), eagle-owl (1), water blackbird (1), salamander (1).

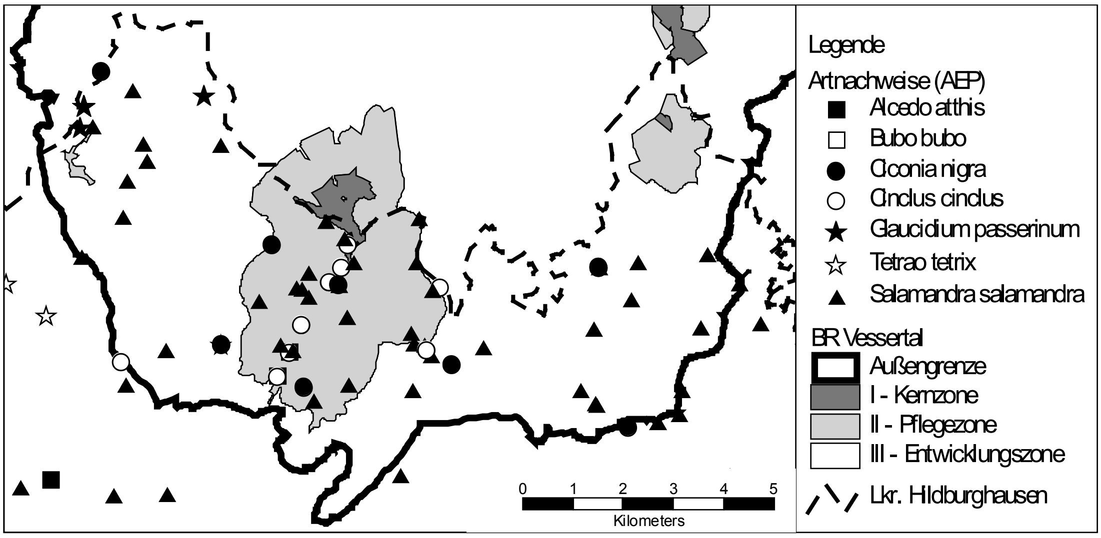

Fig. 1: Distribution of selected disturbance sensitive species in comparison to the zones of the BR in the county (Landkreis) Hildburghausen (Data basis: Thüringer Arten-Erfassungsprogramm (AEP))

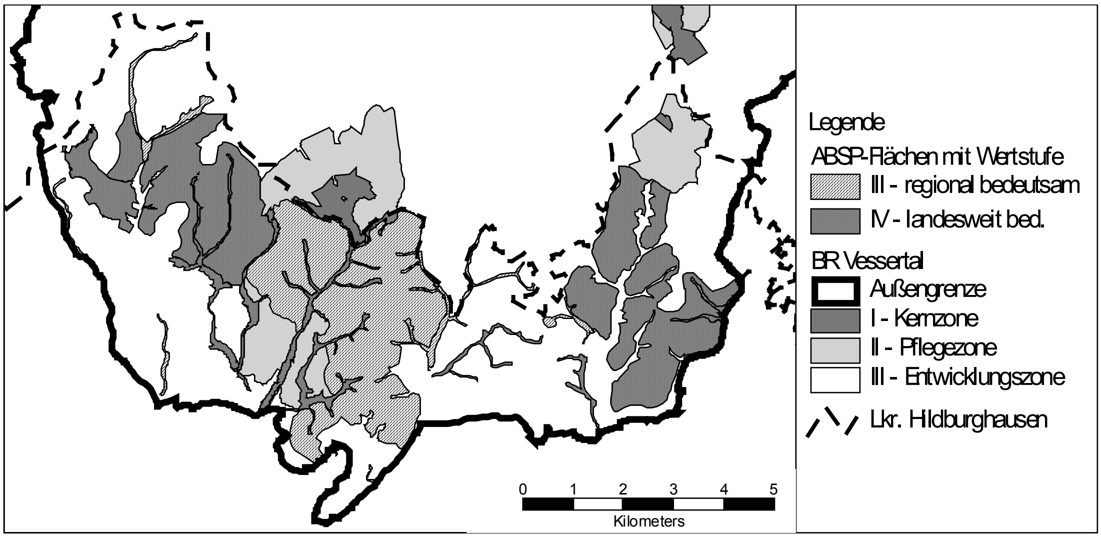

Fig. 2: Areas of nationwide or regional importance for the conservation of important species and biotops in comparison to the zones of the BR
(Data basis: Arten- und Biotopschutzprogramm (ABSP) Thüringen, Landkreis Hildburghausen)

Categorization of the disturbance sensitiveness of species

= (1) disturbance sensitive

(Attractive species like orchids, losses in the traffic e.g. mammals)

= (2) very sensitive to disturbances

(red list 1 species, extremely sensitive to disturbance, e.g. black grouse, black stork;)

Ascertainment of disturbance sensitive areas in the BR

The ascertainment of disturbance sensitive areas in the BR was carried out after an evaluation of the above-mentioned species and biotop protection program (ABSP) as well as the available specialized literature. This evaluation gave hints about the disturbance sensitiveness of single species from certain species groups like mamals including bats, amphibians, reptiles and fishes. Ecological function areas (ABSP areas) were derived on the base of the habitats from the point proofs of species. These areas were subdivided into four categories from “IV” (nationwide important) to “I” (locally important) till according to a certain assessment method (ABSP). Nationwide and supraregional areas are meaningful for the visitors’ guidance.

Ascertainment of the impairment intensities and the spatial effects of tourist activities

The impairment intensities and spatial effects of tourist activities have been represented separately in tables. The information listed there serves as a basis for the assessment of the intensity of threatening for species and habitats, sensitive to disturbance at present.

Determination of conflict areas between tourism and conservation

The ascertainment of conflict areas between tourism and conservation delivers decisive argumentation aids for the execution of visitors' guidance measures (see the following chapter).

REVISION AND COORDINATION OF THE NETWORK OF TOURISTIC TRAILS – FINDING SOLUTIONS BY PARTICIPATION

The basics of nature conservation could be used in a previous project, the "revision and coordination of the touristic trails." Conservation technical aspects were not the single aspect, focussed at this project. According to the aims of the visitors' guidance, the interests of municipalities, forestry, farming and others were taken into account. Due to the high percentage of public owned forests, the project has been carried out in close cooperation with the forestry commission. The involved parties emphasized different aspects in the processing: From the point of view of nature conservation there was too much disturbancein the nature protectorates (NSGs) and in other disturbance sensitive areas. The forestry commission considered the touristic trails as too dense. Municipalities complained that correspondence of signposts of trails and the description in the trail maps and leaflets was insufficient.

Based on the aims of the visitors' guidance the following objectives (see above) were coordinated for the project:

- Disentangling of the existing multiple use of pathways (hiking, skiing, riding, biking)
- Optimization of the touristic trails
- Coordination with the interests of forestry and hunting
- Consideration of conservation technically sensitive areas
- Defusing of conflicts primarily in the nature protectorates
- Improved correspondence between the touristic trails and trail maps and leaflets

The implementation of the project was carried out in five steps in 2000 and 2001:

- Information of the ones involved
- Analysis of the situation
- Discussion and coordination with administration of the municipalities
- Documentation and presentation of the results
- Putting into action

The information of the ones involved was carried out in writing. Furthermore there were meetings and discussions with the mayors of the municipalities. The public was informed through the press.

In a first step the network of touristic trails was analyzed and drawn into maps (scale 1:10,000). Important informations concerning forestry (woods tenure, forestry roads, game reserves) were investigated oder determined. The Thuringian forest authority assisted with plans of the forestry roads ("Waldwegefunktionsplanung"). The conservation technical interests were arranged according to the methodology (protectorates, species and habitats, sensitive to disturbance). Based on this (maps 1:10,000) conflict areas were defined.

In cooperation with the forestry commission and the biosphere reserve administration proposals for the solution of conflicts have been worked out.

The discussion took place separately in each community. In cooperation with tourist tourist information offices, farmers and game tenants, forestry authorities, the District Office, the conservation authorities, the association nature park Thuringian woods (Verband Naturpark Thüringer Wald) and with NGOs and private owners (e.g. restaurant operators) different suggestions were considered and coordinated. Proposals, which were not agreed on, were further revised till conjoint solutions could be found. Compromises partly were necessary. Altogether, ca. 80 advices took place with more than 70 representatives of the communities, institutions and NGOs. The project goals could be accomplished. A reduction and breakup of the tourist way net could be agreed conjointly.

In August 2001 the results were presented to the public under participation of the ones involved. All involved parties agreed on implementation of the proposal.

In fall 2001 implementation started. Implementation includes actualisation of the network of trails (predominately rebuilding, construction of a few new trails), signposting, the revision of the trail maps and leaflets and the update of the information panels in the area.

In 2002 an evaluation is scheduled, including all partners involved. Then we have to search for further solutions in case of obvious problems, occurring during implementation. If necessary, further measures of the visitors' guidance have to be discussed.

PRESENTATION OF THE RESULTS CONCERNING THE NATURE PROTECTORATE (NSG) "MARKTAL UND MORAST".

The nature protectorate "Marktal und Morast" has a size of 205 hectares including a core area of 100 hectares. This NSG is a characteristic part of the uplands and the northern slopes of the Thuringian woods with little plains and deep valleys, the slopes covered with mountain beech woods and mountain sprucewood in the edge area of a moorland area.

The analysis of the actual state showed the following aspects:

- most of the touristic trails are used in multiple ways (hiking, biking, skiing)
- at the edge of the nature protection area (Dreiherrenstein) there isn't any clear way due to numerous tracks
- in the Marktal there is a hiking and biking trail crossing through the core area
- in the leaflets this trail is indicated as a Mountain-Bike trail
- a second path through the core area (from the Dreiherrenstein to the Schortetal) is used as a forestry road (that can be used by trucks).

The analysis of the conservation technical bases led to the following statements:

Legal bases:

- in accordance with the biosphere reserve ordinance there is a way commandment in zone II (NSG);
- in the core area it is forbidden to carry out any economic activities as well as to impair the area in any way;
- the forestry road is granted by law.

Conservation technical aims and models:

- Support of a sustainable tourism

Disturbance sensitive species:

- The NSG is a breeding area of the Eurasian Pygmy Owl, the Teng-malm´s Owl and black woodpecker. It is a food habitat of the Black Grouse and the black stork

Disturbance sensitive area: the complete NSG

Intensity of the impairment:

- the path through the Marktal (core area) attracts only a few hikers and bikers
- the Marktal attracts only few tourists
- the second path through the core area (from Dreiherrenstein to the Schobsetal) is a forestry road of a certain importance for three forestry offices
- for tourists this trail is a main connection from the Rennsteig to the settlements at the mountains edge
- Tracks on the edge of the NSG (at the Dreiherrenstein) show a frequent use of this part of the Rennsteig.

Conflict areas:

- Pathway through the Marktal (core area)
- Pathway in the direction of the Schobsetal (core area)
- Pathway (at the Dreiherrenstein) in the area of the tracks (on the edge of the NSG)

The network of tourist trails was revised as follows:

- the multiple use has been reduced. At maximum two interested groups were put on a way
- the trail, traversing the core area through the Marktal was eliminated.)
- the pathway through the core area (Dreiherrenstein - Schobsetal) remains since it is an important way for the forestry and tourism.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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NATURA 2000 - The Influence of the European Directives on the Development of Nature-based Sport in Mountain Areas

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Abstract: In the counties of the European Community the influence of European directives is increasing. Especially the directive on the conservation of natural habitats and of wild fauna and flora (European Council Directive 92/43 EEC from 1992) and the directive on the conservation of wild birds (European Council directive 79/409 EEC from 1979) are expected to have an influence on the development of nature-based sport. Most of the sport organizations in Germany are expecting negative consequences for their future development concerning nature-based sport in mountain areas. Based on a study of the German sport association possible consequences are analyzed and discussed.
This project gives guidelines for the application and interpretation of these directives, the practicable use and management. The study shows that concerning a possible deterioration three types of sport and recreational activities have to be differentiated. Further more sport events must be evaluated in the future. At least the role and task of the management plan for NATURA 2000 areas is discussed. The management plan helps to choose suitable measures, helps to solve conflicts and to rise the acceptance and transparency for the public. It is demonstrated that the consultation and participation of local people including members of sport and recreational organisations is necessary to reach the best result for the nature conservation and conservation of endangered habitats or species.

INTRODUCTION

In the countries of the European Community the influence of European directives is increasing. Different directives have to be integrated into national law, regulations and administrative provisions.

In the focus of interest are

- the European Council Directive 92/43/EEC of 21. May 1992 on the conservation of natural habitats and of wild fauna and flora
- and the European Council Directive 79/409/EEC of 2. April 1979 on the conservation of wild birds.

The Directives 92/43/EEC and 79/409/EEC will build up an European coherent ecological network called "Natura 2000". Even most member states still have to classify additional special protection areas, the obligations of the Directives have to be considered.

These directives are expected to have an influence on the development of nature-based sport. In the alpine area and other sensitive habitats which are attractive for sport and touristic activities as well as for nature conservation purposes conflicts are increasing.

So the nature park planning for the "Nature park southern black forest" (see fig. 1) shows that those areas, which are suitable for the winter sport, also are most valuable for nature conservation purposes.

An inquiry of different sport organisations in Germany showed that most of the Sport associations have had negative experiences with these directives. They are all expecting further restrictions and regulations for the nature based sport or outdoor recreation.

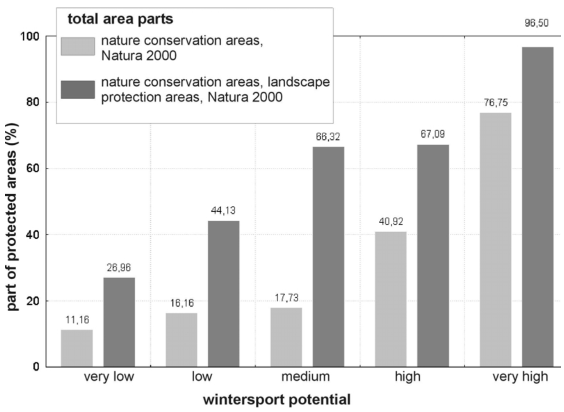

Fig. 1: In the Nature Park Southern Black Forest most of the suitable areas for winter sport are very valuable for nature conservation purposes (Roth et al .2000)

Therefore the German Sport Association commissioned together with the German Ministry for Environment a special study "Natura 2000 and Sport". Within the study, the possible consequences on the sport were analysed and recommendations for the practical use delivered.

Following we show some of the main results of this study concerning:

- the conception for the protection of biotopes and species
- the deterioration
- the FFH-assessment and
- the management plan.

CONCEPTION FOR THE PROTECTION OF NATURAL HABITATS AND SPECIES OF COMMUNITY INTEREST

For the sport associations and the general public it is mostly unknown, that the directive´s protection conception differs much from those in a traditional protected area. In a nature conservation area the decree is regulating all activities which are forbidden. Those restrictions are binding everywhere inside the frontiers of the protected area. For those regulations it is not important whether in each part of the protected area sensitive species or habitats can be found.

In the opposite the protection in Natura 2000-areas does not end automatically at the frontiers of the area. For the species and the natural habitat types protected by the European directive even a disturbance or an impact outside is not allowed, if the circumstances and the conservation status could get worse. But on the other hand not every impact – even inside the protected area Natura 2000 – is forbidden. It is possible if a favourable conservation status of the natural habitat types of the species of common interests can be preserved.

That means for the sport in sensitive mountain areas on one hand more freedom, on the other hand more responsibility if there are no traditional protected areas, but Natura 2000 areas.

DETERIORATION

In the Natura 2000-Gebiet a deterioration hais to avoid. The scope of the FFH-directive is not only concerning plans or projects. It is also applicable to the performance of activities like sport and recreation in the landscape which do not necessarily require prior authorization.

Concerning nature based sport and recreation activities it is therefore to define what are activities, impacts and disturbances that may cause such a deterioration.

In actual publications in the research field of recreation, sport and environment a very critical view is dominating (see Pröbstl 1998, Ammer et al. 1991, Seewald et al. 1998, Schemel et al. 2000). Furthermore it is criticized that sport and recreational activities get more and more separated.

Therefore and in this context we propose to divide the recreational activities into three different types:

- activities depending on infrastructures (Type 1) like downhill skiing or golf,
- activities depending on special attributes of the landscape (Type 2) like climbing, canyoning or rafting and
- activities without any special facilities (Type 3) like hiking, horse riding or biking.

Activities of **type 1** often are not expected to lead to conflicts. If the facilities in the Natura 2000-area had been installed before the ratification of the directives they can be used as before. The visitors or sportsmen depend on these facilities. Therefore they can easily be managed by information or by their license. The facilities are limiting the number of people and a possible increasing of burdens or disturbing effects. So for example the waiting time at winter sport facilities (skiing lifts) is limiting the number of skiers.

There´s an exception of this general positive evaluation, if impacts and disturbances are caused in the surrounding area. This effect may be caused for example by off-piste-skiers. Those developments may cause a deterioration or disturbance.

These disturbance and deterioration should be assessed against the objectives of the directive. If there could be a significant effect – a certain degree of disturbance is tolerated – measures to prevent those effects have to be established. These measures apply only to the species and habitats for which the sites have been designated and should also be implemented, if necessary, outside the sides.

Type 2 are those activities which do not need a special technical infrastructure but a special property of the landscape like rocks for climbing, wild water for canoeing. The suitable areas for these sports are often very close to nature. Therefore these activities often are expected to get in conflict with the aims of the European directives. Here in general a possible disturbance or deterioration has to be assessed on a case-by-case basis. Two aspects are to consider: the favourable conservation status of the natural habitat or species concerned and the contribution (and frequency) of the site to the coherence of the Natura 2000 network.

Even the present situation in different German secondary chain of mountains (for example the black forest, the upper Danube valley or the National park “Saxon Suisse” near by Dresden) and the alpine area shows that here measures to solve the conflicts are needed. The member state has to take measures which correspond to the ecological requirements of both the natural types and the species of community interest. For the touring-skiing and climbing different spatial or temporary regulations and models had been already established. It is still a task of research to prove the positive effects of these agreements. For those areas it will be necessary to develop a large-scale overall planning in relation to the recreation.

Type 3 contains all activities, which can be done without special facilities or special structures in the landscape. Most of these activities are using roads for the agricultural or forest use. In the opposite to type 2 mostly each kind of landscape can be used for these activities like hiking, biking or horse riding.

There could occur a deterioration or disturbance as well but it is less probable. Furthermore it is easier to find acceptable solutions and suitable measures because large areas of the landscape can be used.

Even when it is a moderate activity, a deterioration is possible. It may happen if the number of visitors or sportsman is increasing or the intensity is changing. Furthermore the combination of different visitor groups can lead to a deterioration. This slowly increasing effect is described as a "furtive" deterioration. In most cases an entire description including all forms of land use is necessary to solve those problems. A possible instrument for this is the management plan (see below) which is appropriate to integrate the different demands concerning any form of land use.

FFH-ASSESSMENT

It is the aim of the European community to keep the Natura 2000 areas without any negative effects. But if in the Natura 2000 area or in their surroundings modifications are planned than an appropriate assessment of its implications for the site and the conservation objectives. This new instrument cannot be compared with the environmental impact assessment (EIA), which has a long tradition in the planning process. In the FFH-Assessment all influences, which may cause impacts on the natural habitats and species of community interest in the Natura 2000 areas are to analyze. Only those projects and plans are permitted, which have likely no significant effect on the favourable conservation status and the ecological requirements of the protected species.

Not only projects like a golf course or a half-pipe for snowboarding are to access but also land use or sectoral plans so far as they are likely to have a significant effect on a Natura 2000 site.

This assessment is even then needed when plans or projects are located outside a protected side if they may lead to a likelihood of significant effects towards the natural habitat types and habitats species of community interest.

In a second level of the assessment it is to investigate whether other plans or projects are to take into account to measure a possible combination of those effects.

In mountain areas, which attract different recreational activities, such cumulative impacts must be expected.

A series of individually modest impacts by recreation may in combination produce a significant impact. The main contents of the FFH assessment are:

- definition of the project or plan
- the method and database
- the description of the plan or project
- the description of the Natura 2000-site and the conservation objectives
- the description and evaluation of the impact considering measures for optimising
- alternative solutions and mitigation measures
- cumulative impacts
- evaluation of the significance of the impact
- conclusions

The following example (see fig. 2) shows that the assessment should only focus on the implications for the site in view of the site's conservation objectives. In the first case in a habitat of bat a special riding-path is planned. This path will cross its summer habitat. This project has no influence on the favourable conservation status of its habitats during the seasons. Therefore the riding-path can be realized.

In the other case the riding-path is planned in the Natura 2000 site with very valuable vegetation, a Nardetum. Here we have to expect a significant reduction of this vegetation and a partition of the habitat. Because of these significant impacts this project cannot be realized.

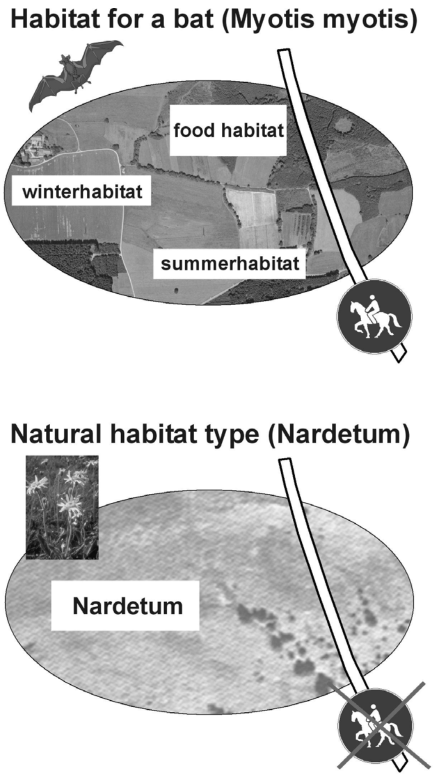

Fig. 2: The assessment of a riding-path focuses only on habitats and species for which the area has been designated.

Projects or plans with a negative assessment study can only be realized if there are no other alternatives and if there exists an imperative reason of overriding public interests, including those of a social or economic nature. For the purposes of outdoor sports and recreation this exception is not to expect.

Looking at the sport and the recreation in mountain areas the FFH-assessment will be relevant for the future development of facilities for sport and recreation. The realization of new golf courses, a harbour for sailing boats, an airport for gliders and auxiliary sailplanes or facilities for downhill biking or inlinescating near or in a Natura 2000-area could get more and more difficult. It is to examine whether these facilities and their development could cause a significant disturbance or deterioration.

To simplify the screening process we propose to divide those projects into three groups:

- projects where the changements of the facilities are very close to the present situation
- projects where the present situation will be intensively changed
- new projects.

In each case the screening has to decide whether significant effects are plausible either individually or in combination with other projects or plans. It is to expect that in the first case an impact assessment is mostly not necessary.

In the second and third case the competent authority has to implement a screening in detail. It decides whether a significant effect is possible. A larger changement of a facility or the development of new infrastructures is considered as a significant negative effect, if they may cause

- a grave reduction of the natural habitat types or habitats of the species,
- a changement of the site conditions like the level of the groundwater, the water quality etc. and of the ecological requirements of species for which the area has been designated,
- disturbances,
- a partition of biotopes and habitats.

In the future especially in the mountain area with a high density of valuable natural habitat types and species of community interest it will be more difficult to develop new facilities. This is necessary to ensure a favourable conservation status there.

A deterioration can also be caused by events. Therefore an event can be seen as a project. Many mountain areas are an attractive locality for sport events. Larger events have to be approved by the authority. If here a deterioration is possible an FFH-assessment is (see above) necessary. In this case not only the possible impacts caused by the sport but also those by visitors, the catering service, accompanying persons or a supplement program for example with music and light show are to analyze. The impacts are only relevant if they are significant for the natural habitat types and species of common interest for which the areas have been designated. So a snowboard competition accompanied by loud music is no significant disturbance if a special vegetation like the Nardetum is to protect. Is this an event in a habitat of the black-cock than it is probably a significant disturbance. If the same event will be organized each year and there are positive results of the monitoring some German countries have the opinion that there is only once an assessment necessary.

MANAGEMENT PLAN

A lot of the Natura 2000 sites need a suitable management of its natural or seminatural habitat types and habitats of the protected species. In some sites conflicts between the interest of the nature conservation and the land use or recreational purposes are expected or already known. In those areas a management plan is needed.

The management plan helps to choose suitable measures (for example statutory, administrative or contractual measures), helps to solve conflicts and to rise the acceptance and transparency for the public.

This may contain restrictions for the recreational use and the sport. Therefore it is necessary to know that the European commission explicitly proposed that the management is to develop in cooperation with user groups in a bottom-up-approach. At the moment this aim is only insufficiently known and should be integrated in the now starting planning process. Therefore the management plan should be written in a popular way and – as far as possible – consider the interests of the other user groups. If they get involved into the planning process differentiated measures can be found which are accepted.

A cooperation and a transparent planning process will not only rise the acceptance towards the directives, it will support the realisation in many ways.

CONCLUSIONS

Even when the administration in Germany has the opinion that “normal” sport and recreational activities cause no problems in Natura 2000 areas, they are to expect.

Whether these activities may have a significant effect on natural habitat types and species of common interest depends on different factors:

- the type of the recreational activities
- the number of sportsmen or recreation-seekers
- the intensity of these activities
- the sensibility of the species or habitat types
- the compromised situation and
- the summarizing effect of different influences like land use, hunting or other recreational activities.

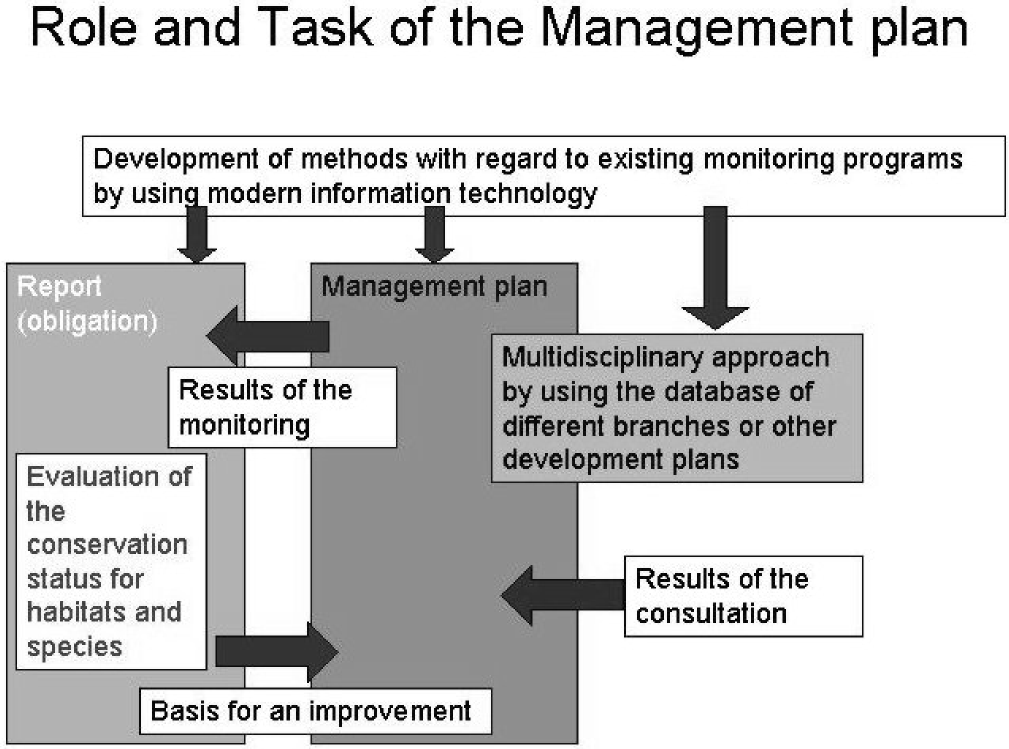

Fig. 3: It is an essential part of the process to establish the management plan using a multidisciplinary approach and to involve local actors and different kinds of land use including sport and recreation.

Therefore in attractive mountain areas there is a need for a differentiated management that brings together the requirement of nature-based sport and recreation and the interests of nature conservation with respect to the objectives of the European directives.

The appropriate instrument is the management plan. In the opposite to the present situation in most parts of Germany the local actors and members of sport associations should be involved in the planning process. Only a bottom-up approach can help to provide further conflicts and to guaranty the effectiveness of the protection.

Further more the actual discussion with landowners and representatives of the sport and recreational associations show that the acceptance of the idea of an European ecological network is very low. On one hand there is more information needed and – very important – a reasonable use of the new instrument, the FFH impact assessment for projects, events and plans for the touristic development.

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Visitor Management and Ecological Monitoring in Austrian, Italian and Bavarian Skiing Resorts by Adapting the EU-Eco-Audit

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Abstract: The problems in skiing resorts caused by winter sports and agriculture and summer touristic land use are well known. They mostly found upon sensitive ecological conditions, building measures, deficiencies in visitor management and an overlapping land use during summer.
A new possibility to face and to decrease these problems will be presented within this article by the EU-Eco-Audit.
Examples from Italy, Germany and Austria show starting points for valuation, deduction of objects for environmental development and suggestions for an environmental management system. A future-development should be influenced by an auditing process which is supported by the enterprise and to environmental concerns set up in business, what should be further developed.

INTRODUCTION

Over the whole alpine arc, skiing is still a main attraction for tourism. Furthermore, it is one of the definite economic factors to ensure the livelihood of the resident alpine population. During the 80´s, skiing was frequently discussed contradictory with regard to the effect on nature condition. The opposition parties often showed their meanings in a biased way, what lead to a non-objective discussion.

Today, political and social representatives became aware of the effects of such land-use and of the full extent of leisure activities with sports concerning on all elements and aspects of landscape. The negative effects of this development in skiing resorts are obvious. Problems are arising with erosion, degradation of the natural vegetation and disturbance of animals.

To solve this conflict, three possibilities have been discussed:

- Labelling for skiing resorts in good condition,
- restrictions and regulations based on nature conservation law in insufficient conditions
- an auditing-system, a market-economy instrument which includes a permanent development and monitoring.

With adding attributes to a skiing resort's ecological quality by labelling, just such resorts with still natural conditions get rewards, whereas other ones with a lot of levelling measures are not attracted. Over and above, restrictions or legal regulations often are noticed as preventing from economic development.

The specified permanent monitoring system and the demand on the enterprise in the skiing resort to accept their responsibility were the reason to choose the Audit-System. With the EU-Eco-Audit, the EU has established a market-economy instrument which makes it possible for companies of different sectors to show awareness of responsibility for nature and, at the same time, optimise the operational procedure. In addition, the efforts may have effects on publicity and attract new target groups. This instrument has already been developed for industrial needs and administration, but the legislator also admits to adjust the proceeding for further needs. Further on, the EU-Eco-Audit is not a single measure, but has to be repeated and developed further at a period of three years.

It has to be underlined, that the EU-Eco-Audit is different from the so-called Environmental Audit, that has an reactive approach and is better known from American or Canadian management systems. This system only detects problems that already have happened and is a valuable diagnostic tool. In contrast to this, the EU-Eco-Audit represents a proactive environmental management system with a more preventative approach.

Therefore a transnational project was initiated and supported by the foundation „pro natura pro ski", Liechtenstein. Three representative areas in three alpine countries (Schladming, Austria; Adelboden, Switzerland; Malbun, Liechtenstein) were selected to develop an adaptation of the EU-Eco-Audit-directive to the needs in skiing resorts. The examination is supported by the experiences acquired with ecological research in the skiing area of Garmisch-Partenkirchen (Germany). In order to reach out for a broadly applicable manual and to learn about the differing conditions and demands in one of the other alpine countries, Italy, and in protected areas, the University Munich-Weihenstephan supports the examination with an investigation in Orso-Pulpito in Solda, South Tyrol. This last examinated area asks much more for an environmentally sustainable management, because it is located in the Stelvio National Park with the legal mission to develop protected areas, which recently also engages with discussing IUCN-criteria. The EU-Eco-Audit may also point out to the National Park's administrative authorities new strategies of environmentally compatible management of skiing areas and intercede between the enterprise's aims and the demands of nature conservation.

As the research field of juridical, ecologistic and operational Audit already is well known, this study deals with the investigation of the whole area influenced by skiing, with special regard to the ecological revalorisation of the resort.

METHODS

From the methodological point of view, it had to be developed

- the adaptation of the Audit-directive to the needs of application in skiing areas,
- a standardised method for data-collection with suitable inquiry and the structure of a Landscape Information System (LIS) with corresponding database.

Figure 1 shows in the left row the main steps of the Audit process. The right row contains the steps for the application in a skiing resort.

Ski runs are mostly characterised by multiple land-using, such as winter tourism, summer tourism, agriculture, forestry or hunting which overlap each other. In combination with biotic and abiotic factors certain problems may result, which land-users often are not conscious of. Further on, the alpine ecosystem shows a particular sensibility with regard to impacts. In addition, an widespread investigation of skiing areas, which was enforced by order of the Deutsche Skiverband (DSV; German skiing association), delivers clues for the possible contents and focal points of the Audit as well as hints for the demands on the method of data-collection. The mapping out in the skiing areas embraced geology and soils, climatic issues, hydrology, vegetation, fauna, building measures, damages distinguished by causes and land use all the year round (method see PRÖBSTL et al. 1996 und PRÖBSTL 2000). In addition, visitor management and ecological information offers were evaluated.

Based on a geographic information system with different layers special maps can be deduced and intersections created. During the step of intersecting the land use and natural items by GIS, conflict ranges may be found out, which partly aren't apparent from the first. Depending on the question, in the GIS the kind of query can be adapted individually. Based on these data set, an effective operational management can be designed.

SOME SELECTED RESULTS

With the present article, some selected examples from the number of possibilities should show the facilities of the EU-Eco-Audit-process.

Examples demonstrating

- the influence on winter-active animals due to off-piste skiers,
- the information drawn from the GIS
- the touristic advent in summertime
- show the widespread application of the EU-Eco-Audit especially in view of the possible results for controlling visitor flows in skiing areas.

Subsequently, three examples from the Audit-process are offered.

Example 1

Apart from the on maintained ski slopes, areas which are passed by off-piste skiers are connected with the skiing resort's enterprise. Off-piste skiers are characterized as skiers who use existing cable railways for ascending, but prefer powdery snow descents in not prepared terrain. Negative effects on the environment can be the consequence when e.g.

- habitats of winter-active animals are disturbed
- trees and coppice, especially young one, are damaged.

If certain distances - crossing habitats - are exceeded, deer or e.g. chamois are put to flight, what leads to an excessive energy consumption. This reaction may cause death, especially when frightened up several times a day.

This seems to be more risky for *Tetraonidae* species, who stay in snowy caves rather the day long, not visible for the skier. Drawing up to much, the cocks are forced to take wing, seldom become victims of ski edges.

Within the scope of the Audit-proceeding, talking with local experts or institute specialist's investigations often brings up knowledge about habitats crossed by off-slope skiers, and such areas can be mapped in this way. The importance of mapping appears in outlines especially at Solda, where rather the whole terrain claimed by skiers is also potential habitat for black cock and white grouse.

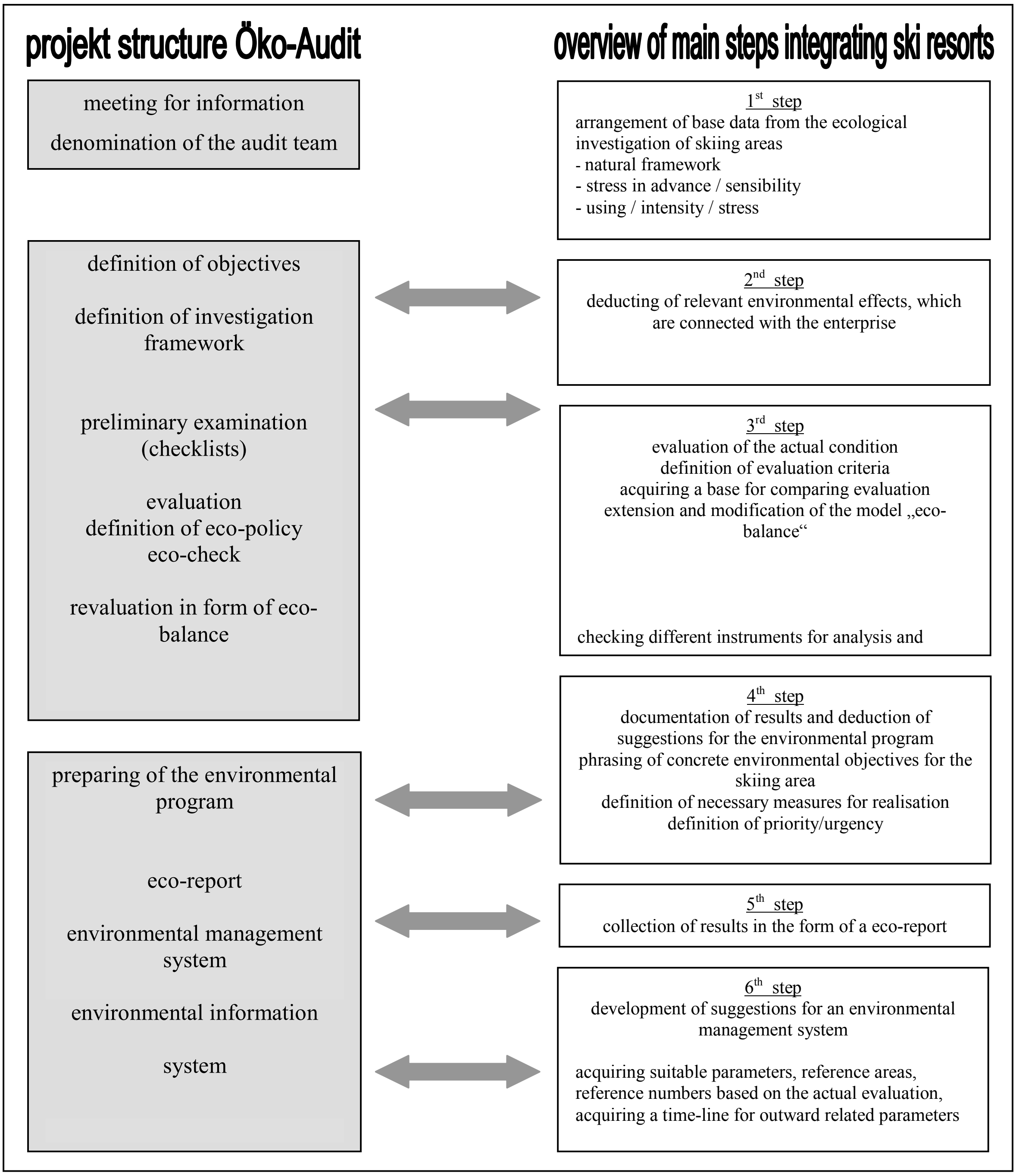

Figure 2: model for the EU-Eco-Audit in skiing resorts corresponding to the steps of the EU-Eco-Audit (see AMMER, PRÖBSTL *1995)*

Even though located in the Stelvio National Park, habitats of *Tetraonidae* species were not yet officially registered. In addition, the area used by off-slope skiers in proportion to the maintained ski slopes is larger than in other skiing resorts. Beside, also during summer a high level of disturbance is noticed, what lead to a fluctuation of the population to neighbouring habitats. The National Park starts engaging with managing visitor flows in the lower valleys and at Solda could take into account in-depth managing for sensitive areas. By mapping off-slope routes used periodically as well as temporarily, it can be ascertained which - even potential - habitats are avoided caused by frequent disturbance. The GIS allows to intersect habitats with other disturbing sources like e.g. the application of technically produced snow.

What concerns the impairment of trees, it's especially up to higher mountain regions that stress-factors sum up: drainage by frost, chilling, lack of water above snow surface, endangering by fungus like Herpotrichia spec. or Chrysomyxa spec. under the snow, locally grazing. Furthermore, the young trees are burdened with mechanical thrust and injury by off-piste skiers. If forests fulfil tasks like avalanche- or soil-protection, a diminution of the resistance and the protecting tasks can not be excluded.

During the Audit-process, the data collected outside gets mapped to be shown to the enterprise's employees. Thus, the employees can realise and understand the concerns of animals and vegetation in high altitude mountain areas much easier. Based on this and discussing reasons and consequences for rare species, measures and responsibilities for realisation can be deducted. At Solda, this could be

- demarcation of particularly sensitive areas
- definite readable delimitation of ski runs
- offering marked off-piste routes in lesser sensitive areas (concentration of visitor flows)
- information and explanation of guests and staff
- cooperation with local ski-schools
- implementation of protected forest sides

The Audit-system offers the possibility to the enterprise to verify the success of these measures periodically and correct them if needed.

Example 2

A frequent conflict is, as already said, the multiple land-use in summer as well as in winter. This is characteristic for the Bavarian skiing resorts. For the cable railways car enterprises the summer season is economically important - much more than e.g. in many Austrian skiing resorts. If the Landscape Information System distinguishes between

- carriage-roads (for forestry and pasture)
- hiking paths (marked, not practicable, signed paths)
- beaten paths (wild stretches and short-cuts)

clues can be drawn from for aims of the environmental program. This can be shown guided by the example of the skiing area Hochgrat, a popular destination during summer. The registered values of 10,5 m/ha beaten paths and 11,2 m/ha officially signed hiking paths point out that there exist problems and deficits in summer. The determined level of development can be given per sector and altitude zones. Furthermore, the data allows to compare the determined level with other recreational areas. Values of 40-50 m/ha are good as average density of hiking paths (see AMMER, PRÖBSTL 1991). The interpretations in the skiing area Osterfelder-Kreuzeck-Hausberg confirm these values with 43 m/ha and can be seen as standard of comparison.

If deficits like landscape damages caused by summer tourism or missing visitor management are found out by the analysis done during the Eco-balance (see fig. 1), different measures can be developed:

- measures for visitor management
- concept for redevelopment of hiking paths
- suggestions for dismantling of hiking paths

and so on.

If these measures are integrated into management, the success can be controlled with the GIS-system. Because the Audit-directive explicitly includes the publication of the outcomes, the presentation of changing balances, supported by the Landscape Information System, is important.

Example 3

The possibilities of the enterprise to contribute to a discharge of the environment lay in the field of information. In coherence with the touristic offers, the Internet has gained in importance. In the skiing resort Schladming, the unanimous opinion of managers and employees was to show the improvements within the ecological management of ski slopes by the auditing system in the Internet. The skier should be able to take into consideration also ecological aspects when choosing a resort. Beside the improvements in the management sector, aspects of easily available environmental information or natural experiences also should be presented.

Further one the Planai cable railways in Schladming emphasize the importance for a credible candidature for large-scale events (e.g. world cup event), in addition to the improvement gained with ecological ski slope management and ecological information.

The „green image" should be noticeable in all departments of the enterprise.

CONCLUSIONS AND OUTLOOK

Combined with a differentiated Landscape Information System, the EU-Eco-Audit proves to be - like the examples show - a good possibility to realize visitor management and ecological revalorisation close to practice. In contrast to restrictions and regulations or Labelling by other organizations, the process lead off in the enterprise to get active in the own concern. It is an argument for further sustainable efforts. This fact can be emphasised by the means of an appropriate public information.

As can be seen in the investigated area of Solda, mapping in the framework of the EU-Eco-Audit can contribute to assess the demand for an expansion of the skiing area. This can happen by harmonizing the offered area of ski runs with the capacity of cable railways. The recent discussion of rearranging the National Park Plan by designing a zonal concept, the vocation of NATURA2000-areas directly neighbouring the ski slopes and even covering the skiing area openly asks for a discussion of the protective as well as enterprise's demands. This discussion can be held by application the EU-Eco-Audit to harmonize appearing problems to bilateral agreement (win/win-situation).

Despite this positive balance that can be drawn from working in different regions, a widespread realisation of this idea will depend on the question, if the immediate benefits of managing ski runs and marketing also will profitable to local tourism. Also the award of skiing contests under international competition will more and more be associated with the existence of a credible ecological concept and a sustainable management. At the same time, the importance of the Audit for sport competition venues will gain in signification. This is especially valid because of the rating that competition venues grab with international sport contests, considerable for the weight and the touristic commercialisation within international comparison.

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Impacts of Tourism Load on the Mountain Environment (A Case Study of the Krkonoše Mountains National Park - the Czech Republic)

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Abstract: Krkonose Mountains (the Giant Mountains in Czech) as the highest mountains of the Czech Republic belong to the most visited middle-european mountains as they are well facilitated for both summer and winter outdoor recreation. More than 8 million visitors within a year means very serious tourism load on the mountain landscape and ecosystems. Primary impacts (e.g. disturbing plants and animals by trampling and noise, soil erosion or cummulation of rubish) together with secondary impacts of tourism development (a.g. arrising of accomodation capacity, impact on traditional landscape infrastructure by reebuilding of original small mountain chalets, nonsufficient disposal of waste, transport of allochtone organisms) create very cotraversional background for sustainable use of the mountains which are the oldest national park of the Czech Republic. Paper describes these impacts and suggests some forms of conflict solution between tourism development and statutes of the national park.

FOREWORD

Mountains together with coastal areas represent doubtlessly the most attractive types of landscape for outdoor recreation. Both are highly sensitive and vulnerable to the large scale of human impacts. Therefore the harmonization of the relationsheep between the nature environment and its conservation on the one side and the wide scale of its exploitation on the other side belongs to the basic problems and the most important management activities of the bodies responsible for sustainable development such areas. There are a lot of examples of hard conflicts between these two range of human interests from the Alps or from the Mediterranean countries. Many of middle-european mountains stand in the shadow of such famous areas for tourism industry but they have a lot of similar or even bigger problems because of smaller size and therefore higher pressure on the fragile mountain environment. **The Krkonose Mountains**, culminating part of Hercynian middle-mountains, represent example of uneasily manageable conflicts between environmental conservation and contradictory demands for tourism and economic activities in mountain protected area.

AREA DESCRIPTION

Lying astride the Czech and Polish boundary Republic, the mountains called the Krkonoše (the Giant Mountains in English, the Karkonosze in Polish) , the highest mountains of the Czech Republic, belong to the Sudetes, a chain of geologically old, non-calcareous middle-mountains shared by Czech, Poland and Germany.

The Krkonose Mts. are about 40 km long and 20 km wide. Their georelief consists partly of an old denuded surface, partly deeply cut valleys that were sculptered by Pleistocene glaciers and nivation. The highest point Sněžka (1602 m a. s. l.) does not point out high-mountainous size, but the summit area of the Krkonose Mts. (between 1300 and 1600 m a. s. l.) displays a landscape system with numerous elements of subarctic and high-mountain features such as alpine timberline, subarctic peatbogs, glacier corries, snow avalanches and landslides, tors, frost sorted grounds, relic plant and animal species and ecosystems.

Average annual temperature on the summits is between 0 ^{0}C and +1^{0}C only. Snowpack is sustained about 180 days per year, which corresponds to climatic regimes encoutered in mountainous zone of Central Scandinavia. As a result of long-term miltidisciplinary research and detailed analyses, the landscape of the topmost areas of the Krkonose Mts. was described as an **arctic-alpine tundra** (Soukupová and others, 1995; Stursa, 1998).

However, the Krkonose Mts. are not mountain range, whose long-term development was controlled by only natural laws. Their position in the centre of Europe meant that man has subdued nature here step by step since the 13th century and created in the highest Czech mountains an landscape, full of signs of the mutual coexistence of man and mountain nature in both positive and negative sense. Because of their unique natural richness and beautiful landscape with extremely rich history and culture, the Krkonose Mts. were declared as the first Czech National Park in 1963 (total area is over 360 km^2). On the northern Polish slopes the Karkonosze National park was created even erlier (in 1959, total area is over 55 km^2). Both national parks (and also the **bilateral Biosphere Reserve** of UNESCO since l992) are well-known and much frequented within the all-European context for their unique natural richness, landscape beauty, outstanding conditions for both winter and sommer sports, wide offer of tourist and recreational facilities and easy accessibility from the foothills to the highest elevation.

TOURISM IN THE KRKONOSE MOUNTAIN

The characteristic landscape infrastructure of the Krkonose Mts. became during the period of farming in 17. and 18. centuries. Plenty of tree-less enclaves with mountain cottages are dispersed from the foothills till upper part of the mountains, created a significant bases for the later tourist utilization during the second half of 19th century. First visitors attended the mountains mainly in the summer but with the development of skiing, tourism extended throughout the winter months.

On the beginning of the last century only a few hundred thousands visitors from the large lowlands of Silesia, Germany and Bohemia came in the Krkonoše every year. Many villages slowly turned from small agricultural-industrial and woodworker´s hamlets into tourism centers. Before the end of the 20th century about 6 million visitors (hikers, skiers and holiday-makers) on the Czech side, and nearly 2,5 million visitors on the northern Polish side annually frequent the valleys and summits of the Krkonoše Mts. (Flousek J., 1994).

Thus the both Krkonose Mts. National Parks (abbrev. KRNAP resp. KPN) with **more than 8 milion visitors** in a year belong undoubtedly between the most visited national parks in the Europe and perhaps according to their small area (the whole mountains around 630 km^2 only) to the most visited national parks in the world, unfortunatelly with all evidences of enormous pressure on very fragile mountain nature. Hotels, roads, ski lifts, ski hoists, downhill courses, skii slopes and other facilities serving tourism and sport activities (table 1.), bring about a lot of disturbance into the mountain environment of the Krkonose National Park .

IMPACTS OF TOURISM

There are many direct influences of tourism on the mountain nature, e.g. picking up nice plants, disturbing of wild animmals through the noise, soil erosion due to trampling of vegetation by short cutting ways, cummulation of rubish, air pollution from the dence traffic etc. Beside these **primary impacts** which might be partly diminished by strict control activities of National Park staff or by some regulations, there are also **secondary impacts** of tourism development which are much serious.

	Czech side	Polish side
Total area	54 787 ha	5 564 ha
-core zone (1st + 2nd zone of NP) - buffer zone (3rd zone of NP) -transition zone (buffer zone of NP)	8 432 ha 27 925 ha 18 430 ha	1 715 ha 3 847 ha -
Inhabitants	26 700 = (48,7/km2)	90 = (1,6/km2)
- in core zone - buffer zone - transition zone	300 = (3,6/km2) 4 900 = (17,5/km2) 21 500 = (116,7/km2)	50 = (2,9/km2) 40 = (1,0/km2) -
Visitors in a year (estimate)	6 000 000	2 500 000
Total length of **road network** - tourist trails only	1 700 km 800 km	250 km ?
Number of **hotels and chalets** on the National Park territory - core zone only	1 500 82	22 10
Number of **cableways** + **chairlifts** „ „ **ski-lifts**	6 250	2 10
Length of **downhill courses/ski slopes**	139/112	10/17

Table 1. Selected data about bilateral Biosphere Reserve Krkonose/Karkonosze

They are connected with inadequate landscape infrastructure development and with step-by-step increasing of accomodation capacity, density of roads and traffic load, the water consumption, total amount of visitors etc. If there are well prepared land use plans with respect of the territorial carrying capacity, they could be guaranty of sustainable development or using of landscape and natural sources of the national park. They could be. Unfortunately these secondary symptoms of landscape deteriorization are not visiable immediately, so normal visitor of the National Park doesn´t realize them and thus he doesn´t feel to be responsible for such a harmful impacts. But in fact he is the primary subject of the improvement of tourism standards and busy activities of local enterpricers.

Some examples of secondary impacts:

Rebuilding originally quite small mountain chalets - that means

- - irreversible changes of the mountain landscape infrastructure character, a loss of historical and culture identity or originality by replacement old woody chalets by new hotels, without respect of local architecture style;
- - reducing of extent of species-rich mountain meadows in surrounding those reconstructed and mainly enlarged chalets (very serious impact because these meadows are essential source of biodiversity; a lot of rare, endangered or protected mountain plant and animal species are connected with existence of these semicultural non-forest ecosystems and with regular care for them; Krahulec and others, 1996).

Higher equipment and increasing of accomodation capacity connected with bigger consumption of drinking and homehold water and serious problems with generation, handling and disposal of sewage and waste-water or liquidation of municipal solid waste - that means- large-scale eutrophization and acidifying of mountain habitats in surrounding of mountain chalets and consequently negativ trends in spatial and species succession of native plant communities, above all missing of rare and sensitive mountain species because of dispersion of some nitrophilous plants or anthropophyta which are strongly invasive (Rumex alpinus, Urtica dioica, Cirsium arvense etc).

Extending of mountain roads and paths because the old construction is already not sufficient for higher moving of persons and for more dense traffic. For extending and repairing of roads are often used the geologically unsuitable material such as limestone, melaphyre, basalt or even asphalt, instead of native rocks - that means

- changes of chemical properties of the soils in the vicinity of repaired roads and again the proccess of eutrophization and expansion of the weeds (Vitkova and others, 1999, Malkova and others, 1997) forcing out the natural ecosystems - threat to the genetic structure of native species (table 2.). *Higher moving of people and tracks on mountain roads and paths* - that means (in synergism with the previous impact)
- an enormous transport of seeds of allochtonous plant species, especially weeds and their rapid and the highly succesful dissemination into the vicinity of roads and paths and consequently potential threat to the genetic structure because of uncontrolled hybridization of taxonomically simillar species (e.g. native *Viola sudetica* and allochtone *Viola tricolor*, some microspecies of genera *Hieracium*, *Taraxacum* etc.).
- Aproximately 30% of all vascular species of the Krkonoše Flora are allochtonous transported into the mountains during tle last two or three centuries - for immagination how big threat the transport of plant diaspors is (Stursa, 1996);

Expansive and invasive anthropofytic species	Expansive apofytic species	Endangered native species
Alchemilla sp.div.	*Calamagrostis villosa*	*Bartsia alpina*
Alopecurus pratensis	*Chaerophyllum hirsutum*	*Campanula bohemica*
Cirsium arvense	*Cirsium hellenioides*	*Epilobium alsinifolium*
Dactylis glomera	*Deschampsia caespitosa*	*Epilobium nutans*
Epilobium adenocaulon	*Filipendula ulmaria*	*Hieracium rubrum*
Epilobium angustifolium	*Hypericum maculatum*	*Juncus trifidus*
Myrrhis odorata	*Poa annua*	*Montia fontana*
Phalaris arundinacea	*Poa chaixii*	*Poa laxa*
Rumex alpinus	*Poa supina*	*Pulsatilla scherfelii*
Rumex longifolius	*Ranunculus acris*	*Swertia perennis*
Tusillago farfara	*Senecio nemorensis*	*Taraxacum alpestre*
Urtica dioica	*Taraxacum officinale agr.*	*Viola sudetica*

Table 2. The most expansive and invasive species of vascular plants and the serious endangered native species at the summit area of the Krkonose Mts due to secondary tourism impacts

- changes in abiotic conditions and species composition of the vegetation along the paths influence undesirable changes in species structure of animals, even disturbance of the animal populations because of strong tourist traffic and too wide roads and therefore dividing of populations into small parts with consequences in genetic structure; the same impact is caused by fragmentation of complexity of mountain landscape with natural pattern of vegetation through too dense net of tourist trails;
- permanent stress for some sensitive species of mammals or birds and graduel disappearing such species like *Tetrao urogallus* or *Bonasa bonasia* from mountain forest ecosystems.

Building of new alpine ski areas, building of new pists or their extending - that means

- - disturbing of forest stands complexity and consequently more rapid physiological damages, pest infestation and dying off mountain spruce forests which are under influence of air pollution (so called phenommena of emmission forest´s walls);
- - revegetation steep slopes after clear-cutting involves problem with appropriate seeds; there are the only seeds of cultivated sortes of grasses on the market , which are suitable for the revegetation of sportgrounds or stabilization of slopes along highways but not for the appliction within the protected areas with strict regime of species conservation. Using these grass cultivars (e.g. *Festuca rubra, Agrostis gigantea, Lolium* sp.div.) means later problem with genetic erosion because of potential threath of spontaneous hybridisation with autochtone population of the same taxa, regardless of conflict with the statute of the national park, where distribution of allochtone organisms is strictly prohibited.

Well, it is obvious that tourism exploitation can induce a lot of serious problems which are in contradiction with the main objectives of protected areas. On the other hand it is doubtless, that tourism sector is the only one potential source of prosperity of local people living inside and outside the national park territory, expecially in the mountainous large-scale protected areas. These two antagonistic functions of the national park landscape evoke a strong confrontation atmosphere between the state administration and ecological bodies on one side and municipalities, indigenous people, enterpreneurs and investors in the area of recreation industry on the other side. Solution of this long-term conflict consists in working out of the proper managament plan for the national park territory, respecting the natural stability of mountain ecosystems. That means to understand the basic principles of what is carrying capacity of the national park environment about.

INDICATORS OF SUSTAINABILITY AND CARRYING CAPACITY

Inspite of many definitions several types of carrying capacity and existence of many publications dealing in this topic (e.g. Ceballos-Lescuráin, 1996; Drdoš and Janik, 1995; Kreisel, 2001), to estimate or to evaluate carrying capacity in such a region like popular mountain national park is ever extremelly difficult and results need not be expected by all stakeholders.

What is the right way to evaluate or to measure a carrying capacity? Which indicators can be used as a warning that the ecological impacts are too strong and the carrying capacity has been already oversteped. Could it be measurable by increased risk of footpath´s erosion, or by speed of pauperization of biodiverzity, by range of water pollution, or by extent of changes of soil´s chemical properties? If we use such indicators, so how to quantify these features, how many degrees plus or minus we could put to single parameters to obtain their weightiness and which ecological impacts are synergistic with the others, etc. Finally we must be aware of absolutelly different sensitivity of single mountain ecosystems which increases with their pauperization.

Therefore is necessary:

- to prepare an inventory of different types of stands or ecosystems of the protected area and to make a list according their sensibility or resistance to anthropogenic impacts,
- to recognize and well describe all types of primary as well as secondary anthropogenic impacts in the area during the proccess of environmental impact assessment taking into account cumulative effects (synergism),
- to carry out the proper long-term monitoring of these impacts; anyway the establishment of special monitoring network for objective way of later evaluation should be done,
- to attempt determine the differences not only in space but even in the time, that means to evaluate the dynamics of some negative impacts (e.g. to measure differences in sensitivity of the trails surface to the trampling not only during summer time but also in herbst or in early spring when there is some synergism with cryogenic factors). Thus, we will be able to realize more effective management activities protecting trails surface against soil erosion,
- to select a list of the most convenient indicators of sustainability and to open a monitoring such indicators.

We have started at the Krkonose Mts. National Park some investigation on **ecological carrying capacity** using recent mapping activities of actual non-forest vegetation and forest vegetation (Nováková and others, 1998)in the framework of Natura 2000 programme. Orthofotomaps are utilised for present field work , basic mapping unit for the non-forest vegetation is the syntaxon on the alliance level ; approximatelly 30 basic mapping units (alliances)for non-forest vegetation from the submountain to the alpine zone. All syntaxons has been analysed and described according:

characteristic of species diversity, group of diagnostic plant species , occurence of endangere and protected species, invasive plant species, significant animal species

altitudinal description (occurence in the main vegetation belts

abundance (degree 1 – 5; one locality only, very rare, rare, disperse, common)

type of threat: (all types of both abiotic and biotic factors)

carrying capacity (5 degrees, see below)

management policy

Degrees of carrying capacity:

1. very low, high vulnerable ecosystem (high internal as weel as external lability)
2. low, vulnerable ecosystem (high external lability, internal stability)
3. relatively stresstolerant ecosystem, both internal and external stability, vulnerable only through rough mechanical distrubances
4. strestolerant ecosystem
5. high stresstolerant invasive (expansive) ecosystem

Using field vegetation mapping and above mentioned syntaxa description we prepared multicriterial analysis several GIS layers (for example density of tourist trail´s network, construction and quality of trail´s surfaces, density of tourist load, actual vegetation and dispersion of invasive plant species)which enabled us to evaluate how particular part of the national park is or will be sensitive to actual tourism load, if the potential carrying capacity still allows to increase some tourism activities and vice versa.

This is convenient way how to elaborate precise management plan which enables to harmonize both above mentioned functions of protected area (nature coservation as well as sustainable tourism). Anyway, detailed explanation and discussion of criteria for such a landscape evaluation with main stakeholders and land-use planers are extremelly important and essential.

Another convenient indicator of sustainable use of mountain landscape seems to be **management of flower-rich mountain meadows**. They have several very important functions within the pattern of mountain landscape:

- biodiversity protection (species-rich habitats with high number of threatened and strictly protected plants and animals; altogether 450 plant species grow on mountain meadows ´more that 1/3 of total amount of vascular plant species recorded from the Krkonose Mts., Krahulec and other, 1996),
- agricultural function (ecofarming),
- high diversity of landscape character,
- recreational function (mountain chalets, skiing),
- cultural-historical heritage (local architecture of wooden houses/log cabins/, traditional practices lifestyles).

For keeping of all these functions appropriate system of funding and supporting from the state budget or from other bodies is absolutelly needed. Recently there are two systematic grants in the Czech Republic (Ministry of agriculture and Ministry of Environment of the Czech Republic) using since 1994. As the National Park Administration is responsible for administration these state funds, results of implementation such state funding policy could be used as a convenient indicator of sustainable development of the National Park and Biosphere Reserve territory.

Therefore the Administration of KRNAP prepared a methodology of long-term monitoring such indicators of sustainability with three main objectives:

1. Evaluation of influence of various types of meadow management on biodiversity
2. Targeting of state support on most convenient parts of NP territory
3. Development of State policy of Landscape Care Funding if necessary according results of monitoring

Such monitoring could contribute to:

- better communication between NP Administration and indigenous people and local communities
- restoration of regular care for mountain meadows as a part of biodiversity protection
- supporting of landscape sustainability on the territory of the National Park and the Biosphere Reserve Krkonose

PSYCHOLOGICAL CARRYING CAPACITY

Untill NOW mainly aspects connected with evaluation of biological or environmental carrying capacity has been mentioned. However, it is very important to be aware, that visitor´s behaviour and attitudes, their wishes and motivation for the visit of protected area, their knowledge what is unique, significant or typical for visited area, what types of visitor´s rules are valid within the area, all these aspects can significantly influence amount of negative impacts of visitors in the protected area. Therefore is crucial to realize well prepared education and information programmes and also to increase our knowledges about feedback in visitor´s behaviour, that means if visitors are satisfied or dissappointed during their trip in protected area etc. These are very important information about the other type of carrying capacity - so-called the psychological carrying capacity.

To estimate this second type of carrying capacity is even more complicated than the first one. But if the psychological carrying capacity is oversteped - the consequences are also negative for the landscape. Many conflicts between visitors and nature and between visitors themselves. What more, these conflicts can owergrows within the conflicts between visitors and local people - thus advantages of the national park statutes become to be dissadvantages for local people. It might be the beginning of missunderstanding between protected area´s staff and indigenous people or municipalities.

Therefore the monitoring of visitor´s behaviour, the evaluation of public opinion, permanent education of both local people and visitors and patient explanation what the sustainable tourism development is about, are so important. This is the only way for stimulation the indigenous people, local communities as well as visitors on the protection of valuable nature and landscape of the national park.

We have investigated some quantitative as well as qualitative aspects of tourism load in some hot spots of the Krkonose national park in 1996 (Cihar and other, 1998). Results are presented in other paper during this conference.

Inspite a fact that there is a direct relationship between degree of our knowledges about both visitors and local people psychology and effectiveness of our magement activities within protected areas, a lot of gaps still exist in this field . We need urgently to know more details about perception of nature or protected landscape by various groups of visitors in relations to their age, education, occupation or social standing, what´s visitor attitudes to the rules, regulations and restrictions valid on territory of visited protected areas, etc. Very important tools for our communication with indigenous people and significant stakeholders consists in visiable flux of incomes from tourism bussiness as a clear economical beneffits of the existence of protected area for local people.

CONLUSIONS

Having such real data about both ecological and psychological carrying capacity we might be able to prepare an adequate tourism management plan as an one chapter of the complete management plan for the national park. Main objectives such document, beeing prepared not only by conservationists but in cooperation with all targed stakeholders, should be to define and to realize such management activities, which enable to keep up an equilibrium between sustainable use and the protection of natural sources in protected areas. Thus we schould be able to make the right decission of what vision of the mountain landscape we will prefare - either bussy scenery on figure 1. or romantic scenery on figure 2.

Figure 1.: Vision of Snezka before the end of 20th century according stylized postcard from the beginning of the 20th century

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Figure 2.: Picturesque spirit of the landscape in the neighbourhood of Snezka on engraving of A. Mattise from the 19th century

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Development of Ecotourism in the Largest National Park "Yugyd va"

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Abstract: The National Park "Yugyd va", Komi, Russia is used predominantly by the Russian population for summer and winter recreation purposes. The National Park (NP) organizes, plans and controls visitor flows. Management of visitor flows is directly and indirectly realized by the NP. The direct management includes functional zone division, normalizing recreation loads, law-enforcement activity. The indirect management includes regulation of visitors access in determined places of the NP because of complex and dangerous routes or specific objects organization of tourist infrastructure. Monitoring of visitor activities in the National Park is realized by short-term visitor observation and route registration. Organization of visitor flow is realized on the basis of agreement between the NP and tour operators. The NP regulates of tourism and recreation by restriction of moving the visitors on the NP area on the basis of permissible recreation loads.

INTRODUCTION

National Park “Yugyd-va” (“Clear water”) is situated in the north-east part of Komi Republic, on western slopes of Prepolar and Northern Ural mountains and Pechorskaya lowland. The park was founded in 1993. In December, 1995 National Park “Yugyd-va” and Pechora-Ilych Nature Reserve were included by UNESCO in the list of World Natural and Cultural Heritage and named “Pristine forests of Komi”. The total park area is equal 1.9 mln ha. Nowadays this is largest reserve area in Russia and Europe. So due to its very large area and small staff in the NP there always exists a danger of uncontrolled spontaneous tourism, which can damage the unique ecosystems and discredit the idea of ecotourism.

The basis of conditions creation for regulated tourism and recreation is work out and realization of system of management and economic actions by the NP, which are directed on attraction of tourists and tour operators in the NP and creation of highly effective tourist's infrastructure. The aim of the NP management in tourism and recreation sphere is development of tourist industry in the Komi Republic on the principles of rational utilization of natural resources and conservation of natural and historical-cultural unique of the NP area.

METHODS

The following methods for the NP management in tourism and recreation sphere were used:

- Effective system creation of management of visitor flows of the NP
- Organisation of tourist activity and visitor's service by enlist the services of local population and private sector
- System creation of constant improvement of the NP tourist infrastructure by additional financing from different sources
- Qualification increase of the NP workers busy in scope of tourism
- Integration of tourism and recreation in the NP into regional social and economic systems

SOME RESULTS OF EFFECTIVE SYSTEM CREATION OF MANAGEMENT OF VISITORS FLOWS IN THE NP

The NP organizes, plans and controls visitor flows. Management of visitor flows is directly and indirectly realized by the NP. The direct management includes functional zone division, normalizing recreation loads, law-enforcement activity. The indirect management includes regulation of visitors access in determined places of the NP because of complex and dangerous routes or specific objects organization of tourist infrastructure.

The NP area is subdivided on 7 zones:

1. zone of reserve regime with 7 complex, 1 ornithological, 3 ichthyological, 23 geological, 2 floristic, 6 archeological natural reservations
2. zone of reserve regime with rocky natural formations and tundra regions
3. zone of regulated tourism
4. recreation zone for sport hunting and fishing based on tourism

5. zone of agricultural landscapes
6. zone of visitor service
7. zone of economic-production activity.

The NP regulates of tourism and recreation by restriction of moving the visitors on the NP area on the basis of permissible recreation loads. The loads were calculated by scientific researchers of Russian Academy of Sciences. The park organizes many tourist routes: traveling on foot, mountain, water, ski. Most tourists prefer water routes. A total distance of river routes is equal 1108 km.

The order and dates of visit, permissible number of visitors for different functional zones are determined by the NP itself. Those also depend on year season and weather peculiarities. The main visitor flows are recorded on the rivers Kojim, Kosyu, Synya, Vangyr, Schugor, Podcherem. Number of visitors constantly increases from 1321 (1995) to 2856 (1999) and 2709 (2000), and consequently a total sum of visitor's fee also increases from 6 000 rbl. (1995) to 51000 rbl. (2000). Organization of visitor flow is realized on the basis of agreement between the NP and tour operators. Unfortunately there are not many quality tour operators in the Komi Republic and Russia. So the NP organizes different routes for visitors based on visitor's application forms sent 2 weeks before visit.

Not large visitor flows is explained by presence of uncontrolled spontaneous tourism, short warm season, mosquitoes, absence of good transport roads. The park area is a great and has not good infrastructure. In spite of these facts 12 workers of the park have certificates of ecotourism instructors, 2 tourpackets are prepared, set of maps (different parts of the park) and 2 information booklets are published. Every year ecological camps for kids from different parts of Russia are organized on the rivers Podcherem and Schugor. It is noted that in 2001 majority of visitors registered in the park control posts. The park workers try to decrease number of uncontrolled tourists through publications and reports in mass information media and lectures in different organizations.

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Ecotourism demand in North-East Italy

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Abstract: There are three regions in North-East Italy: Friuli Venezia Giulia, Veneto and Trentino-Alto Adige. These regions have highly differentiated environmental and natural features. In fact, in this small area we can find the biomes of the main European temperate zones. The environment is important because there are a large number of National and Regional Natural Parks, as well as small protected areas that many people visit every year.
Since the nineties, the authors have been involved in research to examine and analyse ecotourism in North-East Italy.
The main objectives were to: a) define a methodology that would quantify the recreational flow from the results of phone and in-person interviews, b) analyse ecotourism demand, socio-economic visitor features, tourist facilities and economic flow.
The statistical models study the number of visits through a travel cost method, and willingness to pay by means of contingent valuation methods.
The findings have allowed us to fill the considerable information gap regarding ecotourism and the recreational use of the landscape. From the survey we have collected precise data on the economic and social importance of ecotourism, such as recreational benefit and expense flow.

INTRODUCTION

There is a wide consensus regarding the concept of ecotourism in the sense that we all understand the message that it sends (i.e. nature, local community, economics, conservation, culture and the symbiotic relationship between tourism and nature conservation). However, agreement on a universal definition has not yet been reached. The term, coined by Hector Ceballos-Lascurain[8] in 1983, has been accepted by the World Conservation Union (IUCN): 'Ecotourism is environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features - both past and present) that promotes conservation, has low negative visitor impact, and provides for beneficially active socio-economic involvement of local populations' (Ceballos-Lascurain, 1996)[9].

In this sense the features of ecotourism are more specific than the broader concept of sustainable tourism[10] (Bottrill & Pearce, 1995; Coccossis & Nijkamp, 1995; CEC, 1999, WCED, 1987).

Moreover ecotourism is a recent theme. Its late arrival on the scene is not, however, related to the recent development of nature-related tourism, but to the fact that tourism and natural resource exploitation have only recently been linked to conservation. In fact, the relationship between tourism and nature has a long tradition. Since 1800 both in Veneto and Friuli Venezia Giulia the mountain areas were visited by mountaineers from all over Europe. Subsequently, trips to the mountains developed into mass tourism[11]. In the same way, other natural areas were transformed into resorts. In recent years, awareness of the need for conservation has increased, and places addressed to different uses (like agricultural land or border areas) have been involved in renaturalisation and wilderness conservation projects. Consequently, there is greater interest in hill and lowland areas, such as wetlands or places where wild animals have been introduced, and visitor flows have risen.

At present there is no qualitative and quantitative information available regarding the size of visitor flow and recreational benefit, even if a

[8] Member of Commission of Environmental Cooperation, CEC.
[9] The three main characteristics of ecotourism are defined as: nature based; environmentally educated; and sustainably managed (Blamey, 2000).
[10] Definition coined by World Travel and Tourism Council, World Tourism Organization, Earth Council 'Sustainable tourism meets the needs of present tourist and host regions while protecting and enhancing opportunity for the future. It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity, and life-support systems'.
[11] In the alpine region 5 million beds are offered; every year 60 million of tourists reach Alps to stay in the resort and as many to visit them daily. The tourist turnover is about 23.000 million of Euro, representing circa 5% of the whole world tourist turnover (CIPRA, 2000).

few research projects are beginning to study the matter[12].

The purpose of this paper is to illustrate the results of this limited research, which was carried out both in the Veneto and Friuli Venezia Giulia regions. The aim is to describe and quantify visitor flow and to determine the socio-economic role of ecotourism[13].

ESTIMATION OF VISITOR FLOWS IN NATURAL AREAS

The main problem in analysing ecotourist demand concerns the estimation of visitor flow. At present in Italy there is no detailed or reliable information on the subject. In fact, the only data available is related to the presence of tourists in hotels. This kind of information is limited because: a) it does not take day-trippers into account; b) many people stay either in second-homes or with friends; c) in general there is very little information about the places visited during the holidays and recreational activities. In order to fill this data gap, many surveys have been carried out in Veneto and Friuli Venezia Giulia using different methods (Mitchell & Carson, 1989; Bishop & Romano, 1998).

The issue of estimating visitor flows in natural areas raises several problems connected with the kind of area studied (Chase et al., 1998). The ways of estimating the visitor numbers are related to: 1) dimension of the area under investigation; 2) the number of access points; 3) payment or not of an entrance fee.

It is widely accepted that these elements are strictly connected because small natural areas have few access points and this allows for both better control/management of flow and the payment of entrance fees. This situation, however, is very infrequent in the zones we studied because in most cases the natural areas are very large and have a lot of access points.

The most frequent situations both in Veneto and Friuli Venezia Giulia are the following:

- highly extensive mountain areas with many access points;
- small natural areas with few access points, where nobody controls visitor numbers and no entrance fee is required;
- small natural areas with an entrance fee.

Only in the last case is information about the number of visitors collected.

In the first two cases, if we want to estimate visitor flow, we need either to set up phone/postal surveys regarding the whole population of potential visitors, or to carry out field surveys. In this latter case the problem regards the number of access points.

Estimation using phone surveys

In 1999 and 2000 two phone surveys were carried out, one in Friuli Venezia Giulia and the other in Veneto (Tempesta & Thiene, 2001; Marangon & Gottardo, 2001). The purpose of the research was to analyse the tourist-recreational behaviour in mountain areas. In particular, the survey aimed to discover the number of daily hiking/trekking visitors in the most important mountain massif and forest districts; the number of days spent in the mountains; type of recreational activities carried out during each trip. Two stratified samples were defined, one composed of 500 and the other of 760 people. They were interviewed in both regions.

The results show that in Veneto 48,1% of the sample had been on day trips, while 12,6% had been on holiday; in Friuli the percentages were lower, so we discovered that 33,8% had been on daily excursions and just 4,8% had been on holiday. Therefore, visiting alpine and prealpine areas is a very common practice in both the regions, especially in regard to daily excursions. While we met difficulties estimating the number of people on holiday, it was easier to define the number of day-trippers, which was estimated to be 6 million either in Friuli or in Veneto. Besides, it resulted that the average number of excursions was higher in Friuli than in Veneto. On the contrary, the number of excursions per hectare was higher in Veneto (21 against 12 excursions per hectare) than in Friuli (see Tables 1 and 2). For a better interpretation of the estimation we should consider in person surveys, which estimated that 25% of mountain visitors had been on holiday. Therefore, visitor flow was equivalent to 26 and 16 units per hectare in a year. These values are similar to those reached in other alpine zones and in this way they are substantially reliable.

At this point we should highlight that it is very difficult to estimate visitor numbers in each natural area. If we consider the average number of excursions done in each massif/district with a confidence interval of 95%, we can observe that in some cases the lower boundary is negative. Therefore, the estimation cannot be reliable (Tables 1 and 2). This problem depends on district dimension, in so much as smaller districts were visited by fewer people and so the estimation was more problematical. In fact, a meaningful sample should be larger than those used in our research. Therefore, phone surveys are only able to collect general information. On the other hand, they can

[12] The value of the world's ecosystem service and natural capital is a very interesting theme (Costanza et al., 1997; OECD, 1992). This research is going in this direction focusing in on the recreational value.

[13] To study in depth consult: Marangon et al., 2000; Marangon & Gottardo, 2001; Marangon & Tempesta, 1998; Marangon & Tempesta, 1999; Tempesta & Thiene, 2000a; Tempesta & Thiene, 2000b; Tempesta & Thiene, 2001; Visintin, 2000.

Mountain massif	Surface Km^2	Trips			95% Confidence Interval	
		mean	total	per ha	Lower Bound	Upper Bound
Vette Feltrine - Monte del Sole	779	0,0639	285.513	3,67	0,0356	0,0922
Piccole Dolomiti - Pasubio	80	0,1995	891.500	111,44	0,1258	0,2732
Cansiglio - Alpago	196	0,0795	355.435	18,13	0,0490	0,1101
Asiago - Monte Grappa	408	0,4876	2.179.223	53,41	0,3694	0,6058
Baldo-Lessini	157	0,1382	617.641	39,34	0,0873	0,1891
Antelao-Marmarole	235	0,0365	163.150	6,94	0,0172	0,0558
Pelmo	21	0,0404	180.631	86,01	0,0190	0,0618
Tofane-Cristallo	198	0,0626	279.686	14,13	0,0404	0,0848
Duranno-Cima Preti	99	0,0143	64.095	6,47	-0,0012	0,0299
Sorapiss-Cadini	80	0,0104	46.614	5,83	0,0032	0,0176
Bosconero	20	0,0117	52.441	26,22	-0,0020	0,0255
Tre Cime-Croda dei Toni-Popera	78	0,0665	297.167	38,10	0,0439	0,0891
Civetta - Moiazza	145	0,0795	355.435	24,51	0,0496	0,1094
Marmolada	77	0,0691	308.820	40,11	0,0255	0,1127
Nuvolau-Averau-Croda da Lago	150	0,0326	145.670	9,71	0,0148	0,0504
Agner- Pale S. Lucano	149	0,0169	75.748	5,08	0,0078	0,0261
Total	2.872	1,4094	6.298.771	21,93	1,23575	1,58302

Table 1: Day trip number estimation in Veneto mountain zones.

District	Surface Km^2	Trips			95% Confidence Interval	
		mean	Total	per ha	Lower Bound	Upper Bound
Valcanale	423,28	1,8063	2.140.805	50,58	1,2191	2,3935
Canal del Ferro	313,38	0,1107	131.165	4,19	-0,0218	0,2431
Carnia	1.221,02	0,7154	847.890	6,94	0,4194	1,0114
Dolomiti Friulane	422,27	0,1186	140.534	3,33	-0,0078	0,2449
Prealpi Giulie	317,42	0,3636	430.972	13,58	0,1083	0,6189
Prealpi Carniche e P.C.Merid.	655,11	0,3162	374.758	5,72	0,0433	0,5891
Prealpi Venete	381,05	0,2589	306.833	8,05	0,0728	0,4450
Prealpi Giulie Meridionali	414,50	0,6462	765.912	18,48	0,1943	1,0982
Colline Moreniche	81,30	0,0632	74.952	9,22	-0,0117	0,1382
Collio e Colli Orientali del Friul.	212,46	0,1383	163.957	7,72	-0,0591	0,3358
Carso	321,64	0,6067	719.067	22,36	0,2160	0,9974
Total	4.763,4	5,1443	6.096.843	12,80	4,1175	6,1711

Table 2: Day trip number estimation in Friuli mountain and hill districts. .

give an overall estimate of the number of visitors in areas that are well-defined and extensive.

Estimation using field data

In order to overcome the difficulties connected with phone surveys, a field survey was used. There are no problems in areas with few access points. In this case, we defined a stratified sample that included counting the entries over a number of days in which the areas were visited. In general, counting was carried out in one third/quarter of all visiting days. This method is reliable and not so expensive when there are no more than 3 access points to check. Above that number survey costs increase, especially in mountain and hill zones, because interviewers have difficulties in reaching them.

In the case of multiple access points we suggest using the following method:

- identify the main parking areas;
- define a stratified survey calendar;
- count the number of cars in the parking area, taking care to note the time;
- carry out in-person interviews in order to calculate:
  a) average number of people per car;
  b) the relationship between the fraction of total arrivals recorded in the parking area (sh) and the times (hours in the day) (h) in which they was counted using the following formula:

$$sh = f(h) \quad [1]$$

By means of formula [1], from the number of cars in the parking area at a given time it is possible to estimate the number of cars present in the parking area during the whole day. In this way, a single interviewer can complete counting in a large number of parking areas. For example, in the case of Natural Park of the Dolomiti Ampezzane, 17

Area	Typology	Geografic area	Province	Surface Km^2
National Park of the Dolomiti Bellunesi	National Park	Mountain	Belluno	32,00
Natural Park of the Dolomiti Ampezzane	Regional Park	Mountain	Belluno	11,20
Property Regole Ampezzane Cortina**	Collective ownership	Mountain	Belluno	13,00
Vincheto Celarda	State nature reserve	Mountain	Belluno	0,80
Waterfall of Molina (Cascate di Molina)	Regional nature reserve	Hill	Verona	0,15
Isonzo delta (Foce dell'Isonzo)	Regional nature reserve	Coast	Gorizia/Udine	23,40
Valle Canal Novo	Regional nature reserve	Coast	Udine	0,36
Quadris nature area (Fagagna)	Bird reserve	Hill	Udine	0,10
Griffin vulture project (Forgaria nel Fr.)	Regional nature reserve	Piedmont zone	Udine	5,10
Caves of Villanova (Lusevera)	Caves	Mountain	Udine	0,02*
Historical garden Villa Varda (Brugnera)	Garden of Palladian Villa	Plain	Pordenone	0,18

Table 3: Environmental and natural features, localisation of studied areas
** Estimated just on the base of length of open to visitors caves*
** * The right name is 'Property owned by the Regole Ampezzane south of Cortina'.*

parking areas were checked, and through 500 interviews it was possible to estimate the following formula:

$$sh = \frac{1}{1+e^{13,40+1,29\bullet h}} \qquad r^2 = 0{,}99$$

In this way we estimated that 540.000 people had visited the area mainly in July and August (more than 65% of presences). This figure is very different from that obtained through the phone survey (Tempesta and Thiene, 2000b).

Applying this method to the land owned by the Regole Ampezzane it was possible to estimate that 340.000 people had visited the area during the Summer of 2000.

VISITOR FLOW IN THE AREAS STUDIED

The surveys on ecotourism both in Veneto and in Friuli Venezia Giulia involved natural areas which were diversified either as regards their dimensions or their geographical-ecological-environmental features (Table 3). In fact, there are National Parks, Regional Parks, Nature Reserves and areas managed by private or non-profit associations. Consequently, land use is extremely variable and allows people to practise recreational activities that are not strictly connected with the environment and nature (Table 3).

Tourist flow, which was estimated using the method described above, is highly variable. Large alpine parks stand out from other natural areas as regards the total number of visits. Every year they are visited by a wide range of people, varying in number from 285.000 to 540.000 units (Table 4).

However, the situation changes if we consider the number of visitors per hectare. In fact we observed that higher flows are connected with single-purpose visits. In this case, it appears as though the areas are treated as an “outdoor museum". This is evident in the natural areas of the Waterfall of Molina (Cascate di Molina), the Caves of Villanova (Grotte di Villanova), the historical garden of Villa Varda (parco storico di Villa Varda) and the Quadris Nature Reserve in Fagagna (Oasi dei Quadris di Fagagna). Considering the extension of the zones examined, tourist flow is very high in both the areas studied near Cortina. In this case, the number of visits is influenced by the presence of the well-known resort of Cortina.

VISITOR CHARACTERISTCS AND RECREATIONAL ACTIVITIES

In order to collect information regarding visitor characteristics and recreational activities about 8.400 people were interviewed in person. The sample of people interviewed in mountain zones is very small and therefore the following data are only indicative (Table 4).

The average age in the sample was aligned with the average age in Italy (39years), as was the average family size, around 3 units. On the contrary, the mean of family income was much higher than the national average at around 16.000 Euro per year. Average income was even higher in the Dolomite resorts. In fact here the figure was above 28.500 Euro (Table 4). These data were in keeping with an above-average educational level. In fact the sample share with a degree or a secondary school qualification was in the worst of the cases more than 52%, often going beyond 70%, while the national average is just 33%. Therefore, the North-East Italian ecotourist is a cultured person who enjoys a well-off lifestyle. The catchment area, which is defined as 'the distance covered by the 90th percentile', could be a significant indicator for the attraction potential of a defined area, and for the value tourists attach to it. The catchment area is broader in most of the mountain areas (exceeding in general 100 km) (Table 5). It is also extensive in many of the single-attraction natural areas studied. The griffin vulture project, the Waterfalls of Molina, the Caves of Villanova and the Valle Canal Novo are able to attract visitors coming from a long way off

Area	Visitors		Interviews	Age	Income (Euro)	Family	Graduates/ diploma*
	Total	per ha	%	mean	mean	mean	%
National Park of the Dolomiti Bellunesi	285.000	89,0	0,07	37	19.600	3,7	52
Natural Park of the Dolomiti Ampezzane	540.000	482,1	0,09	42	28.400	3,3	81
Property Regole Ampezzane Cortina	340.000	261,5	0,15	39	38.200	2,9	80
Vincheto Celarda	8.000	100,0	3,95	37	18.600	3,1	69
Waterfall of Molina (Cascate di Molina)	34.000	2266,7	2,80	37	18.100	3,4	72
Isonzo delta (Foce dell'Isonzo)	31.000	13,2	3,11	40	24.300	3,0	81
Valle Canal Novo	12.850	356,9	9,63	41	22.700	3,0	66
Quadris nature area (Fagagna)	9.000	900,0	11,34	40	18.100	3,1	74
Griffin vulture project (Forgaria nel Fr.)	8.000	15,7	10,63	40	23.800	3,1	71
Caves of Villanova (Lusevera)	6.470	3235,0	13,76	39	24.300	3,3	69
Historical garden Villa Varda (Brugnera)	69.500	3861,1	1,43	35	35	3,6	65

Table 4:Visitor Characteristics
** diploma means high school diploma*

Area	Catchment area (km)	Visitor activities (%)				
		Pic nics	Hiking	Natwatc*	Excursions	Other
National Park of the Dolomiti Bellunesi	100	43	17	16	18	6
Natural Park of the Dolomiti Ampezzane	150	8	3	45	58	4
Property Regole Ampezzane Cortina	220	2	38	53	31	6
Vincheto Celarda	75	0	40	60	0	0
Waterfall of Molina (Cascate di Molina)	115	0	71	42	0	0
Isonzo delta (Foce dell'Isonzo)	77	0	54	70	0	7
Valle Canal Novo	120	0	33	70	0	28
Quadris nature area (Fagagna)	73	0	44	48	0	8
Griffin vulture project (Forgaria nel Fr.)	97	0	47	37	0	20
Caves of Villanova (Lusevera)	98	5	0	67	7	22
Historical garden Villa Varda (Brugnera)	35	4	67	27	0	36

Table 5: Dimension of catchment area and visitor activities
**Natwatc means Nature watching*

in virtue either of their unique natural heritage or, more likely, because of the information facilities that help the visitor to understand nature. Therefore the catchment capability of a natural area is strictly influenced by developing, enhancing and promoting environmental projects.

As regards the reasons inducing people to visit the site, some conflicting elements emerge (Table 5). In fact, the decision to visit an area is not always founded on a naturalistic reason. Moreover, it is a secondary choice only in the National Park of the Dolomiti Bellunesi (in the Dolomites). The reason for this is connected with the dimension of the zone, as the surface area makes the park ideal for multipurpose visits that are often unrelated to the natural features of the area. In fact, the most environmentally interesting areas inside the park are inaccessible to many people.

On the other hand, the nature-based choice is the main reason for people visiting both other mountain areas and small wetlands. It is very interesting to note that people generally mentioned activities like walking or trekking for almost all the areas examined.

ACCOMODATION, VISITOR EXPENDITURE AND RECREATIONAL BENEFIT

A measure of the economic role of ecotourism is given by travelling expenditure borne by visitors to reach natural areas. As expected, expenses are correlated with both distance and use of tourist facilities. First of all, it is interesting to observe that in most of the cases analysed tourists are day-trippers who do not require any accommodation. The only exceptions are the two Dolomite areas near Cortina, where this kind of visitor is not very common. In this case, expenditure includes almost exclusively travel costs and cost of meals (Table 6). However, sometimes the entrance fee is the main expenditure.

Even if we exclude the two Dolomite areas, the average expense varies greatly throughout the sample, but this could be mainly ascribed to the payment or not of an entrance fee. The ability of natural areas to generate expenditure flows is indicated by the visitor expenditure per hectare figure. We should note that there are several differences among the areas studied. If we ignore the value for the Caves of Villanova, because of

Area	Expenditure per trip (Euro)					Expenditure (Euro)	
	Travel	Ticket*	Food	Accom.	Total	Total	per ha
National Park of the Dolomiti Bellunesi	3,6		7,9	0,3	11,8	4.026.401,3	1.054,6
Natural Park of the Dolomiti Ampezzane	3,5	3,4	9,7	16,1	32,7	17.639.585,4	15.749,9
Property Regole Ampezzane Cortina	19,3	3,1	7,0	14,2	43,5	14.802.687,6	11.386,8
Vincheto Celarda	3,4		0,4		3,8	30.161,1	377,0
Waterfall of Molina (Cascate di Molina)	2,1	2,0	1,9		6,0	203.690,6	13.579,2
Isonzo delta (Foce dell'Isonzo)	1,3	3,6	3,5	0,4	8,9	275.374,8	117,8
Valle Canal Novo	1,3	2,3	6,4		9,9	127.874,7	3.552,2
Quadris nature area (Fagagna)	0,7		1,7		2,4	21.846,1	2.184,6
Griffin vulture project (Forgaria nel Fr.)	1,5		4,8	0,2	6,5	51.852,3	101,7
Caves of Villanova (Lusevera)	1,5	3,7	3,4		8,6	55.467,5	27.734,3
Historical garden Villa Varda (Brugnera)	2,5		0,3		2,8	192.018,7	10.668,5

Table 6: Expenditure flows ** Entrance fee or cable railway in mountain zones*

Area	Recreational benefit per trip (Euro)				Benefit (Euro)	
	TCZ	TCI	CVM	Mean	Total	per ha
National Park of the Dolomiti Bellunesi		5,5	5,3	5,4	1.843.751,1	482,9
Natural Park of the Dolomiti Ampezzane		3,1	6,8	4,9	2.663.368,2	2.377,8
Property Regole Ampezzane Cortina			4,1	4,1	1.404.762,8	1.080,4
Vincheto Celarda	2,1	4,6	4,1	3,6	28.405,1	357,4
Waterfall of Molina (Cascate di Molina)			4,2	4,2	142.542,1	9.495,1
Isonzo delta (Foce dell'Isonzo)	6,3		3,9	5,1	158.552,3	67,7
Valle Canal Novo	6,2	10,0	7,6	8,0	102.258,5	2.839,0
Quadris nature area (Fagagna)			1,7	1,7	15.493,7	1.533,9
Griffin vulture project (Forgaria nel Fr.)	5,4		3,5	4,5	35.635,5	69,7
Caves of Villanova (Lusevera)			10,9	10,9	70.754,6	35.314,3
Historical garden Villa Varda (Brugnera)		4,8	2,3	3,6	247.899,3	13.759,4

Table 7: Recreational benefit

the difficulty in estimating the extension of the area, the per hectare value varies between a few hundred Euro and over ten thousand Euro. In particular, the expenditure flow is very high in mountain and hill areas. In some cases this is due to high tourist development, in others it is thanks to the exploitation of natural areas by the private sector.

In order to assess the recreational benefits, we used both direct and indirect approaches[14] (Table 7). We should note that, from some points of view, benefits per trip are quite similar because they only vary between 3,5 and 5,5 Euro, which highlights the considerable recreational value of the areas examined.

Obviously, the per hectare total benefit flow is influenced by the number of visitors and this is why it appears to be so variable. In general it is higher than for other alternative economic uses, like forest or agricultural productivity.

CONCLUSION

In the second half of the 1990s several surveys, which were carried out both in Veneto and Friuli Venezia Giulia, collected information regarding the size and features of ecotourism.

By applying appropriate counting methods we were able to quantify visitor flow in many natural areas. Despite a high level of variability, factors capable of increasing visitor flow were substantially related to the extent of tourist development in the area and to the facilities supporting outdoor activities, especially as concerns nature and the environment.

Data collected through interviews highlighted that the choice of visiting areas of great natural beauty does not just depend on an interest in nature. It often depends on an unspecified need for a natural habitat that has not yet been affected by urban and agricultural growth.

What is more, the fact that the ecotourist's level of education is higher than the national average is encouraging. So it is reasonable to assume that ecotourists will have a more careful approach towards nature and the environment. Because of the relationship between educational level and ecotourist flow, we can assume that a steady increase in school attendance will encourage people to visit natural areas.

Finally, we should highlight the expenditure flow generated by ecotourism and the great recreational benefit deriving from it. In conclusion, ecotourism seems to play a significant role in the economic development of the areas studied. In particular it favours the development of marginal areas (such as hill and mountain zones) or guarantees recreational and cultural benefits to the

[14] Statistical models study the benefit of visits through several methods. We applied an indirect approach, the so called travel cost method (individual travel cost, TCI and zonal travel cost, TCZ), and a direct approach, contingent valuation method (CVM) (Mitchell & Carson, 1989; Bishop & Romano, 1998).

inhabitants of overcrowded areas on the Veneto and Friuli plain.

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Visitors and Managers: Differing Evaluations Concerning Recreational Impacts and Preferences for Management Actions?

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Abstract: During the summer of 1999 tourists were interviewed along two important scenic roads in Norway. Later on managers in all Norwegian counties were asked some of the same questions. The questionnaire presented twelve photos of trails and paths in different conditions, and twelve potential management actions concerning minimizing or repairing impacts on the ground. The results show significant differences between the two groups in their evaluations of photos with comprehensive impacts and corduroy covered paths. The managers have a lower level of tolerance towards impact, and the visitors are more in favor of using corduroy. Almost all of the proposed management actions were also rated significantly different, but the two groups are still quite consistent in their overall rating patterns: Actions concerning information of visitors or shielding the resource are favored; using fees is unacceptable.

INTRODUCTION

The impact of recreation and tourism on the natural environment has been an important research and policy topic in recent years (Liddle, 1997, Hammitt & Cole, 1998). Reported visitor concern about such impacts has been promoted as a basis for s practice of self-regulation and management intervention. Nonetheless, there have been relatively few empirical evaluations of how such impacts affect the visitor experience.

Provisions of (physical) facilities in recreational areas often have a double purpose. They offer service to the visitors, but their primary purpose might equally well be as management actions with the purpose of limiting impacts on the natural environment.

Research in the outdoor recreation field suggests that land managers may be more concerned about impacts than are the visitors. But how do the two groups judge the need for facilities, and which management actions are regarded as good or acceptable tools in order to repair or minimize impacts?

It is important to understand the visitors' evaluations (as a stakeholder group) in order to determine whether "conventional wisdom" about concern for such impacts are accurate, and whether facilities and management actions are necessary. Moreover, it is important to know to what extent the visitors represent a homogeneous group and whether various stakeholders support a given management action or set of actions.

This paper reports results from two studies in Norway concerning evaluations of impacts and stated preferences for facilities and other management actions. The results will be discussed in relation to recreational experiences, management objectives, and also in relation to what is acceptable environmental conditions and the establishment of environmental standards.

METHODS

The evaluations are based on respondent ratings of 12 nature-oriented photos showing paths and trails in different conditions and shapes, combined with ratings of several (written presentations of) potential management actions for minimizing or repairing impacts. The rating questions used a 7-point scale, where a low number indicates a negative valuation of a picture or a management action. Four is a neutral statement. Surveys were administered to visitors along Sognefjellsvegen (a scenic road through a mountain area in the middle of Southern Norway) and along Atlanterhavsvegen (a scenic road along a part of the coast between the two towns Molde and Kristiansund N) during the summer 1999 (N=569). The visitors were contacted along the roadside, where they filled out a self-report questionnaire. A broad mixture of nationalities was represented in the sample: 40 % Norwegians, 24 % Germans, 9 % Dutch, 8 % Swedes and 6 % Danes, together with tourists from 14 other nations.

All the relevant managers at the county level (The Environmental Division at the 20 County Governors Offices) in the entire country were mailed a questionnaire during the autumn 2000 (N=205). The managers were (on an average level) much more experienced in outdoor recreation than the visitors.

The relevant questions for the results presented here were identical in the two studies. The analysis used are ANOVA (analysis of variance) and Factor

Analysis (Principal Component Analysis, Varimax rotation)

RESULTS

Impacts on the ground

Significant differences (ANOVA, 5 % level) were found between the managers and visitors for 10 of the 12 pictures. Each of the last two pictures show a path with little or limited impact on the ground, and both were given a high positive rating from both groups (mean values 5,45 and 5,71 for the two pictures). The rest of the pictures display a great variety in types and levels of impacts, and there is also (as always with photos) quite a lot of other information (more or less hidden) in the pictures. A factor analysis tries to simplify data in a complex material; in this case data "hidden in the 12 pictures".

A factor analysis revealing three factors explains 54,0 % of the variance. The factors can be described as following:

- **Factor 1**: Comprehensive impact on the ground (comprised by seven pictures) - called HI-IMPACT
- **Factor 2**: Logged paths, to shield the ground from impacts (two pictures) – called CORDUROY PATH
- **Factor 3**: Minor impact on the ground (three pictures) – called LO-IMPACT.

Analysis of variance (of the factor scores) shows that there are significant differences between the visitors and the managers in how they valuate HI-IMPACT ($F (1, 697) = 94.64$, $p < .001$) and CORDUROY PATH ($F (1, 697) = 23.18$, $p< .001$), but not LO-IMPACT ($F (1, 697) = .22$, $p=.643$). (Factor 3 includes the two pictures that did not show significant differences in themselves either, between the two groups – mentioned above).

So what do these differences actually indicate? We can make three new variables, each of them reflecting one factor. We get an average rating for each respondent by combining the rating scores for the pictures that make up each of the factors. This way we can visualize the pattern:

HI-IMPACT: The average score is low (meaning 'negative' rating of the pictures) for both groups on this factor, but especially low for the managers (2.8). The visitors' average is 3.8. The interpretation is that the visitors have a higher tolerance for recreational impact on the ground than do the managers.

CORDUROY PATH: Here the average score is close to neutral (4). But the visitors' average is in the positive direction (4.7) while the managers' average is somewhat negative (3.9). It seems like the visitors appreciate facilitation like wooden cover along or on a trail, more than the managers.

LO-IMPACT: The average score is almost identical for both groups, and this is the only factor with an average score clearly in a positive direction (5.6). The interpretation is that both groups tolerate, and probably even appreciate, the moderate impact along a path.

Valuation of facilities and management actions

We presented 12 different types of facilities or management actions to the respondents. All of them represent an alternative in managing recreational impacts. The results show a great variety in how both the visitors and the managers evaluate the different alternatives.

Once again we used an exploratory factor analysis in trying to reveal an overall pattern in the material. The analysis gave four factors (Eigenvalues > 1) explaining 57,7 % of the variance. The factor loading matrix is presented in Table 1.

Proposed management action	Factor 1	Factor 2	Factor 3	Factor 4
Regulate the number of visitors in wildland areas	.766			
Regulate certain activities in certain areas	.720			
Prohibit big groups	.712			
Only allow camping on specific sites	.429			
Fee requirement for entering a specific area		.827		
A yearly fee for using the nature for recreational purposes		.771		
Fee requirements for activities that especially impact the natural resources		.686		
Inform visitors in order to guide the use to robust areas			.835	
Inform visitors in how to impact as little as possible			.826	
Restore and strengthen the sites by supplying more soil before sowing or planting				.835
Close especially impacted sites for some years, so that the vegetation can recover				.552
Making corduroy paths across bogs				.421

Table 1. *Rotated factor loading matrix (sorted) for variables on management actions*

The result of the factor analysis is quite easy to interpret. The variables with high loading on each of the factors can be thematically simplified like this:

- **Factor 1**: Regulations and prohibitions
- **Factor 2**: Economical means
- **Factor 3**: Informing the public
- **Factor 4**: Protecting or repairing the resource

There is a significant difference between the visitors and the managers for all four factors. Regulations and prohibitions (factor 1) is more appreciated by the managers than the visitors ($F(1, 517) = 11.87$, $p<.01$). It is opposite with the economical means (factor 2); these are more acceptable among the visitors ($F(1, 517) = 30.60$, $p<.001$). To inform the public (factor 3) seems to be more welcomed among the managers than among the public itself ($F(1, 517) = 19.36$, $p<.001$). To protect or repair the resource (factor 4) is valued more positively among the visitors than the managers ($F(1, 517) = 20.39$, $p<.001$). But these results only present the differences between the two groups, not their actual view on the different actions.

Table 2 presents the valuation of the different management proposals in a descending order, with the most favored ones at the top (based on the mean value in the whole sample). Generally spoken, it is highly acceptable to inform the visitors how to behave, but not to make them pay. The different suggestions with prohibitions and regulations varies along the scale; it is more accepted with specific regulations (certain activities in certain areas) than more general regulation (visitors in wildland areas).

DISCUSSION

The results show that there are significant differences between the visitors and the managers both in their level of tolerance for recreational impact, and in what they consider to be good management practice in dealing with recreational impacts. However, it is very important to note that the two interest groups, despite the differences, follow almost the same pattern in how they evaluate both the impact and the management actions. Although the visitors have a higher tolerance than the managers for recreational impact along a path, they still prefer a path with little impact. And although the visitors are less appreciative than the managers of 'information of visitors' as a management action, they still find this the most favorable one among the proposed actions. We have the opposite case with 'fee actions': These are (perhaps surprisingly?) more acceptable among the visitors than among the managers, but they are still rated as unacceptable management actions. Today it is not relevant policy in Norway, anyhow, to introduce fees as a management actions, because of 'Allemannsretten'.

Management actions	Interest group	Mean (n)	Mean (N)
Inform visitors in how to impact as little as possible	V M	6.1 6.2	6.1
Inform visitors in order to guide the use to robust areas	V M	5.7 6.2	5.8
Close especially impacted sites for some years, so that the vegetation can recover	V M	5.8 5.5	5.7
Regulate certain activities in certain areas	V M	5.2 5.9	5.4
Making corduroy paths across bogs	V M	5.3 5.2	5.3
Restore and strengthen the sites by supplying more soil before sowing or planting	V M	5.2 4.7	5.1
Prohibit big groups	V M	4.3 4.8	4.4
Only allow camping on specific sites	V M	4.5 3.9	4.4
Fee requirements for activities that especially impact the natural resources	V M	4.2 4.1	4.2
Regulate the number of visitors in wildland areas	V M	3.7 3.8	3.8
Fee requirement for entering a specific area	V M	3.0 2.2	2.7
A yearly fee for using the nature for recreational purposes	V M	2.4 1.6	2.2

Table 2. *How the two interest groups (Visitors and Managers) value different management proposals – separately (n) and all together (N). The scale goes from 1 (= very bad) to 7 (= very good).*

This public right of access says (both according to tradition and law) that anyone is allowed to walk etc. on uncultivated land, without paying, and no matter who owns the land, *"... when it is done considerately and with due care"* (Ministry of Environment 1985, Vistad 2001a).

The ratings on the different management actions show quite a similar pattern as the results from a previous study in two recreational areas in Norway (Vistad 2001). An important point here is that these two recreational areas are located quite a distance from the road. They require hiking or canoeing to be reached, and these visitors were also more experienced recreationists. Anyhow, the level of experience does not seem to influence the results dramatically: The most popular actions (the same list was used in the two studies) were those based on use of information, and on protecting or repairing the resource, and the least favorable ones were fees – quite similar to the present study.

Many studies conclude that recreational impact on the ground are quite accepted by the visitors, especially when compared with impacts like litter and other "unnatural" traces (Stankey & Schreyer, 1987, Kuss et al., 1990, Vistad, 1995). This study shows that the tolerance for impact on the ground is very much a question of how comprehensive the impact is. Cole et al. (1997) have a similar conclusion in their study from high-use destinations in six wilderness areas.

These findings show the relevance of discussing and studying "the limits of acceptable change" of a recreational resource. Evaluating and defining standards of quality is one of the important, but difficult tasks for the managers (Anderson et al., 1998, Lime et al., 2000, Manning, 2000). For the managers it must be pleasant to confirm that their view – in this study – is very much mirrored by the visitors' view. But there are still important differences to be noticed.

An important reminder is the fact that the visitors (or even managers) seldom or never appears to be a homogeneous group. Here the visitors and managers have been treated as two groups, only comparing mean values. There will probably be a broader variety in the results if we bring in the potential of segmenting variables like attitudes, recreational experience, gender, nationality etc.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Environment and Rural Tourism in Bustamante, Mexico

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Abstract: The community is Bustamante, population 3,501, in Nuevo Leon state, Mexico. It is a privileged rural landscape, made fertile in the middle of a semi-desert by springs that flow year-round. And in the vicinity of the oasis lie the internationally known caverns known locally as *Grutas de Palmito*.

The problem are the pressures of recreation on the environment: day excursionists who come in great numbers are causing erosion near the water, both around the springs and along the river that flows from them. The waters that used to be clear are now murky because of the soil deposition. And in the cave, the visitors walk freely in the gallery spaces and trample on the formations. But because the local tourism industry is nature-based, it is imperative to conserve the natural resources that make it possible.

This research considers the potential of what has come to be known as sustainable tourism to promote economic development in Bustamante and possibly in similar communities, not by replacing the agricultural base but by complementing it. Data were obtained from observations, interviews, survey questionnaires, from the Mexican census, from the regional newspaper, and from the literatures on sustainable tourism and history of the region. The study proposes that the natural and cultural resources of Bustamante had been largely conserved until recently, and that the present accelerated degradation of these resources can be reversed through approaches to sustainability that are related to tourism, so that Bustamante's people meet their present needs without compromising the ability of future generations to meet their own needs, measured against the standard of living currently enjoyed.

INTRODUCTION

"We receive a hundred thousand visitors a year, and we want to receive a million", declared Felipe Hernandez, Jr., owner of what was until recently the only hotel in town, at the public meeting on tourism held at Bustamante's city hall on July 10, 2001. The answer from Jordi Perez, a tourism consultant from Spain, was: "Instead of getting a million visitors, it would be better to get ten times more money out of the hundred thousand who already come". Aside from this controversy, let us start by saying that the number of visitors to Bustamante per year has never been reliably counted, a statement that I made at the meeting after Jordi's remark. Thus the importance of my attending the Conference on Monitoring and Management of Visitor Flows in which this paper is to be presented: the topics that will be explored there are of great value for my learning to research the relationships between landscape and rural tourism, which is the topic of my doctoral dissertation at Texas A&M, a larger work in progress. Because the number of visitors per year is one of the basic elements of research data for this larger project, an approximation was made using the number of tickets sold for entrance to the park that has been developed in the canyon where the spring waters flow, which is where most visitors go. For one of the two major festivals of the year, this one held in *Semana Santa* or Easter week of 2001, (1) the regional newspaper la Prensa published that during the period of the week-long festival, 12,027 tickets for entrance to the park were sold (Tesoreria Municipal de Bustamante, N.L., 2001). Using the same number for the other week-long festival of the year, we come up with 24,054. 20 out of 30 visitors surveyed mentioned the canyon or the springs as the attractions that brought them, and if 24,054 then constitutes 67% of the visitors, we obtain 35,901 for the two weeks out of the year which define peak demand. We have observed that on weekends during the Summer season the park gets almost as heavily used as during *Semana Santa*. If fourteen weekends during school holidays (when visitors increase dramatically) make up 28 days, that equals four weeks of heavy use. Considering the intensity of this use even at one half of that of the use the park gets during festivals, in terms of number of visitors, that equals another 35,901 visitors. Now we have 71,802 and triangulation with Mr. Hernandez's figure starts to seem reasonable.

"It is necessary to ensure that the development of rural tourism is sustainable, including allowing for the participation of all the members in the given community" (Verbole, 2000). "Individuals have no effective voice in any community of more than 5,000-10,000 persons" (Alexander, 1977). At 3,501

(INEGI, 2000), the Bustamante community can have a democracy, and control over the destiny of the privileged landscape that they inherited. As defined by Krippendorf (1982), ”soft” tourism stresses local control, along with slow, self-determined development. The paper argues in favor of this tourism model, over large scale, mass-based tourism controlled by large corporations, for the sake of protecting the natural and cultural resources for future generations. The work focuses on the notion of community as a scale of things, and on how the power of community is decisive in environmental outcomes. In researching the relationships between environment and rural tourism, using Bustamante as a case study, we define the local phenomenon of tourism and recreation as nature-based, and understand that even when inserted in an international system of eco-travel, it is the local community who should lead the effort towards its own sustainable development, benefit the most from the economic gains of receiving visitors, and be most directly responsible for the conservation of the natural and cultural resources that are bringing in visitors and revenue, precious resources that have traditionally given them an exceptionally high quality of life. ”Sustainable tourism development depends on protecting the environmental resources for tourism” (WTO, 1998). Efforts at state, national and international levels are also necessary for success in this complex environmental arena, but the grassroots and local leadership levels are the most crucial.

I am involved in the community and in contact with the leaders, transitioning as an observer from the non-participant that I was on my first visit in the Summer of 1999, to the role of a participant observer during my field trips which in 2001 became monthly. It is the ultimate goal of my involvement that this present and other work will eventually directly or indirectly become useful towards landscape conservation in Bustamante, a place admired by many.

HISTORY AND SOME OTHER BACKGROUND

On June 8 of 1686, thirty families of Tlaxcalan indians officially applied for land and water rights to settle in what was to become San Miguel de Aguayo, and later Bustamante (2). This northern frontier of the New Spain, now northeast Mexico, was before the conquest inhabited by semi-nomadic tribal peoples who are some of the least-known in the larger region. One group settling at least seasonally in this landscape were the Alazapa (Gomez, 1998), who left us rock art such as paintings and petroglyphs attesting to their magical interpretation of the universe, art which today some people still value as sacred, while unfortunately others value merely as money to be made in the international stolen art market, as evidenced by the recent thefts of major petroglyphs in nearby Mina.

”This place had a distinct economic boom in the last decade of the Seventeenth Century and the two first decades of the Eighteenth” (Cavazos, 1994). It was during this period that the waters coming from the mythical springs at the west end of the eight-kilometer long canyon, were diverted into three *acequias*, small earthen irrigation ditches that turned the flatlands just to the east of the canyon into a lush oasis of pecan and avocado orchards, as well as other crops which constituted this garden community, one that would feed the mining booms in nearby Villaldama and Lampazos.

The Canyon of Bustamante is most dramatic, with sheer rock faces that tower more than a thousand meters above the valley. Its orientation is a clear east-to-west (See Figure 1), and the sun sets exactly between the canyon walls. This is a highly ”imageable” place, easy to read, without a problem to find one’s way. And the clarity of the orientation makes it pleasant. ”A good environmental image gives its possessor an important sense of emotional security. He can establish a harmonious relationship between himself and the outside world. This is the obverse of the fear that comes with disorientation. Indeed, a distinctive and legible environment not only offers security, but also heightens the potential depth and intensity of human experience” (Lynch, 1960). The town is laid out on the cardinally-oriented gridiron pattern characteristic of Spanish Colonial America, consisting of one-story houses of small and human scale, with a central plaza and the Catholic church across the street. The town layout orientation reinforces and complements that of the natural features, contributing further to place legibility and pleasant atmosphere. There is a harmony of built and natural environments, and even though the historical core has lost its architectural integrity, there remains a town full of artistically valuable old houses, mostly from between 1850 and 1950, based on the dates inscribed in main entrance doors.

Houses old and new, but all one story, shaded streets and open plazas, and the unpretentious church as a landmark, all assemble to a larger landscape, surrounded by vast fields and dramatic mountains. The view west from the plaza is composed of the church in the foreground, and in the background, the highest mountain in the region, the *Cabeza de Leon* or Lion’s Head of characteristic profile. Houses front the streets making a consistent urban composition, and the core of each urban block is not built up, but rather a garden with towering pecan and avocado trees that shade the environment, producing a good microclimate that attracts visitors from around the arid, dry surrounds. The acequias run through plots and under streets, surviving today in functioning mode. And even though there has been a high degree of

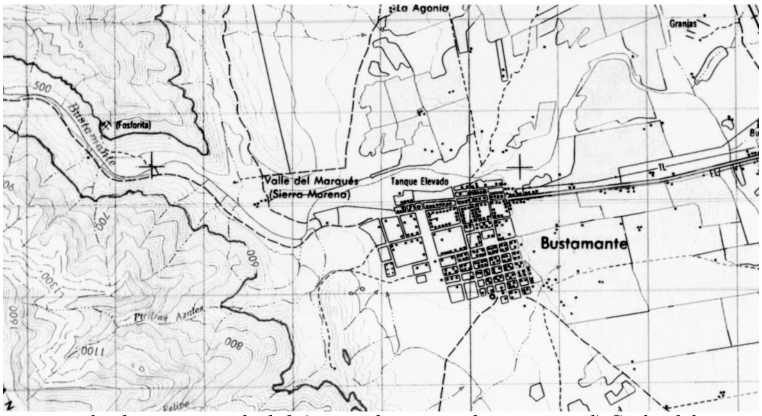

Figure 1: Map of Bustamante withe the canyon to the left (spring shown as a dot at west end) Grid in kilometers

abandonnement of the traditional agricultural practices (3), this continues to be one of the oldest surviving cultural landscapes of Tlaxcalan origin. Four hundred Tlaxcalan families emigrated from their central Mexican homeland after the conquest, and those who moved north left us a heritage of hydraulic works, also influenced by Spanish technology, that extends well into Texas. In San Antonio the 270-year old *Acequia San Juan* was recently restored, having been dry since 1968 (Koidin, 2001). In that city only two of seven original *acequias* survive, and the fact that in Bustamante all three original acequias are still working adds importance to this landscape as a cultural resource that needs to be restored, maintained, and legally protected.

Mexico gained independence from Spain in 1821, and in 1832, the name of the town was changed to Bustamante, after Anastasio Bustamante who was president of the newly established republic. The community continued to be a prosperous one, fortunate to live in a highly fertile agricultural landscape, and maintained its sustainable agricultural traits well into the Twentieth Century. The railroad came in at the end of the Nineteenth, and in 1906 the caverns were discovered. Clean, clear water flowing year round in the middle of a vast semi-desert, a small colonial garden city in the shade of pecan and avocado orchards, and a cave with huge inner space and fantastic formations all turned Bustamante into a community attractive for recreation, drawing visitors in growing numbers from throughout the region, and also increasingly from outside.

From observations of the past two years, it is evident that growing numbers of visitors are resulting in negative impacts on the environment: vegetation around the most fragile of two spring-fed pools has diminished, and grass cover in the valley between town and the springs has also demised due to excessive traffic of motor vehicles approaching the running stream, with resulting soil erosion, deposition, and loss of *acequia* water clarity. Other evident problems resulting from the pressures of growing recreation include littering, crowding with its loss of experiential quality in going out to the countryside, and unmet needs for human waste disposal with consequent contamination of land and water. And this is not to mention the impact on threatened and endangered species, evidence of which would have to be found from studies other than this, from fields such as biology, botany, or ecology.

COMMUNITY AND LANDSCAPE

The scale of *landscape* is used to define the geographical area of study, that is, land size between the larger environment called a *region* and the smaller-than-landscape land area which would be called an *ecosystem*. "A *landscape* (in contrast) is a mosaic where the mix of local ecosystems or land uses is repeated over a kilometers-wide area" (Forman, 1995). The landscape of Bustamante that we study is approximately thirteen kilometers long (See Figure 1). This length is defined by a east-to-west line between the *Ojo de Agua* springs site, at the west end of the canyon, and the connection to Nuevo Leon State Highway 1. A paved road runs the entire length. As one turns onto this paved road to approach Bustamante town from Highway 1, a scenic corridor experience starts. To the sides of the road there are pecan and avocado orchards, and as one is traveling west the background is composed of the Sierras Morena and de Gomas, cut dramatically by the Canyon. After four kilometers one enters the town, and if continuing on this main spine, the town is passed and the entrance to the canyon is reached. The mountains on both sides grow higher and higher, and become sheer rock faces as one reaches the park site that has developed around the springs. The pavement ends, and the Sierras get left behind if the direction of travel keeps west. Here one enters the vast arid plains that conform the drainage basin from which the waters of Bustamante come. Hence this plain is a connected landscape, outside the strict limits of the research study, but one that needs to be managed in synchronicity with the management of the Bustamante landscape as this paper defines it. The width of the landscape of study varies, bounded to the north and south in the canyon area by both visible rims, and outside the canyon area to the east of town defined by the land area under irrigation. At its maximum near Highway 1, this dimension is about 6 to 7 kilometers stretching north-south. Within the canyon area, ”landscape” can be advantageously defined and managed using the concepts of watershed and viewshed.

Community and landscape are overlaid in this study in terms of scale, if we understand ”community” as per Alexander, at less than 10,000 inhabitants (4), and ”landscape” as per Forman at several kilometers long. In this case, participatory decisionmaking makes it possible to reach autonomy in environmental management. ”Few case studies in Latin America have been carried out that have demonstrated meaningful local participation in tourism planning and development” (Mitchell and Eagles, 2001). ”The predominant form of tourism found in Mexico today is export-oriented, large-scale, mass-based, and centered around beaches. Evidence shows that this brand of Mexican tourism has been significantly affected by state action” (Clancy, 2001). In the case of Bustamante, the demand for recreation has been met in an unplanned way. Then the numbers of visitors grew to the point where business potential became a driving force for planning, as did the evidence of ecological damage caused by the recreation phenomenon. Since then, several meetings have been held which have included stakeholders involved. One recent such meeting was held on July 10, 2001, and I was in attendance, in the group of technical advisors together with Jordi Perez and Alberto Gayoso from Spain. The meeting included the mayor, the city manager, the local historian, representatives of the State Bureau of Tourism including the director of the Rural Tourism Project, leaders of the local hospitality industry, the presenters of a project to build commercial features in the cave, and the leader of the *ejido* or communal farmers (5). The main purpose of the meeting was for the community to inform the Spanish consultants, hired by the Bureau of Tourism, about what attributes of the place, possibly unknown to planners, need to be planned for and included in a comprehensive rural tourism plan for the state, which defines a sub-region composed of the communities of Bustamante, Villaldama, and Lampazos, which together could integrate a tour larger than what each individual community could offer.

It was evident during the forum, based on ideas expressed by some participants, that the model of large scale, large capital tourism development is popular among some stakeholders. One participant expressed that a golf course would be good; a technical advisor defended that the establishment of a chain hotel could be more sustainable than community control over the lodging business, and found it desirable (an idea expressed more privately after the forum) to shut out the regional visitors who come to picnic for the day, with their coolers and very little money, by charging high prices to enter the park. Felipe Hernandez Cruz Sr., owner of the Ancira, the only hotel in town until recently, disagrees that the market is large enough to support a multinational chain operation. Observations and surveys on the types and amounts of tourists here support Don Felipe, since most visitors come for a day picnic seasonally and on weekends, with the exceptions of the two week-long festivals that draw large crowds to stay. And it seems philosophically unacceptable to ”shut out” the people from the region, who have traditionally enjoyed bathing in these beautiful natural pools. They have the right to access places like this more than anybody else! ”A reasonable assumption for a given tourism project is that maximising local participation is a desirable objective” (Mitchell and Eagles, 2001). In Bustamante, Don Felipe and other business and political leaders are ideally positioned to lead a successful effort toward sustainable economic development for the community, with tourism at the core. Other elements of the green/soft/alternative tourism model appropriate for Bustamante include that tourism ”is embedded within a diverse local economy, makes use of local products and inputs, employs local people end yields them satisfaction and enhanced self-esteem, does not place unacceptable burdens on the environment, and respects local traditions and ways of life” (Kippendorf, 1987).

My own interactions with some of the players who have in their hands the environmental destiny of Bustamante are not very encouraging. Even though the organization of public meetings to discuss tourism is a good sign, there seems to be a lack of political will, as well as ignorance of landscape planning for recreation. One mayor whose identity I would rather protect, said that ”tourism is a business for which you don’t have to invest”; La Prensa published in February of 2001 that the equivalent to half a million dollars ”at least” would be spent to improve the Canyon (Flores, 2001), but tracing the source of the information through a phone call to the newspaper director revealed fuzzy origins; typical of small towns, there is a jealousy that makes it difficult to access records to do research; my students’ designs for landscape conservation, presented to the municipal authorities, have been largely ignored; and the expenses necessary to display the best of these student projects in the public library, suggested at U.S. $ 500, could not be covered by the municipality because ”they would equal the cost of running five ambulance trips” (6).

But there are also encouraging signs: streets look clean and public gardens in the town well kept; municipal worker crews make daily efforts to collect trash from bins in the canyon’s recreational facilities; local policemen are well equipped and polite; there does exist some sense that local government is doing things relatively well. And, to begin with, this is a privileged place, enjoying much better lands, infrastructure, and general quality of life than average in rural Mexico, as well as a scenic landscape which is an asset for tourism to become a source of revenue and make things even better . There is also an explicit level of commitment by the local population to care for their environment: 22 out of 30 locals surveyed responded that they were willing to volunteer cleanup work in the canyon, or to pay to have it done, or both.

There is a dilemma in Bustamante between exploitation of local resources for short term gain (7) with the consequent environmental degradation and loss of tourist attractions, and planning toward landscape conservation through sustainable tourism development. Only the latter is acceptable.

CONCLUSION

There is a charming sense of ”picturesque disrepair” in the town of Bustamante, evidenced by ruinous old houses and overgrown gardens. But this also means lack of economic vitality. Even though population grew in the the 1990s from a slump of 2,976 to an all time high of 3,501 in 2000 (INEGI, 1990, 2000), economic opportunities are scarce. Those people from Bustamante who pursue an education find it difficult not to leave the town behind, and the community relies heavily on money sent to local families by members who are working ouside. With the decline in percentage of the labor force employed in agriculture, there has been a diversification of the economy that still needs to develop. Agriculture should not be sacrificed for tourism, as they are complementary rather than exclusive economic activities in rural areas. The insufficiency of the local tax base to deal with needs of infrastructure and planning for tourism could be alleviated through the growth of locally owned, small-scale businesses responding to the current needs of visitors and thus promoting growth and development in the tourism sector. Money is needed for parks to be maintained, *acequias* repaired, and the historic building stock preserved, and while much of it should come from taxes and other public funds, small scale private enterprises in tourism and recreation need to be undertaken, intervening in the environment for profit, but positively, constructively, sustainably. Severe degradation of the environment is resulting with the present form of recreation, while very little money is made by the community since most visitors do not spend the night and come already supplied with food and drink. It is observably in beer sales where the most of the revenue lies. Increases in visitor spending are necessary. These can come from an increase in spending per visitor or from an increase in the number of visitors, but more than likely and perhaps ideally from a combination of both.

Political and economic strategies need to be deployed towards sustainable tourism development as presented in this paper. Local autonomy and control over the development strategies and their application is highly desirable, as are community-owned, small-scale, moderately commercialized businesses. However, municipalities are limited in terms of what they can do legally and economically in the interdependent society of today, and frameworks and institutions at larger scales should also be integrated to the local development efforts. The currently in-progress Rural Tourism Plan for the State of Nuevo Leon is key, as is the larger National Tourism Plan. Also international agencies can be tapped into for knowledge, legal instrumentation, and funds. In the meantime, urgent landscape planning and conservation efforts need to be made to avoid environmental disasters.

NOTES

(1) The other festival is held during the first week of August, in honor of *El Senor de Tlaxcala*, an effigy of Christ on the cross that is revered by the community since the early Eighteenth Century. It is housed in the local church all year and taken around the streets of town during the festival.

(2) When Hernan Cortes and his men invaded the Aztecs in Mexico, they were helped by the Tlaxcalan indians, who were at constant war with the Aztecs, always resisting their annexation to the empire and serving as a source for prisoners destined for human sacrifice. When the Spaniards defeated the Aztecs,

they gave the Tlaxcalan people special rights which included land grants in the northern frontier. The data on the application for land and water rights comes from J. Portillo’s ”El Senor de Tlaxcala...” to be found under next heading, ”References”.

(3) According to INEGI census data, the proportion of the local labor force working in agriculture dropped from 70% in 1950 to only 17% in 2000, dropping below one half for the first time in 1970.

(4) There is a long tradition of theorizing about the maximum number of people in a community who can have a situation of complete access to the democratic process for all, meaning direct access at anytime to the top of authority, either individually or as a group. The Greek *Agora* is a conceptual origin of the physical space needed to accommodate this maximum number of people. And even today, many townships exist where the entire population gathers in a public space to engage in political dialogue. Of course there is no exact figure, and for instance, whereas Alexander uses ten thousand, Lewis Mumford would say five. At any rate, 3,501 for Bustamante is good.

(5) *Ejidos* date from early colonial times, when they existed as small communal lands outside or near villages where herds could overnight. After the Mexican Revolution of 1910-1917 agrarian reform was accomplished, and a new form of *ejido* created in which land was distributed to peasant

farmers who have full control over the rights to cultivate and inherit their plots, but without the ability to sell them.

(6) This was the response of Valdemar Gomez, city manager, via telephone (the local ambulance is sponsored publicly).

(7) An example is the plan by a landowner from Lampazos to convert the canyon of Piedras Azules, a significant resource for eco-tourism just outside of town, into a source for crushed stone aggregates destined for the construction industry.

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Towards Quality Rural Tourism in Alpine Recreational Areas in Europe: Integrated Quality Management of Rural Tourist Destinations & Presentation of a Case Study in Bregenzerwald, Austria

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Abstract: The rural recreation areas of Europe provide a wide variety of experiences and attractions for the visitor. Domestic and international visitor flows mostly from conurbations are turning to countryside destinations for holidays in increasing numbers. There are changes in the length and type of visits sought and there is a rapid growth in alternative recreational outdoor activities world wide and thus the alpine rural areas have to be ever more competitive and have to concentrate on sustainable development. At the same time there is an increasing need to be sensitive to both the positive and negative impacts of tourism on the economy, the environment and the local communities. Integrated quality management is an approach to focus on quality by putting suitable management in place, to ensure that visitors have a special experience, meeting or exceeding their expectations while maximising the benefit to the destination and while managing visitor flows. This approach is explored here and the main issues that are discussed, are based on a case study in the Bregenzerwald, Vorarlberg.

INTRODUCTION

Rural areas need to offer new prospects over conurbations in Europe if they are not to be left behind in this era of increasing globalisation and specialisation. There are regional developing programmes encompassing a wealth of individual measures geared to develop the strengths of the region and to reinforce the creation of added value through organised measures relating to a local supply network such as co-ordinated marketing activities. At the same time, the aim is to increase awareness of the value of the natural and human resources of a region.

In the interest of sustainable tourism, the regional measures in rural tourist destinations are based on a bottom-up form of development, on promoting a balanced sense of community through solidarity and a willingness to co-operate. The feeling of involvement is to be encouraged by a new local awareness, open groundwork and a network approach. The coherent alignment of different activities towards common goals will achieve both ecological and economic results.

Therefore improving quality management in rural tourist destinations is an essential requirement in satisfying the needs of tourists, in enhancing the competitiveness of the tourism industry and in ensuring balances and sustainable tourism development. The case study with the title “Raumkultur und Tourismus” which roughly translates as the “natural and cultural heritage of the region and the impacts of tourism” is situated in the rural and mountain region of the Bregenzer-wald,Vorarlberg, providing us with new ideas showing an opportunity for a sustainable economical development of rural and border regions.

RURAL TOURISM AND INTEGRATED QUALITY MANAGEMENT

Rural tourism is not a new phenomenon, however in recent years the market has become more sophisticated and discriminating. There has been an increasing interest in tourism as a valuable vehicle for much needed diversification of the rural economy. Rural areas often have small scale and widely dispersed enterprises, communities and administrative structures. The relationship between tourism, agriculture and other sectors in the local rural economy is increasingly important because many different players are involved. Natural resources, cultural traditions, transport services and a wide range of tourism enterprises have an influence on the visitor’s experience and in turn are affected by tourism impact. For this reason an integrated quality management approach to tourism is very relevant in rural areas.

It is accepted that quality management should be applicable to a broad range of types of rural areas where the nature of tourism is dictated by the type of location, resource and market (Groier, 1993). Rural tourist destinations may broadly be defined as areas which are separately identified and promoted to tourists as places to visit, where enjoyment of the countryside and countryside related activities are a primary motive. Examples of different types of rural tourist destinations are illustrated by the case study in the Bregenzerwald, Austria and include the following:

- Traditional, popular destinations near sizeable urban areas receiving a high proportion of day visitors. There are priorities to improve the environment, update the infrastructure, manage visitor pressure, address transport issues and convert day trips to overnight stays.
- Traditional holiday areas with a significant quantity of visitor accommodation and infrastructure, seeking to upgrade the offer and reduce environmental impact. Working with enterprises on physical improvements, planning controls and more sustainable forms of tourism is required.
- Protected areas seeking to manage tourism as well as environment and local economy in an integrated way. Key issues include inter-sectional integration and visitor management.
- Rural areas where a significant part of the product is characterised by small historic towns and villages and a rich historic, architectural, cultural or industrial heritage interspersed in the countryside. Opportunities improve with linking sites and communities, preserving buildings and creating quality branded accommodation and other facilities.
- Remote areas with appeal based on wildlife and wilderness with particular issues of accessibility, environmental protection and development of ecotourism.
- Rich agricultural areas where farming provides much of the visitor appeal. Priority is given to providing quality farm based accommodation related to local produce and gastronomy.
- Mountain or forest locations with some established rural tourism but seeking to diversify and strengthen their offer. The main priority is to establish or co-ordinate better quality accommodation, to actify recreation centres and heritage themes.

Destinations pursuing integrated quality management should think carefully about the visitors they are able and wish to attract as their target market segments. They should consider how different market segments relate to their own strategic objectives such as income per head or off-season visiting. Selection has to be based on a realistic assessment of the destination’s strengths, weaknesses, opportunities and threats (SWOT-analysis). The aim should be to seek and meet the particular expectations and quality requirements of the segments they select (Berndt et al., 1988). Segments can be based e.g. on a range of characteristics such as age, family structure, income, interests, home location and mobility. Examples of some broad segments and how they relate to rural destinations are given below:

- Visitors on day trips from home: This segment is very important and increasing in many rural areas close to towns. Quality of infrastructure, traffic management, attractions and well managed countryside access are key issues.
- Short holiday takers: In much of rural Europe the length of holidays taken in the countryside has been decreasing. This has affected viability especially in less accessible areas.
- Families: The popularity of rural tourism for families tends to vary. Families have traditionally provided by far the largest market for farm accommodation. However, families are becoming more quality as well as price conscious, demanding good facilities and the right balance between fun and safety. The segment can be divided by the age of the children. Families with very young children tend to enjoy rural areas but have special needs in the facilities and experiences offered.
- Senior citizens: Rural destinations are popular amongst older age groups. They enjoy rural traditions and tranquillity, but they are also becoming more health and activity conscious. In general higher standards of comfort are sought by this segment.
- People with special interests: There has been a significant increase in participating in countryside recreation, notable cycling and walking, often as the main purpose of a visit. It is also possible to target those with a declared interest in gastronomy, local heritage and other rural themes.
- Educational and other groups: A number of rural areas have been very active in providing programmes based on rural themes including agriculture, conservation and heritage for group visits, ranging from schools to senior groups. Such groups are easy to target and communicate with but have particular quality requirements in handling and guiding.
- People with disabilities: Compared with urban areas and coastal resorts, rural destinations have paid less attention to provide facilities for visitors with disabilities. Providing disabled people with accessible countryside recreation in small rural enterprises is an important challenge for quality management.

In recent years some important factors have led to an increase in the number of identifiable rural tourist destinations and enterprises in Europe. Declining of agricultural incomes and changes to agricultural support systems put pressure on farmers and rural dwellers to diversify their activities (Ortner, 1996). A lot of work is newly organised by rural development agencies, supported by EU structural funds. There is an increasing awareness of a duty to provide access and the opportunity to benefit from tourism involved with environmental management and cultural heritage.

Over the same time the market for rural tourism has changed showing a different picture that highlights the need for quality management. Individual rural tourist destinations need to become more competitive to attract and hold on to business. Unlike cities and resorts, rural areas tend to be rather diffuse. Most local rural authorities have limited financial and staff resources for the management of tourism. It is important for them that management activities remain simple and practical.

BASIC CONCEPTS OF INTEGRATED QUALITY MANAGEMENT OF RURAL TOURIST DESTINATIONS

The concept of integrated quality management (IQM) emerged in business management theory in the 1980s (Bodzenta et al., 1985, Chaloupek et al., 1993, Nowotny et al., 1994, Zimmermann, 1995). It is a way of meeting objectives of organisations by improving the experience of the customer of the product or service provided. It is concerned with effective use of resources and the level of participation and satisfaction of the people in the organisations. Integrated quality management should not be seen as a route to instant success, but it should lead to the following key benefits upon which success can be built.

This means that more local awareness and support is necessary for tourism in the area amongst local people and across all rural sectors. Whereas there is a need for better co-ordination between local tourism enterprises and greater support for the management and marketing of the destination. A set of rural tourism products which can be promoted with confidence and an improved image of the destination which is real and not based on false expectations are important. Further key benefits are an increased customer satisfaction with more repeat visits and recommendations and a better knowledge of the economic, social and environmental impacts of tourism. Accordingly the individual elements of a strategy based on quality standards must be founded on a thorough understanding of the customer's requirements.

Total quality management systems are a common feature in the approach developed for specific tourist service providers (tour operators, travel agents, hotels, restaurants). However, as far as the tourist is concerned, the satisfaction derived from staying at a destination does not only depend on the experience of a specific tourist service, but also on more general factors, such as hospitality, safety and security, sanitation and hygiene, traffic and visitor management. A large number of elements have an impact on the tourist's perception of a destination and in consequence on the tourist's willingness to come again and to recommend the destination to potential visitors.

The success of a destination in terms of customer satisfaction is a function of several interdependent components. This underscores the need for the use of strategic and integrated planning of tourist destinations together with the selective use of specific measures addressing integrated quality management and controlling of the destination. The reference framework given by the European Commission (April 1995, July 1998) for analysing good practice in integrated quality management and presentation of tourist destinations is as follows: Integrated quality management should take into account and have a favourable impact on the activities of tourism professionals, tourists, the local population and the environment (i.e. the natural, cultural and man-made assets of the destination). The IQM strategy implemented at the destinations must fulfil the requirements of tourists as one of its major considerations.

Sustainable tourism development is a concept that is widely accepted at an international level (Parasuraman, 1985, Weiermair, 1997) and in most tourist destinations. It is about keeping a balance between the needs of the visitor, the environment and the host community for current as well as future generations. Therefore a tourist destination manager typically has two main objectives, namely to increase local income and employment through tourism and to ensure that the environment and quality of life of the local people is not damaged or even enhanced by tourism. IQM can meet both these objectives by improving visitor satisfaction, and by monitoring and managing impacts on the local environment and economy. There are two important key elements of the IQM approach. On the one hand it means focusing on visitors, improving the quality of what is provided for them and satisfying their needs and influencing their activities so they come back again or recommend the destination to others. On the other hand one should concentrate on involving local people and local tourism enterprises in the management of the destination as participants and as customers of the management process.

It is helpful to think about how visitors experience a destination as a sequence of influences over space and time, from initial planning, during the stay to departure and post visit reflections. This is sometimes referred to as the Tourism Value Chain (Figure 1). In IQM the quality of each link in the chain should be of concern.

1.pre visit image/messages 2. pre visit information
3.making bookings

4. journey to destination 5. initial welcome
6. information at the destination

7. infrastructure, environment 8. attractions and amenities 9. places to stay and places to eat

10. farewell and return journey 11. after visit contact 12. memories

Figure 1: The Tourism Value Chain by Parasuraman (1985)

Quality management is partly about meeting or exceeding visitors' expectations by setting the right standards, meeting them and communicating them effectively. Some theories of quality by Kano (1984) refer to mandatory standards and attractive standards. In setting quality standards for facilities and services at a destination it can be helpful to think of different levels of visitor needs that should be met in practice and communication through good information.

Very important are mandatory requirements such as safety and hygiene. Failure to meet them may cause a destination to fail completely, but meeting them does not really add to its competitive edge. Many rural accommodation enterprises are small, often family run businesses with little professional training. Special attention needs to be given to the range of accommodation, the level of facilities and the quality of service and how the establishment reflects the rural qualities of the destination.

Scaleable requirements such as the number of attractions at a destination should be analysed. These may influence a visitor's decision to choose the destination. Rural areas typically have many small attractions and events often reflecting the heritage of the area and environment. Quality management involves linking these experiences and promoting them creatively.

Attractive requirements - these are more subjective factors such as style of facilities and treatment by the host; This means that a destination should be well organised and should know what it wants to achieve through tourism while concentrating on all aspects of the visitor's experience and the impact on local people and the environment.

To pursue IQM successfully, a number of structures and actions should be strengthened or - where necessary - put in place. These are summarised below and aspects particularly relevant to rural areas are identified.

- Working together to establish a strategy (initiating the process, leadership and partnership structures, involvement of the local community and local tourism business); This process requires the co-operation of all affected parties in the area as a whole. There should be a clear and well communicated strategy, based on analysis and consultation to improve quality. Initial motives for pursuing quality will vary between different types of rural areas. Whatever the trigger, it should be followed up by getting the main players together and ensuring an integrated and comprehensive approach.
- Delivering quality at all stages of the visitor's experience (marketing and communication, welcome, orientation and information, accommodation, local produce and gastronomy, attractions and events, countryside recreation, environment and infrastructure); as well as requiring specific facilities and services, visitors expect the countryside to be a pleasant place to relax, easy to reach and to get around with appropriate shops and other services and an attractive and clean environment. There is a rapid growth in demand for countryside outdoor recreation such as walking and cycling, a common phenomena not only across the whole of Europe. In turn, visitors should be encouraged to behave with respect towards the area.
- Installing effective quality management and monitoring processes (understanding visitors' needs and ensuring they are met, setting, checking and communicating standards, working with people in training workshops and improving quality, monitoring impact on the local economy, community and environment);

There should be a strong effort to manage tourism in the destination with a recognisable lead agency providing co-ordination for all main organisations whose activities influence tourism. The IQM process requires that a range of motivated people are involved (Denman et al., 1999). A key requirement is to have structures in place for the regular involvement of local tourism businesses enabling them to work together for the destination as a whole, especially in rural areas where co-ordination often is lacking. There should be a clear strategy in the local community, based on analysis and consultation which is widely recognised in the destination. There are often strong interrelationships between the needs of the visitor, the environment and the local people in a community. These should be recognised and priority should be given to actions which bring mutual benefit.

CASE STUDY: BREGENZERWALD, AUSTRIA

The case study in Bregenzerwald, Austria is the result of a project carried out for the European Commission (Tourism Directorate) under the leadership of Ecotrans network by the contractor The Tourism Company (UK) in association with Futour (Germany) and other partners in Austria (Denman et al., 1999) since 1998. The case studies were identified from leads provided by a range of European bodies and national organisations responsible for tourism in the states comprising the European Economic Area (European Commission, 1999). Approximately 100 leads were followed up, leading to the preparation of a long list of 38 destinations containing initial details of their activities relevant to integrated quality management. A final short list of 15 areas was chosen to reflect a wide spread of types of geographical locations and tourism initiatives. The case study in the Bregenzerwald is part of these chosen ones reflecting a wide spread of types of rural tourism regions.

Figure 2: Location of Vorarlberg, Austria

What was the primary motive for Austria to join this programme? Improving quality in rural tourist destinations is an essential requirement in satisfying tourists´ needs, in enhancing the competitiveness and in ensuring sustainable tourism development. The case study in Bregenzerwald (1999-2002) fits perfectly in the final list of the European Commission. It is co-ordinated by the government of the State of Vorarlberg.

The Bregenzerwald area (Figure 2) is situated in the far west of Austria, next Lake Constance, and covers 580 km² with a population of just 30,000. It is a region of mountains and valleys, Alpine pastures and forests. Agriculture is dominant; with 40 % of employment in the farm sector and small food producing enterprises (Figure 3). Traditional milk and cheese production is prevalent in the area and shapes the lush, green landscape, with 42,500 tonnes of silage-free milk and 4,260 tonnes of mountain cheese ("Bergkaese") and Emmentaler cheese produced each year.

Figure 3: Bregenzerwald, Schroecken, alpine peasantry and tourism

Bregenzerwald has a well-established rural tourism sector with 15,000 beds accommodating 1.5 million visitors. 60% come in summer, mainly for walking, and 40 % in winter, for a mixture of cross-country and Alpine skiing. Many also come simply to enjoy an unspoilt rural area with beautiful villages and traditional wooden architecture and excellent accommodation (Figure 4). Tourism is very important in the local economy, with around half the workforce employed in the service sector (Liechtenberger, 1984).

Since 1991 tourism has been stagnating; agriculture on ageing family farms is in decline, and there is an overriding sense of competition between small enterprises (Liechtenberger, 1978). It was decided that the only way forward was through a joint strategy between agriculture and tourism, driven by co-operation between young tourism entrepreneurs and young farmers. Based on this philosophy, the initiative "Natur und Leben (nature and life) Bregenzerwald" was established. The strategy is to build up the image of the area for tourism, agriculture and related rural products under a common identity of "nature and life" with the following objectives:

- To increase the use of local agricultural products, thereby strengthening the viability of farms;
- To make people aware of the critical role of the farmer as creator and custodian of the cultural and tourism landscape;
- To build networks between producers, processors and sellers for marketing, motivation and training;
- To encourage direct consumption of local produce, reducing the costs and pollution of transportation, and ensuring a fresh quality experience for all consumers including visitors;

In 1995 when Austria became a member of the EU the financial position of the small agricultural enterprises was weakened, but on the other hand brought access to funds of the EU (Anon. 1997). This underlined the need for the "Natur und Leben" initiative and enabled it to be more effective through well funded projects. New tourism guidelines are being elaborated for the Bregenzerwald area. Forty representatives have been working on this, and an exhibition has been shown in the local communities. Target markets have been clearly defined in Austria, Europe (Germany, Benelux, Italy) and overseas.

Although the strategy contains no specific quality charter, its aims are to improve the quality of life of local people as well as of services and products for visitors in order to maintain the high quality of landscape and nature. It builds on and conveys to visitors the philosophy and spirit of the local people, summed up in the regional proverb "honour the old and welcome the new, but to your native roots be true". Traditionally tourism was the responsibility of the Bregenzerwald Tourism Association founded in 1904. In 1997 a joint professional body "Tourismus Bregenzerwald" was established by bringing together all 22 communities of the region, doubling the budget and appointing two managers. This has considerably strengthened the ability to deliver quality.

This tourism structure works effectively in parallel with the development organisation "Regionalentwicklung Bregenzerwald" created under a programme which is responsible for new funding and training initiatives. A bottom-up approach has been adopted, keeping the local population very well informed. Two special newspapers have played an important role here. The new funding and professional approach of "Tourismus Bregenzerwald" has strengthened the quality of marketing and the materials used, including internet access via the Austrian information system (TIS), CD information and more effective direct mail.

Projected images of the Bregenzerwald area emphasise the fine scenery, the greenness, the warmth of the community and the high quality of local produce. Action has been taken to strengthen the product in reality to meet these images, developing joint products between tourism and agriculture to meet the strategic objectives of "Natur und Leben".

A great deal of effort over three years has been focused on an integrated themed rural project the "Bregenzerwald Cheese Route". This embraces all the elements of "Natur und Leben" and is based on strict quality criteria. It provides a unique selling proposition for the region linked to its established image, a range of events and places to visit, special products to buy and a greater profile for the restaurants of the region, based on cheese in the local gastronomy. Underpinning the viability of dairy farmers helps them to maintain the rich green landscape which is the main attraction for visitors in the area.

Members pay a fee to a marketing organisation which has generated a considerable amount of press coverage and organised numerous events such as cheese tasting, cheese markets, parties, special games for children involving cheese etc. There is an individual web site for the route, too (www.bregenzerwald.at). Local agricultural produce is promoted to visitors in a number of ways - regular culinary weeks with local products are held by restaurants and annual tasting and selling exhibitions are organised. There is a standardised sales point or boutique ("Bauernkasten") for agricultural products placed in catering and accommodation establishments and a branded "Bauernfruehstueck" is available (farmer's breakfast) at accommodation establishments using local agricultural products.

Joint training workshops between tourism enterprises and food producers have fostered a greater understanding of the needs of both types of enterprises and of their clients. Courses include practical marketing and management skills as well as catering including cooking with cheese. For the cheese route project quality criteria have been

Figure 4: Bregenzerwald, Schwarzenberg, old inn "Hirschen"

worked out within the individual branches. The quality criteria having been identified include offering a minimum of five cheese specialities, development of special menus involving cheese, naming the individual producers on the menus, and participating in special training both for chefs and waiters.

Participants who meet the specified criteria are awarded the "Cheese Route" label. A further incentive which strengthens inter-sector recognition is the innovation prize for agriculture awarded by the association of young chefs. Initiatives have concentrated on improvements in enterprise performance to increase the level of local income, generate employment and support the maintenance of the landscape. Two initiatives help tourism enterprises to be environmentally sensitive:

- "Oeko-log" is a manual developed by a team of hotel managers full of practical hints for energy saving and waste prevention etc. and including a computer-based energy control system.
- "Oekoprofit" is a programme of training workshops and advice, based on the manual leading to better ecological practice and economic benefits for a group of enterprises.

These award winning schemes have provided a foundation for the application of the Austrian eco-label in the area.

SUMMARY OF RESULTS AND FUTURE PROSPECTS

An important result is that the quality of tourism in the area has constantly been improved and creates a sustainable income in comparison with most rural destinations in Austria. There has been an innovative input for rural local produce. The range of cheese types has risen from six up to thirty as a result of the cheese route and many new cheese dishes have been created. Turnover in dairy shops increased by over 20 % in the first year, and they have been able to achieve far higher prices by selling directly to visitors. In 1999 over 150 cheese events were held, attracting some 90,000 visitors. These results were successfully presented at the world exhibition EXPO 2000 in Hannover (Maetzler, 2000).

The Bregenzerwald area has demonstrated the positive partnership that can be formed between tourism, agriculture and local food production linked to ecological principles. The new professional tourism structure working in parallel with the development agency creates a sound basis for the future. Working together and taking small steady steps towards quality has proved to be right for this area. Success has come through a bottom-up networking approach with regular meetings and training workshops supported by enthusiastic professionals.

CONCLUSION

Integrated quality management (IQM) should be understood as an appropriate strategy to improve the quality of the development of sustainable tourism in rural and nature-based destinations by increasing both supply and demand satisfaction. Tourism and recreation go together and both depend on the quality of the natural and cultural environment for their success. One key success factor proved by a case study in the Bregenzerwald area in Austria is to create a better and authentic image of the destination itself. Therefore it is essential to support innovative management and marketing strategies. The long-term success of a destination in terms of the satisfaction of the tourist has an important impact on the tourist´s willingness to come again. Furthermore, IQM has positive side-effects on the tourism professionals, the local population and the environment.

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Problems of Recreational Use of the World Natural Heritage Territories (Ubsunur Hollow Example)

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Abstract: Six Russian territories are included already into UNESCO World Natural and Cultural Heritage List. Several more territories have to be included into the List in the near future. The Ubsunuur Hollow that is situated in the very center of Asia on a border between Russian Republic of Tyva and Mongolia will be among them. This place is probably the only one in the world where almost all the Earth nature zones (including the northernmost deserts and southernmost tundra) are met on a relatively small by size territory. Besides one can meet here the unique historical monuments – numerous burial-mounds and stone steles from 2–1 Millenniums B.C. The traditional nomad stockbreeding as well as ecological tourism can develop on this territory as main types of nature use. The tourists could visit the Reserve cluster plots where they could acquaint themselves with the popular traditions and enjoy the nature. Unlike the homelike European regions the nature of the Ubsunuur Hollow has been preserved for the present in practically untouched condition. The remoteness and hard accessibility of this territory don't contribute to the mass tourist flows attraction. In the future it is planned to organize here the recreational use by small tourist groups that will observe the strict rules of behavior. Large hotels and other massive constructions of the tourist infrastructure won't be built here. The tourists will move mainly by horses or by feet using the existing roads and paths and will live in tents and yurts. The definite flow of the financial sources will be possible together with the pure educational effect.

INTRODUCTION

6 Russian territories are included already into UNESCO World Natural and Cultural Heritage List: Virgin Komi Forests, Baikal Lake, Volcanoes of Kamchatka, Golden Mountains of Altai, Western Caucasus and Curonian Spit. Such unique territories as Ubsunur Hollow, Valdai Upland, Green Belt of Fennoscandia, Delta of the Lena, Putorana Plateau, Magadan Nature Reserve, Commander Islands, Vrangel Island, Daurian Steppes, Central Sikhote-Alin. Bashkirian Urals, Kuril Islands will be included into the List in perspective.

Ecological tourism has to become the main possible type of use on those territories. It allows managing the tourists' flows helping them not only to receive knowledge about nature and to gain skills of communication with it, but also influence it in a minimal way.

MONITORING AND MANAGEMENT OF VISITOR FLOWS ON THE TERRITORIES OF WORLD NATURAL HERITAGE. ECOLOGICAL TOURISM.

The majority of the researches understand the ecological tourism as an organized type of tourism combining the rest with the receiving of knowledge about the concrete territory and about the questions of relations between man and nature as a whole. Ecological tourism determines its mail goal as the awakening of interest to the Nature, creation the sense of respect for it, education of a careful attitude to it, the man's understanding of the responsibility of environment preservation for the forthcoming generations. The eventful development of this kind of tourism during last years is connected in many countries of the world with the intensification of the society's attention to the solving of the ecological problems that were met by the Earth's population.

There exist several types of the ecological tourism: scientific, excursion, walking-cognitive, educational, individual and others. However all of them assume the execution of the definite and rather hard rules of behavior in nature. It means that the tourist has not to make the unfavorable influence to the nature complexes of the territory where he spends his free time. As soon as the ecological tourism is characterized with the lowest influence on the environment in comparison with the other types of nature resources use including different recreational activity types, it has to have the preference during the process of choosing of the possible variants of development on the territories of World Natural and Cultural Heritage.

One of the most effective methods of monitoring and management of visitor flows on the World Natural Heritage territories is the use of ecological routes organized as the so cold

Educational Nature Paths. This comprehension appeared at first in the beginning of the XX Century in the USA. The first Educational Nature Path had been opened in 1922 as a pedestrian path via the Appalachian ridge thanks to the forester Benton MacKey’s proposal. It was named by him «the Reserve for the Pedestrians» and became very popular rather soon. Later on such paths appeared also in other regions of the USA and in many other countries of the world (V.P.Chizhova, E.G.Petrova, A.V.Rybakov, 1985).

The pedestrian path created in Crimea in 1916 in 7 Km from Sudak city could be counted as a first path of this type in Russia. It received a name of “Golitsynskaya” because its construction had been done due to the instructions of the Prince L.S.Golitsyn. However that path had been created mainly for the admiring of the natural objects and for active leisure and is closer by its character to the tourist paths than to the educational ones (V.P.Chizhova and others, 1989). The natural paths received their real wide spread in Russia only beginning from the 1970s. The Staff members as well as the students of the Faculty of Geography of the Moscow State Lomonossov University also took an active part in their construction.

The Educational Nature Paths are in reality the special tourist routes. From one side they allow to show the visitors the nature of the particular territory in all its beauty and peculiarity, to acquaint them with the local nature sights and to give them the necessary ecological knowledge. From the other side they are constructed in such a way that the most vulnerable parts could be protected from the undesirable invasion. That’s why the Educational Paths answer to the ecological tourism goals in the whole sense. It is very important to include into such paths the most typical for the region and the most interesting and informative objects during a process of choosing. At the same time the path has to go round, for example, the habitat places of the rare animals, the nesting places of birds with the purpose of not trouble them. The information about the path and about the represented objects on it could be placed either on special information billboards placed directly on the path or in booklets. The detail path plan with all the points-stops as well as the necessary explanations are placed in the booklets The tourists receive such a booklet and walk by path independently or accompanied by the instructor.

According to the different ecological tourism types the Educational Paths with different functions and level of complexity (for specialists, students, pupils, parents with children, pensioners and so on) could be created. The whole chain of such paths’ use on a concrete World Natural Heritage territory helps to regulate the recreational load on it. The visitors’ monitoring is conducted by their registration on entrance or in the starting point of the path. Simultaneously not only the visitors’ number but also their arrival purpose and choosing category of the route are fixed. In a case of reaching of the maximum possible load on any of the paths the visitors are offered to use another route or they are stopped in the starting point. In necessity the recreational capacity could be raised with the help of the Educational Paths. It could be reached by the improving of the paths, by growing of duration and extension of the routes and by the widening of the paths network.

UBSUNUR HOLLOW EXAMPLE

Ubsunur Hollow is situated in the very center of Asia on a border between Tyva Republic and Mongolia (between 48-50 degrees North Latitude and 91-99 degrees East Longitude) (Figure 1). It is probably the only one place in the world where almost all the Earth natural zones are met on a relatively small territory (the extension of the hollow from North to South is just about 160 km, from West to East – 600 km). The hollow bottom (1000 м above the sea level) is occupied by sand and clay deserts. They are changed by sandy and dry steppes. Higher by the mountain slopes they change into forest steppes and on the heights of 1500-2300 m – to the forest belt. The different types of forests are presented in it: on the North slopes there are mixed forests, in the river valleys – larch, spruce, poplar forests, in other places – cedar forests. In the high mountain belt the mountain tundra predominate. The meadow vegetation develops in the places where snow is collecting and the ground waters are coming out. And at last higher in the mountains one can observe snows and glaciers.

Such a landscape diversity appearance is obliged to the unique geographical position of the hollow. From all sides it is surrounded by mountains: from the North – by the East and West Tannu-Ola ridges and by Sangilen Plateau; from the South – by Bulan-Nuru and Khan-Khukhey ridges; from the West – by Tsagan-Shibetu ridge and by Turgen-Ula Massif (Mongolian Altai); and at last from the East the hollow is closed by the watershed with the Delger-Muren river valley. The role of the “inner sea» that receives all the waters from the mountains is played by the salty lake of Ubsunur, that gave its name to the whole hollow. The closed character of the hollow stipulates its microclimate: the warmth and humidity are spread unevenly. The bottom is warming by the sun larger than slopes and summits of the surrounding mountains. At the same time they receive the larger precipitation amount.

Figure 1. Study area: Ubsunur Nature Reserve. Cluster Plots: 1. Mongoon-Taiga; 2. Ubsunur; 3. Oruku-Shinaa; 4. Aryskannyg; 5. Yamaalyg; 6. Ular; 7. Tsuger Els (S.Mikhailov & E.Petrovskaia / Greenpeace Russia).

Except the natural originality the Ubsunur Hollow is a monument of the historical and cultural heritage. People started to settle this territory beginning from the early Pleistocene (there is a data about discoveries dated at the period of 350 thousand years ago). Till nowadays the majority of the very interesting archeological monuments, such as sacrificial-commemorative burial-mounds from the Neolith epoch, burial-grounds and "prayer stones" from the Skiffs epoch, the large number of steles, stone man statues as well as rock carvings and the ancient people encampments are preserved here. Only in the Tyvinian part of the hollow 15,000 burial-mounds were discovered and described under the governance of Pr. V.Bougrovsky (Global…, 1996).

The nature reserves with cluster (isolated) structure were created in 1992 – first in Russian and then in 1993 – in Mongolian parts of the Ubsunur Hollow. The Russian Ubsunur Nature Reserve consists of seven plots that present most brightly the main types of the region ecosystems. Five of them are of great interest for the ecological tourism.

The westernmost, the most remote and the most hardly accessible plot have the name of Mongoon-Taiga. The eternal snow and large glaciers (the unusual phenomena for such an arid region) are lying here on a height of 3970 m. Lower than glaciers one can find the Alpine moss-lichen meadows, and in valleys – forests created by dwarf birch and palmate bush. Such a rare species as snow leopard has been preserved here as well as Siberian roe, Altaian argali (the largest sheep in the world), and gray marmot. Among birds the most interesting species are Altaian snowcock, Alpine ptarmigan, black vulture and banded goose.

The Aryskannyg-Khem cluster (with the plots of mountain tundra, sub alpine meadows, mountain taiga and forest steppes in lower places) is situated on the southern slopes of the East Tannu-Ola ridge. The typical tundra animal and bird species, such as wild reindeer, ptarmigan and Mongolian plover as well as taiga species (Siberian deer, brown bear, lynx, wood-grouse and tawny owl) inhabit those places.

The Ular cluster with the taiga, forest tundra and tundra (the southernmost tundra in the world) vegetation groups, is situated in the eastern outskirts of the Sangilen mountain massif. The animal hood here differs by richness and diversity. Snow leopard, brown bear, wild boar, glutton, wolf, lynx, otter, marten, sable, badger, Siberian weasel, musk-deer, Siberian roe, Siberian deer, reindeer, as well as wood grouse, hazel grouse, black grouse among birds are met there.

The northernmost sandy deserts in the world are represented in Tsuger-Els cluster. It is possible to observe here the whole complex of sand dunes beginning from those that completely lost the vegetation and blow with the wind till the dunes fixed with elm and other desert plants. The inhabitants of those places: steppe hare, rough-legged jerboa, Jungarian hamster and such rare species as Roborowski hamster and long-tailed gopher, among reptiles – variegated agama, small sandy boa, among birds – steppe and bearded partridges, bustard. Midday sandy snake could be met on the unfixed sands. In some places one can find tarbagan that became rare. The real birds' kingdom or fresh water lake Tore-Khol is situated in the buffer zone of that plot. The nesting places of red hawk, black kite and gray heron are located on its shores, as well as many species of the water birds as swans, been and gray gooses, cormorants, lake and gray gulls are met there. From time to time the great black-headed gulls were marked. During the flight period the egret, gray crane, different kinds of sandpipers are rather usual.

The Yamaalyg cluster represents the peculiar granite island among wavy steppe lowland. The ornithological complex of the Outlier Mountains and rocks is also rather rich. Such rare birds of prey as falcon-hobby, falcon-saker, peregrine, shot-toed eagle are of special value. The kestrel and longlegged buzzard are widespread there. The steppe horned owl and eagle owl are not rare. The whole complex of the cultural-historical monuments is located in the southern part of the massif. The compact burial place with about 350 burial grounds and stone steles from 2-1 Millenniums B.C. was discovered there (Petrova E.G., Petrov A.V., 2000).

If the Ubsunur Hollow will be recognized as the World Natural and Cultural Heritage territory, the intensive economic activity will be excluded here completely. The traditional nomadic cattle breeding as well as the above-mentioned ecological tourism could develop on this territory as the main types of nature use.

The nomadic cattle breeding remain the main economic activity in the Ubsunur Hollow for more than two and a half thousand years. It is most adapted to the local natural peculiarities. Mainly sheep, as well as goats, cattle, horses and yaks are breaded here. One can find there also the camels that normally were breaded by Tyvinians at grass all the year round. For their winter camps the nomads traditionally choused steppes and southern slopes of the forest belt, for spring camps – the good heated slopes with southern exposition. The upper part of the mountain steppe belt and Alpine zone as well as upper reaches of larger rivers served as summer pasture grounds. The hollow bottom with rich grasses and good watering places served as autumn pasture grounds. The seasonal pasture changing helped not only to provide animals with feed better, but also gave the possibility for vegetation to restore, made lower its treading by cattle as well as the soil compression, didn't lead to the development of the erosion processes.

Nomad cattle-breeders depended very much from nature. That's why they treated to it with care from the ancient times. They probably were faced with the ecological problems more than once and for centuries developed the definite ecological culture of a balanced co-existence with the environment. Tyvinians had the rituals of worship to the sky, water, fire and wood. Many lakes and springs, mountain tops and passes, as well as ancient monuments – steles, burial-grounds were sacred for them and had the cult importance. It contributed to the preservation of the steppe ecosystems, conservation of many plants and animals' populations, that are rare and small in number in other regions (Global…, 1996). That is why the conservation and rebirth of the popular traditions in Nature Reserve is not contrary to the nature preserve status of the territory and contributes to its maintenance.

The unique natural peculiarities of the Ubsunur Hollow, existence of historical, archeological and cultural monuments, traditional nomadic way of life, its ethnographical peculiarities, popular home crafts give the wide opportunities for development of different kinds of ecological tourism in the Hollow: 1) proper ecological tourism; 2) ethno-ecological tourism; 3) scientific tourism. Ethno-ecological tourism implies not only research of the natural peculiarities of the territory but also the acquaintance with traditional way of living of the local population. Scientific tourism may be divided into observation and photographing (video shooting) of birds, small mammals, insects, plants, nature sights as well as of archeological monuments.

Unlike the lived-in regions of Europe, the nature of the Ubsunur Hollow has been preserved for the present in practically untouched condition. Remoteness and hard accessibility of this territory create the natural obstacles for the mass tourism development here. Therefore the territory does not have a task of tourist flows limitation for a while yet. On the contrary the territory possesses the task of tourists attraction here. At present the amateur tourism now exists in a stage of development and industrial tourism – in a stage of formation. Institute of Geography of Russian Academy of Sciences together with Greenpeace Russia and Faculty of Geography of the Moscow State Lomonossov University elaborated the scheme of the ecological tourism development in the hollow and conducted an expedition via possible routes.

Problems of Tourism Development*:*

- Lack of tourism development plan for the hollow territory;
- Difficulties of tourists delivery (lack of direct flights to Tyvinian capital city Kyzyl, lack of regular bus communication between Kyzyl and Erzin – the administrative center of the Nature Reserve);
- Insufficient development of the recreational infrastructure: there is no auto transport for traffic operations, lack of tourist bases;
- Lack of local tourist companies and economic possibilities;
- Lack of necessary management level of tourism development.

However, the originality of these places, their obvious value as for scientific research as for the purposes of the ecological education and training will undoubtedly contribute to the ecological tourism development here in the near future. Nature Reserve leaders and local administration are concerned with this process. Tourists including foreigners will be able to arrive here individually or in small groups being accompanied by guides from the number of local inhabitants (Nature Reserve staff) to visit all the main cluster plots of the Reserve as well as those interesting places, that were not included yet into the protected natural territories composition.

The recreational use by small tourist groups (4-10 persons) is planned to be organized here in the future with maintenance of strict rules of behavior in the natural environment by them. The numerous routes with different duration (beginning from 4 days till 3 weeks) are worked out. The tourists will move mainly by horses and by feet using the existing roads and paths (some water and bicycle routes are also planned), to live in tents and yurts. The use of the preserved popular traditions with recreational purposes (in particular, the Khoomey guttural singing as well as the existing elements of shamanism) looks very important.

The definite inflow of the financial sources that could be used for the Nature Reserve development and in perspective for the whole hollow territory will be possible together with pure educational effect. In conditions of rebirth of the traditional nature use and ecological tourism development in the Ubsunur Hollow it will be quite possible to decide the main existing problems of nature use. The illegal hunting for argali, snow leopard, Siberian deer, roe, some species of predatory birds (for example, falcon-saker), water birds as well as collecting of antlers are among the main existing troubles. The violation of pasture grounds rotation, intensive cattle pasture in river valleys and in the foothills, especially near the settlements and in watering places, lead to the degradation of steppe and meadow eco-systems. Forest and steppe fires also cause a great damage.

Strengthening of the existing recreational infrastructure as well as the creation of its new objects are necessary for the development of the valuable ecological tourism. Big hotels and other large constructions of the tourist infrastructure will not be built there. However the Visit-Center organization (Center of ecological education) in Erzin on a base of the Nature Reserve Headquarters answers to the aims of the ecological tourism development. It will be necessary also to equip the stationary places for tourist stops in some of the cluster plots and in their buffer zones. First of all the equipment for tents, fire places, toilets and dust-heaps need to be built on a shore of the Tore-Khol Lake that undoubtedly is the most attractive place for such purposes. It will be necessary to equip more thoroughly the stop places for the ecological tourists at the downhill of Oulug-Khaiyranan-Dag Mountain. One can find the sacred spring for Tyvinians and definite infrastructure objects that exist there already. It is essential to think about the equipment of the stationary stops and in the most remote Mongoon-Taiga cluster plot as well to acquaint the tourists with Alpine and glacier landscapes.

CONCLUSIONS AND OUTLOOK

It is possible to count as a whole that, excluding several small by size and difficult of access plots, the territory of the Russian part of the Ubsunur Hollow has significant perspectives for the development of foreign as well as of domestic ecological tourism. The unusual beauty and originality of landscapes presented here, the large number of preserved in a good condition archeological monuments will not leave anybody indifferent. At the same time only ecological tourism has a right to exist here, because all the other types of recreational activity (intensive, in the first place) can negatively influence on the preservation of natural complexes of the future World Heritage territory.

The problem of monitoring and management of the recreational flows doesn’t face sharply the territory yet because of a very small number of tourists. Nevertheless in future it’s not worth to ignore the development of the monitoring system, taking into account the existing experience of other popular for tourism territories. Doubtlessly it will be possible to use the experience existing in the other countries of the world. Correctly organized (not mass) tourism will allow not only to preserve the existing slightly disturbed condition of the natural complexes, but will also create the base for finance sources flow into the development of the traditional brunches of economy in the region.

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Visitor Flows in National Parks and other Protected Areas of Serbia: Case Studies of Proper and Improper Practices

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Abstract: The principles of management in the protected natural areas of Serbia are defined by the Environment Protection and National Parks Acts of the Republic of Serbia. Even though these laws were adopted by the Parliament as early as 1991 and 1993, respectively, their implementation is not performed in an equal manner in all the protected areas. According to these laws, the tourism in such areas is not primarily considered as an activity of economic/commercial character, but as one of the environmental principles. It is supposed to contribute to the protection and development of the national parks and nature reserves by promotion and presentation of the natural and cultural values. The role of such tourism in the environmental education of the general public is also of paramount importance.
The Ministries of the Environment and Tourism of the Republic of Serbia have brought in 1998 the Action Plan for the Sustainable Development of Tourism in the Protected Natural Areas. On this basis, the Minstry of the Environment has also brought the Action Plan for Sustainable Management of Hunting Grounds and Game Fauna in the Protected Natural Areas.
In addition to a brief survey of the above legislation, some case studies are presented of both positive and negative practice in performing the management of the protected natural areas in this respect. The case studies relate to the Nature Reserve „Begej - Carska Bara“ and the National Park „Kopaonik“ as the two extreme examples of the corresponding approaches
.

INTRODUCTION

The system of management in the national parks and other protected areas in Serbia is defined by the Environmental Protection Act, the accompanying bye-laws and other laws arranging the particular issues (the protection and utilisation of the natural resources – forests, water, soil, planning and arrangement of the space, construction of objects) by the basic management instruments (normatives, plans, institutional – organisational framework, informational – documentational basis and financing).

Starting from the fact:

That the protected natural good is a well-preserved part of nature of especial natural values and features, due to which it possesses permanent environmental, scientific, cultural, educational, health-recreational, touristic and other importance, due to which as a good of general interest it enjoys particular protection;

Also, to follow Basic legal principles of the protection and development of protected areas:

1 Protection, preservation and enhancement

- biogeographical characteristics of the area, the ecosystem and biological diversities
- representative biological, geomorphological, geological, hydrological and landscape characteristics
- cultural heritage;

2 Development:

- scientific research activities
- cultural educational activities
- activities on the presentation and advertising of the natural and cultural values
- tourist, recreational and other development activities within the scope and in a way that will ensure the protection, preservation and enhancement of natural and cultural values of protected areas

3 Improvement and construction must be in line with:

- obligations of protection, and aims of preserving, renewing and enhancing natural and cultural values
- with the needs of presentation, rehabilitation and revitalisation.

4 Activities that could damage the basic and other characteristics of the protected area must be prevented.

One of the most important functions of management by the protected nature is the management of users and visitors. The reports on the state of management as well as performing the activities of protection and development in these areas indicate the need of improving these models in practice. In this sense, the models from the practice have been chosen illustrating the positive and negative examples of management, with the consequences either of successful protection or the increase of the level of degradation of the protected natural values.

The Action Plan for sustainable tourism in protected areas in Serbia was drawn up having in mind all the key trends in European tourism, the main tourism strategies in Serbia, sustainable tourism actions undertaken at international and national levels and it is of national interests to preserve the values of nature. Its aim is to implement the national tourism and environment protection policies and promote natural heritage while following the framework of the European Charter for sustainable tourism in protected areas.

The strategy of sustainable tourism in protected areas can only be developed and implemented in cooperation with institutions responsible for nature protected areas and environment protection, for tourism, culture, education, with representatives of the tourist industry and other sectors of the economy, local authorities and the local population. Activities have been charged with regularly following the implementation and effects of these activities.

METHODS

With respect to the fact that the visitors' management and monitoring in all protected goods in Serbia were directed to the models from the conventional touristic activities, the reliable results on the total number of visitors were not obtained, and in that sense, there is no representative model.

In all the protected natural areas, where there are the touristic and recreational objects, the number of visitors is followed only by the number of overnight stays during the year or the educational groups of schoolchildren and adults.

In the Special Nature Reserve „Stari Begej – Carska Bara„ only the environmental tourism programme is organised and the number of visitors is followed only according to target groups whose transport is organised by a special tourist boat (60 adults or 80 children), accompanied by guides, to the I zone of protection where there are the habitats of the colonies of the Great Gray and Great White Heron. The reserve is suitable for bird watching, with so-called photo-waiting shelters..

Special Nature Reserve "Stari Begej - Carska Bara" (1600 ha) represents the richest site of wetland birds (340 species), fish (24 species) and endangered plants. This reserve is placed on the Ramsar list.

The methodology of following the number of visitors relates to the number of visitors according to the target groups (children or adults) during a month. The active period of the organised visits to the habitats of colonies of the Great White and Great Gray Heron (I zone of protection) lasts from the month of May to November each year.

SOME SELECTED RESULTS

Special Nature Reserve "Stari Begej - Carska Bara":

In the following tables the dynamics is shown of the visitors in the period from the year 1996 to 2001, and as an example the motion of the visitors' numbers in 2000.

month /year	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**Total**
1996	2120	2960	320	410	1950	1460		**9220**
1997	2804	3205	252	309	1870	1415		**9855**
1998	1996	2236	492	350	611	950	50	**6685**
1999		60	25	290	1018	1055	50	**2498**
2000	3311	2531	542	775	455	288	51	**7953**
2001	5170	3303	885	695	896	802		**11751**
Total								**47962**

Table 1. Review of dynamics of tthe visitors (1996-2001

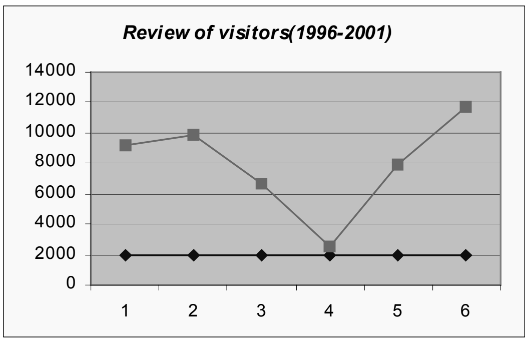
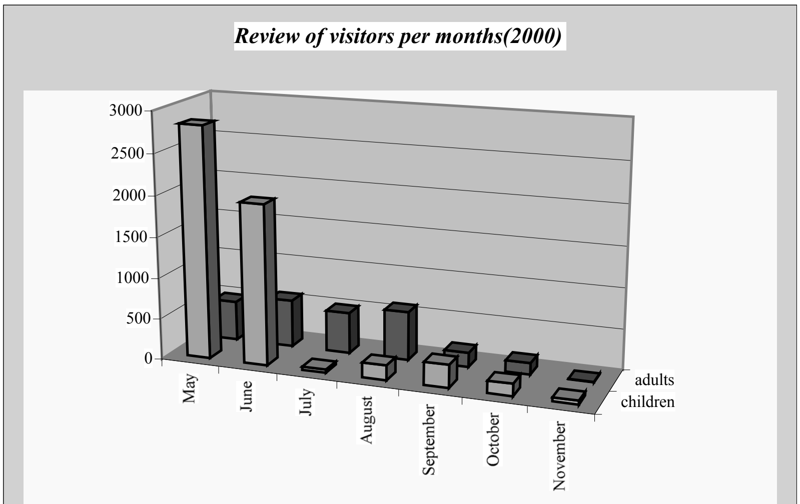


Figure1. Review of visitors per years from 1996 to 2001



	May	June	July	August	September	October	November
children	2827	1954	39	180	279	148	46
adults	484	577	503	595	176	140	5

Figure2. with a table of the Review of visitors per months (2000) in Special Nature Reserve "Stari Begej carska Bara" - for example

In the II and III degree of protection zones sport fishing is also allowed with the special permit from the managers. Also, during the summer camps are being organised for the students, and researchers (NGO's) who usually also organise the actions on cleaning the waste from the park. The waste issue is one of the negative effects of the visitors. Also, still a good co-operation has not been established with the local population, since the benefits have not been clearly defined of the limited utilisation of the area.

The Kopaonik National Park:

The Kopaonik National Park was founded and proclaimed in 1981. It covers an area of 11.800 ha and has a protecting belt of 19.986 ha. The Park is placed on the highest parts of the mountain.The highest summit is "Pancicev vrh" (2017 m).

According to the laws of the Republic of Serbia on protection of nature, a large number of objects of nature, natural and man-made objects which can be found in the NP Kopaonik, are singled out and classified according to the different ways of protection.

The following programmes are developed:

- schools in the nature
- excursions - walking encompassing the programmes of environmental education:

a) about the nature of Kopaonik
b) about flora and fauna
c) about minerals and geology
d) about ethnography and customs of the locals
e) about waters and springs
f) orienteering and map reading
g) recreation: horse riding, mountain-byke ...

There are some examples of the educational actitivies within the Park.

Two days visits were organised of students of biology and forestry and Geografy (231). Also there were (160) school children, then (38) members of the Mountaineering association of Yugoslavia who paid the 2 days visit to the NP. Groups of Young Gorans were in the NP in shifts lasting 7 days (68). 90 Young Researches also stayed in the NP in shifts of 7 days.

Within the classical tourism framework, during the 3 winter months there are 72000, and in the summer 10000 overnight stays in the area, which exceeds the carrying capacity of the park and causes the environmental problems.

DISCUSSION

The informative system as a necessary instrument for identification, valorization and monitoring of the particular natural values and cooperation in management has not been established as yet (anticipated in the Programme of Development of the Unified Information System of the Environment of the Government of the Republic of Serbia)

The development functions in the national park and other protected areas have to respect the principles of protection and promotion of the natural values, rarities and phenomena due to which such an area is placed under protection. Achievement of the high level within the system framework implies overcoming the conflicts between the environmental and economic objectives and achieviong their harmony. For purpose of performing and respecting a series of legal regulations and rules, the mechanisms have been established of the continuing control and surveillance.

Problems of our Protected areas are:

- building of objects and urban structures above planned levels and their discrepancy with zoning character of the nature protection in national parks
- illegal and inadequate building of Summer houses, temporary objects etc.
- inadequate protection and exploitation of waters
- support to stone mining and similar banned activities
- exaggerated and inadequate tourism development in certain national parks
- lack of coordination among exploiting and conservation activities in forests etc.

The negative effects of the utilisation of the national parks and other protected areas caused by the former way of management indicate the necessity of changing the former concept of management and introduction of the new mechanisms and system solutions, applied to the large extent in the countries of the developed part of the world.

From this also the necessity appeared for a pilot programme to be performed on organising the service of volunteer-monitors in the national parks. The public enterprise „National Park Kopaonik" dared as the first with this intention, in order to promote the quality of performing all the protection and development functions in the park, especially at the time of the winter tourism. The world experiences show that the best way to overcome the negative effects of the management is to include, in the measures and numebrs as high as possible, the local population viz. Volunteers as the people of good will, of different specialities, crafts and interests.

Thus, in the National Park Kopaonik, following the professional training, volunteers – volunteer rangers were chosen, assisting the official surveying service.

RECOMMENDATIONS

As the members of the EUROPARC Federation, the protected natural areas of Serbia should follow the sustainable tourism concept ("Loving them to death?")

Guidelines for managers of protected areas: Developing sustainable tourism

The aims of sustainable tourism for protected areas:

Environmental aims:

- Conservation in the long term - the essential over-riding aim
- Better knowledge and awareness of conservation among local people and visitors

Social aims:

- Visitor satisfaction and enjoyment
- Improvement of living standards and skills of local people
- Demonstration of alternatives to mass and package tourism and promotion of sustainable tourism everywhere
- Making sustainable tourism part of local and national culture
- Enabling all sectors of society to have the chance to enjoy protected areas

Economic aims:

- Improvement of the local and national economies
- Provision of local business and employment opportunities
- Generation of increased revenue to maintain protected areas

Bear in mind also the carrying capacities for sustainable tourism:

Environmental carrying capacity

The degree to which an ecosystem, habitat or landscape can accommodate the various impacts of tourism and its associated infrastructure without damage being caused or without losing its sense of place.

Cultural and social carrying capacity

The level beyond which tourism developments and visitor numbers adversely affect local communities and their ways of life.

Psychological carrying capacity

The level beyond which the essential qualities that people seek in the protected area (such as peace and quiet, few other people, few signs of human developments) would be damaged by tourism developments.

Action plans of protected areas should be based on the following principles of the Charter of Sustainable Tourism in protected areas:

1. Integrated approach towards tourism management
2. Preservation of resources and open air spaces
3. Development of specific and quality tourism
4. Recruiting new clients
5. Distribution of duties in the preservation and enhancement of the natural and cultural heritage
6. Involvement of the local community
7. Support to the local economy
8. Development of new forms of employment
9. Education on how to behave in line with the preservation of the environment
10. Support to the economy to take into account the environment factor, economic, social and ethical factors.

CONCLUSIONS

1. According to the presented practical examples the system of management of the protected natural areas should be promoted, and in this framework to develop particularly the new methods of monitoring of visitors, including the categories of those who come for longer stay, as well as the day visits and according to the target groups and various programmes. The entrance gates to the national parks are a good possibility to establish control and render the first informations to the visitors.
2. The environmental education programme should be systematically conceptualised and performed, including the management, tourist guides, park surveyors and volunteers who are the key factors of organising, control and informing.
3. Within the process of harmonisation of legislation in the area of environmental protection with the EU legislation, to regulate the criteria and instruments for managing the visitors (legislation, institutional and organisational frameworks, action plans, professional structure, monitoring, financing etc.)
4. Implementation of the Aarhus Convention into the frameworks of the National strategy of education for environmental protection.
5. Grants, subsidies or tax concessions for farmers and local communities to set up small-scale enterprisies for the sustainable enjoyment of protected areas.
6. Pioneering Projects should be to show innovative approaches to small-scale sustainable tourism to rural Economies;
7. Goverment and protected area management authorities should encourage innovative forms of transport, e.g. electrically-driven buses, to enable people to reach and circulate within protected areas in ways that do not harm the environment

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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The Contribution of the Alpine Convention to Nature Conservation and Visitor Flows Management

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Abstract: The Alpine Convention, entered into force in March 1995, is an international treaty that obliges eight countries and the European Community to undertake specific measures for the protection of the natural and cultural heritage and for the sustainable development of the Alps, the largest and highest mountain region in Central Europe. One of the twelve Protocols for the implementation of the Convention is dedicated to "nature protection and countryside conservation". It highlights the importance of protected areas and the necessity to manage human activities in order to reduce negative impacts and to guarantee biodiversity and natural processes.

INTRODUCTION

The International Commission for the Protection of the Alps (CIPRA-International) was founded in 1952. CIPRA is a non-governmental umbrella-organisation formed by over a hundred associations and organisations from all seven alpine countries, standing in a holistic way for the conservation of the natural and cultural heritage in the Alps as well as for a sustainable development of this region.

Already in its founding documents in the early fifties CIPRA highlighted the necessity of an international treaty to guarantee the cultural and natural diversity of the alpine space. In the middle of the eighties CIPRA re-launched this idea organising first preliminary conferences and documents.

In 1989 the German minister of environment, Klaus Töpfer, overtook the initiative and invited his colleagues from all alpine States to Berchtesgaden from 9 to 10th October for the first Alpine Conference of Environment Ministers. The Declaration of Berchtesgaden became the starting point of the alpine process.

In the last twelve years the Contracting Parties (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, Switzerland and the European Union) elaborated the Alpine Convention and eight Protocols. CIPRA-International participated at this work as a critic and constructive observer.

Till now the Convention on the Protection of the Alps remains the only multilateral treaty specifically devoted to the organisation of inter-regional co-operation in a mountain area. The Convention outlines the principles and urgent action fields in distinct environmental, economic and social features. It can therefore be considered the first and most detailed conception of sustainable development of a large mountain region (cf. Agenda 21, article 13 of the Rio Conference 1992).

CONTENTS AND STRUCTURE OF THE ALPINE CONVENTION

The Alps are not only the largest, but also the most important ecological macro-system in Europe. They are an area of an outstanding variety and diversity, in cultural as well in natural features. Biologists considers the Alps as the biggest genetic reservoir of cultivated as well of wild species in Europe, e.g. at about 40% of Europe's species of vascular plants you can find in the alpine space.

The authors of the "Convention on the protection of the Alps" (Alpine Convention) highlight right at the beginning of the treaty the natural and cultural richness of the Alps, their importance for people living there or visiting the area, the need for reinforcement of transborder co-operation and for reconciliation of economic interests with ecological requirements:

> „AWARE that the Alps are one of the largest continuous unspoilt natural areas in Europe, which, with their outstanding unique and diverse natural habitat, culture and history, constitute an economic, cultural, recreational and living environment in the heart of Europe, shared by numerous peoples and countries,
>
> RECOGNIZING that the Alps constitute the living and economic environment for the indigenous population and are also vitally important for extra-Alpine regions, being the site of important transport routes, for example,
>
> RECOGNIZING the fact that the Alps constitute an essential habitat and last refuge for many endangered species of plants and animals
>
> AWARE of the substantial differences existing between national legal systems, natural conditions, population distribution, agriculture and forestry, the

> state and development of the economy, the volume of traffic and the nature and intensity of tourism,
>
> AWARE that the ever-growing pressures caused by man are increasingly threatening the Alpine region and its ecological functions, and that the damage is either irreparable or rectifiable only with great effort, at considerable cost and, as a rule over a long period of time,
>
> CONVINCED of the need for economic interests to be reconciled with ecological requirements"
> the Contracting Parties have agreed as follows..."
>
> *(Alpine Convention, 1991)*

With the Alpine Convention the Contracting Parties will pursue "a comprehensive policy for the preservation and protection oft the Alps" (Alpine Convention art. 2, par. 1, General Obligations). Therefore they will apply the principles of prevention, co-operation and "polluter pays" and consider the interests of all the Alpine States, their Alpine regions and the European Economic Community. The use of resources has to be prudent and sustained. Transborder co-operation will be intensified and extended both in terms of the territory and the number of subjects covered.

In order to achieve this objective the Contracting Parties will take appropriate measures in twelve priority areas that are singled out in the Convention (Alpine Convention, art. 2, par. 2):

a) population and culture
b) regional planning and sustainable development
c) prevention of air-pollution
d) soil conservation
e) water management
f) conservation of nature and countryside
g) mountain farming
h) mountain forest
i) tourism
j) transport
k) energy
l) waste management

The measures for these twelve issues must be concretised in so-called Protocols. The Alpine Convention as a framework treaty just mentions the general objectives for each issue.

The objective for the conservation of nature and countryside is regarding the Alpine Convention (art.2, par. 2. let. f):

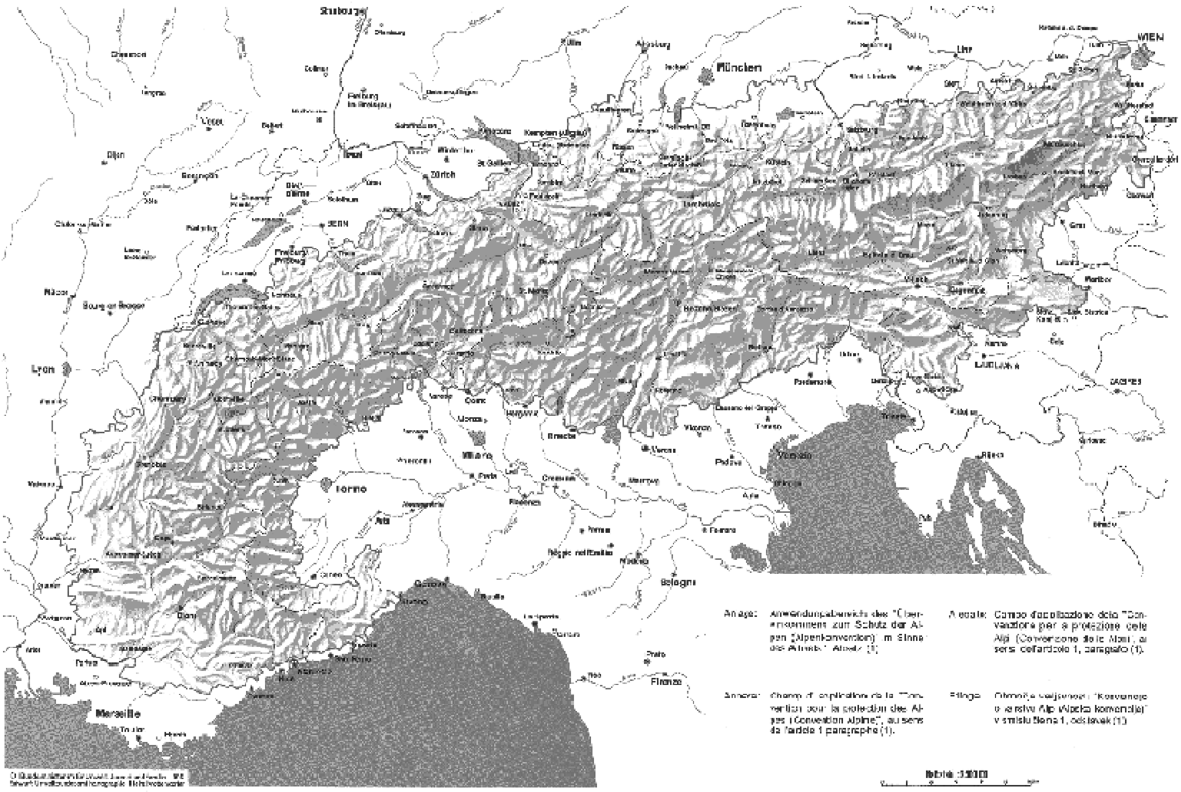
> „to protect, conserve and, where necessary, rehabilitate the natural environment and the countryside, so that ecosystems are able to function, animal and plants species, including their habitats, are preserved, nature's capacity for regeneration and sustained productivity is maintained, and the variety, uniqueness and beauty of nature and the countryside as a whole are preserved on a permanent basis"

This objective formulated in letter f, paragraph 2, article 2 of the Alpine Convention was the guideline for the elaboration of the "Protocol Conservation of Nature and Countryside" that we will describe later.

The Alpine Convention also institutionalise the co-operation among the Contracting Parties.

- The *Conference of the Contracting Parties* (art. 5, 6, 7), called *Alpine Conference*, is the most powerful organ of the Alpine Convention. It is composed by the Ministers of Environment and is held at regular intervals to discuss issues of common concern, exchange information, accept the Protocols, examine the implementation etc.. So far six Alpine Conferences have been held: Berchtesgaden October 1989, Salzburg November 1991, Chambery December 1994, Brdo February 1996, Bled October 1998 and Lucerne October 2000.
- The *Standing Committee* (art. 8) consists of delegates of the Contracting Parties and works as an executive body. It elaborates in working groups draft Protocols and guidelines for the achievement oft the purposes of the Convention. At the same time the Standing Committee has a supervisory function since it informs the Alpine Conference about the implementation of the Convention, its Protocols ant the Conference's decisions. The Standing Committee meets regularly between the Alpine Conferences.
- The *Permanent Secretariat* (art. 9) would be the administrative board of the Alpine Convention. But the Ministers of Environment didn't yet establish a professional office, although the necessity of a permanent secretary is obvious to guarantee the continuation and implementation of an international treaty. As the Alpine Convention knows four official languages (French, German, Italian and Slovenian) already translation work needs a lot of resources and experiences. Since now the Chair of the Alpine Conference had to overtake the whole administrative burden of the alpine process. As the chairmanship changes every two years all administrative know-how had to be newly build up which broke the rhythm of the work.

The Alpine Convention regulates in general terms further important issues like the co-operation in research, education and information art. 3, 4) or the involvement of Alpine territorial authorities and non-governmental organisations (art. 4). There are no effective instruments to control and evaluate the implementation of the Convention apart from the



reports of the Contracting Parties addressed to the Alpine Conference.

The Alpine Convention entered into force on 6 March 1995, after three States had expressed their consent to be bound by the Convention. Meanwhile all eight Alpine States and the European Union have ratified the Convention.

So the Convention applies for the whole Alpine region. The perimeter of application is defined by a map annexed to the framework treaty. It may be extended by each Party to other parts to its territory (art. 1).

Till now, eight of twelve priority areas are concretised in Protocols. The Alpine Conference of Chambery 1994 adopted the first three Protocols:

- Protocol on Mountain Farming
- Protocol on Regional Planning and Sustainable Development
- Protocol on Nature Protection and Countryside Conservation

At the Alpine Conference of Brdo 1996 the Ministers signed the

- Protocol on Mountain Forest

Two further Protocols have been adopted at the Alpine Conference of Bled in 1998:

- Protocol on Energy
- Protocol on Soil Conservation
- Protocol on Tourism

Finally, at the Alpine Conference in Lucerne 2000 the Ministers signed the

- Protocol on Transport

None of these eight protocols were entered into force because no Contracting Party has yet ratified. That's why CIPRA-International appealed to the States to ratify the first eight Protocols of the Alpine Convention as quickly as possible, at least by the beginning of the International Year of the Mountains 2002.

The working groups for the four missing Protocols (population and culture, water management, prevention of air-pollution and waste management) are not yet installed. The Ministers decided at the last Alpine Conference to make a particular effort for the implementation and ratification of the existing Protocols rather than for the elaboration of new Protocols. CIPRA-International regretted the decision to stop the work on new Protocols, because alpine people have already been waiting for ages for the basic Protocol on Population and Culture.

PROTOCOL ON NATURE PROTECTION AND COUNTRYSIDE CONSERVATION

In the Alpine Convention the conservation of nature and countryside is one of the priority themes among others. The Convention is not a conservationists Bible, but a conception of sustainability that tries to mitigate different interests.

The framework treaty is aware of the outstanding value of the large and unspoilt natural areas in the Alps with essential habitats and last refuges for many endangered species of plants and animals. One objective regarding the Alpine Convention is “to preserve the variety, uniqueness and beauty of nature and countryside as a whole” (cf. Convention art 2, par. 2, letter f).

The Protocol on Nature Protection and Countryside Conservation, adopted at the Alpine Conference 1994 in Chambery, expands the general objectives of the Alpine Convention on this issue in 27 articles.

The full text of the Protocol is available in French, German, Italian and Slovenian Language on the Internet: www.cipra.org.

The goal of the Protocol (art. 1) is the protection, the management and, where necessary, the restoration of nature and countryside so that

- ecosystems are able to function,
- animal and plants species, including their habitats, are preserved,
- and nature's capacity for regeneration and sustained productivity is maintained.

Each Contracting Party oblige to take the necessary measures to achieve the goal of the Convention and the Protocol (art. 2).

The Contracting parties co-operate namely in the fields of mapping, management and surveillance of protected areas and other elements of natural and traditional cultural landscapes and of the connectivity of habitats (art 3).

The objectives of the Protocol have to be considered in the other specific policies like regional planning, mountain farming and forestry, water management, transport, tourism, education, research etc. (art. 4).

The rights and the participation of local and regional territorial units are guaranteed as they exist in the stately order (art. 5)

The Contracting Parties oblige to present the state of facts and dates that are specified in the annex, e.g. lists of species and habitats (art. 6).

Within five years after the Protocol entered into force the Contracting Parties elaborate conceptions, programmes and plans that describe the actual and the aimed state of nature and countryside (art. 7)

The Contracting Parties use the instrument of landscape planning in co-ordination with regional planning to preserve and develop the natural habitats of plants and animals as well as significant elements of natural and cultural landscapes (art. 8).

The potential impact of public and private activities and projects on nature and countryside have to be studied. Detrimental consequences of inevitable influences on the ecology have to be balanced and compensated (art 9).

The Contracting Parties aim to reduce negative impacts in the whole Alpine space and to preserve and, where necessary, to restore habitats, ecosystems and traditional cultural landscapes. As the role of mountain farming and forestry are critical they should be motivated to sustainable use by contracts remuneration (art 10).

The Contracting Parties protect and enlarge existing protected areas and establish new ones. They promote the establishment and the management of new national parks as well as zones of rest where wildlife has priority for all other interests. Finally they study the possibilities of remuneration of the local population (art. 11).

The Contracting Parties adopt measures for the establishment of a network of national and trans-border protected areas or areas worthy of protection (art. 12).

The Contracting Parties enact measures for the long-term conservation of natural and semi-natural biotops (art 13) and species (art. 14)

The taking and trade of certain species is to be prohibited. These species are to be listed within two years after the entry into force of the Protocol (art. 15).

The Contracting Parties promote the re-introduction of native species if they don’t have insupportable impacts on nature, countryside and human activities (art. 16).

The introduction of non-native species is generally prohibited. Exceptions are possible if it is proved that there will be no negative impacts on nature and countryside (art. 17). The introduction of genetically modified species is regulated in the same way (art. 18).

The Contracting Parties are free to take measures that go further than foreseen in this Protocol (art. 19).

The Contracting Parties encourage the co-operation in research and monitoring that are a useful basis for the protection of habitats, species and landscapes. In annex II are listed some priority themes for research (art. 20).

Education and information will be encouraged (art 21).

The Contracting Parties are obliged to implement this Protocol in the order of the stately legislation (art 22). They regularly address reports about all achievements to the Standing Committee (art 23) and evaluate the effectivity of the Protocol (art. 24).

The last three articles define the relation from the Protocol to the Convention (art. 25), the procedures of signing and ratifying (art. 26) and the procedures of notifying (art. 27).

The Protocol has been signed by most of the Contracting Parties, but until now no Party has ratified. It will enter into force after three Parties have ratified, that means have expressed their consent to be bound by the Protocol.

Even before the ratification France made an important effort for the implementation of the Protocol. After the first “International Conference on protected areas”, organised by the National Park les Ecrins, the “network of protected areas” with a professional team was established in Grenoble, later in Gap, to promote the international co-operation of national and regional parks, reserves of biosphere and other protected areas. The “Network of Protected Areas in the Alps” is until today the one and only official instrument for the implementation of a Protocol of the Alpine Convention. Detailed information to the activities of the network can be found on the Internet www.alparc.org.

PROTECTED AREAS AND VISITOR FLOWS MANAGEMENT

The Alpine Convention and its Protocols are part of an international legislation, applicable to different countries with different legislations. That's why the specific measures in the Protocols are still formulated on a rather abstract level.

Article 11 of the Protocol "Nature Protection and Countryside Conservation" is dedicated to the protected areas. The contracting parties take all appropriate measures to avoid negative impacts or degradation in protected areas. They promote the installation of zones of rest where wildlife has absolute priority. In these zones they reduce or prohibit all activities that are not compatible with the protection goals.

In this general formulation the management of visitor flow in protected area is included. Recreation activities and traditional use may enter into conflict with the requirements of protection.

If and how the conflicts between economic interests and protection needs can be solved will be decided on, in every case, in the field. An international treaty like the Alpine Convention can only outline the problems and the principles for action, and it's organs can evaluate the progress and effectiveness of the measures undertaken in each contracting country, if a good monitoring and reporting system is installed. Until now, the contracting parties of the Alpine Convention have not established an efficient observation and information system

CONCLUSIONS

The Alpine region is a (relative) natural space with ecological systems which is unique to the whole of Europe. The international community is nowadays aware of the rich cultural and natural heritage of the Alps and will protect and develop it through the Alpine Convention.

One of the twelve Protocols of the Convention is dedicated to the protection of nature and conservation of countryside. The Protocol aims to preserve the variety of habitats and species and the beauty of the landscapes.

Although the Protocol did not yet enter into force, the "Network of Protected Areas" started already 1996 with a wide range of activities for trans-border co-operation in the whole Alpine arc. The network is the first official implementation tool of the Alpine Convention. The next two years will show us if the Contracting Parties will establish further tools and install the Permanent Secretariat to continue the ambitious Alpine process...

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Reasonable Illusions: Participatory Planning and Protected Areas

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Abstract: Popular images of protected areas are among the best known images in the world. They are composed in equal part of myth, hype and rare glimpses into incredible places. These images, of peaceful unchanging areas, disguise the bitter debate over the real purpose of protected areas, and our continually changing relationship with nature and wild places.
The use of participatory approaches to plan and manage land, water, and conservation-based interventions is now well established. Today, few projects in natural resource management are funded unless they contain substantial components of community involvement. This is especially true in protected area development where participatory approaches form the entry point for working with local communities and user groups. Despite the increasing numbers of participatory initiatives, few initiatives remain uncontested or non-controversial. This paper offers seeks to suggest why the popular image, a reflection of social values and influences, is important to visitor management in protected areas as a unifying factor.

This essay offers some loosely organised comments arranged around the subject of protected areas. The essay seeks to suggest why the notion of protected areas as a social construction is important for visitor management. In order to establish a context for this essay, let us begin with two caveats. First, what we offer here are personal observations based on our experience with state parks in Florida. Second, we are also attempting to draw attention to the general way we think (and talk) about protected areas through the mirror of the wilderness concept. Though different from one another, both 'protected areas' and 'wilderness areas' are essential elements of protection (Aplet, 1999; Barry, 1998). Wilderness is the idea and place where the concept of protection reaches its highest expression. The concept therefore affects all management decisions and actions in protected areas.

On Wilderness

Having worked with and in parks for several years, we realise that the notion of wilderness as man-made nature can be problematic. The concept 'wilderness' is highly valued in society (Manning and Valliere, 1996) as an apparently natural phenomenon, not dependent on human thought or obvious human constructs such as experience, recreation or leisure. Flora, fauna, land and space, however, are all found in parks, wilderness, forests, wildlands and protected areas. These designations are based on the interpretations and needs of human beings, and do not reflect an objective reality. Our view is that the concept of a social construction forces us to confront the extent to which we impose our own meanings on the physical world. Wilderness is created from the interplay of thought, language and cultural practices. For example, the image of Yellowstone National Park is one of the best known in the world. The popular image of the world's first national park is composed of equal parts myth, hype and rare glimpses of the incredible wonder of the place. The awe, and in some cases reverence, inspired by its landscapes continues to dominate our ideas of, and about, protected areas. All protected areas are established, and measured by this image.

Popular images lead to popular places, and popular places suffer a different fate. Protected areas inevitably become sites of clash and contradiction. Every popular place that has been "discovered" is a vortex of different needs and desires. At some point a choice has to be made between integrity of place, local quality of life, and imposed popularity that brings "progress" and change that may or may not support local interests. One could argue long and hard about when, or even if, the boundary between the "unspoiled" and the "popular" is breached in any one place. Our continually changing relationship with nature and wild places, and our altered preconceptions about them bring complex emotional and political conflicts (between people and place or people within a place) to play.

Despite this, the basic purposes of protective designations have not changed. What has occurred is that changes in population, income, transportation, leisure time and recreation have altered the demands placed on protected areas. Their managers are often caught between the contradicting goals of preservation and protection for specific purposes and benefits, and the need to provide use and enjoyment for this generation of users. As a result, judging whether a protected area actually fulfills its role is far more complicated than knowing whether a protected area is sufficiently large and representative to sustain desired ecological attributes in the long-term.

On Nomenclature

Because of places like Yellowstone, protected areas are among the most strongly imagined pieces of our cultural heritage. Along with individual experiences, there are cultural and symbolic images, such as Yogi Bear, that become a part of the popular place image. In addition, the constructed images can also include family stories, postcards, the poster at the local travel agent's office, the neighbour's video of their visit, and a thousand and one small anecdotes that are a part of our lives. All these provide us with an underlying agreement about what wilderness means. Whether as proponents or opponents, we understand that the wilderness image frames the debate about the (social and physical) boundaries. Because of all the ways in which these images intrude on our consciousness, it should come as no surprise that visitation to these places continues to increase. As visitors, we search for a glimpse of the wonder, and a chance to embrace the imagery.

Before considering visitation, we need to consider the wilderness definition. In one definition, it is a pristine environment free from any human impact. By this definition, wilderness no longer exists in the Northern Hemisphere (Vitousek, 1999). Wilderness may also be defined in legislative terms. This definition recognises wilderness as an area affected primarily by the forces of nature. Here, wilderness is an area of unmodified naturalness that is of a size and remoteness that makes protection from change feasible. Because ecosystems presuppose that the whole is greater than the sum, wilderness defined in ecosystem terms makes a great deal of sense.

The use of ecosystem terminology reflects the scientific foundation of conservation. First, it provides agreement about characteristics (rather than appearances), and second, it provides a suitable vehicle for discussions about large-scale protection. Yet, in a curious way, the confusion in the public debate suggests that the scientific terminology is not well understood. Why is this? An ecosystem has intrinsic characteristics; yet often lacks a unifying principle. The elimination or addition of components continually changes the system. It is difficult to argue that certain components are essential, and claims that equate change with destruction are rarely supported. The problem here, as we see it, is that if the ecosystems cannot be destroyed or preserved, it is not at all clear how visitors to them can be managed.

On Visitors

Tourism has always been an important use of protected areas. In quantitative terms, a tourist, and thus tourism, is usually defined as a person who travels for non-business reasons for a distance of over 50 miles and overnights away from their usual place of residence (Gunn, 1991). In many areas, the managers of the protected areas are also responsible for tourism management. However, the market for tourism is increasing, and today many more (direct and indirect) stakeholders are involved, resulting in many types of tourism and multiple definitions. From the various existing definitions for tourism, we think that there are two important points that have ramifications for successful visitor management. First, there is the view that visitation is an individual human experience that some anthropologists theorise is actually a ritual human, cultural experience (Graburn, 1983). The second view is that tourism is an export economic activity.

As an experience: The individual dream of a future experience at a place other than home or office motivates people to travel. When people are in the time and space of this extraordinary, mystical place, the rules of their ordinary lives are usually suspended. They have high intensity, deeply moving experiences, and it is the guaranteed repeat of the experience that brings them back a second time, or inspires them to "spread the word" about a destination.

As an economic activity: Tourism can also be viewed as a unique export economic activity. Its uniqueness lies with the nature of the activity. Rather than shipping goods and services to the purchaser, the purchaser comes to the point of origin to procure and experience them. This phenomenon often leads to the many undesirable externalities -congestion, pollution, and crime - that occur at tourism locations.

From these, the fundamental elements of visitation management are formed. They are experienced by local residents and visitors in the visitor domain (Winterbottom, 1993). Local residents are part of the experience. Their culture contributes to a sense of place. About the visitor, Winterbottom remarks: "The truly successful visitor destination is one that is concerned more with visitor quality than quantity. The quality visitor is the one that is most likely to repeat the visit and to respect the visitor environment - both natural and man made". Winterbottom defines the visitor domain as the location where tourist facilities are clustered. For protected areas, we believe this is too narrow a scope. Because of the popular image, the visitor domain in protected areas includes those elements, located both within the boundaries and outside of them that enable us to enhance appreciation of the resource.

Addressing the visitor domain is critical to enabling proactive visitor management. The concept allows us to define boundaries is space that might otherwise not be recognised as legitimate by multiple stakeholders. It acknowledges that tourism in protected areas has implications for the areas around them. Furthermore, it encompasses the economic aspects of tourism, and allows an even distribution of the benefits. The challenge of tourism management is for obtaining consensus, not on the issues that cause the least disagreement, but on the strategies and objectives, that produce the best results.

On Public Involvement

Public involvement in protected areas provides a framework for addressing conservation issues within a social and political context. A context that is often polarised over not only what constitutes a desired future, but is also characterised by "messy", interrelated problems. What we have are situations that cannot be dealt with in isolation of other problems. Today, more than ever, it is important to co-ordinate efforts to manage tourism in protected areas, and ensure participation by key stakeholders.

The state park system in Florida has chosen to address these challenges through the public development of park specific management plans. We have found, that where these participatory initiatives have worked, it is because of individuals and groups that have seen the benefits of working collaboratively based on:

- Development of an agreed vision;
- Identification of all the stakeholders;
- Establishment of the partnerships that need to operate;
- building a consensus on the future direction;
- development of the actions needed to achieve the agreed direction; and
- undertaking an implementation plan.

In this process, the most complicated part is the first. To have an agreed upon vision, there must be a culturally accepted definition for protection.

What is a protected area? Answers to this question depend on the specific region and goals outlined for a particular area. The definition depends on social preferences or the natural values to be preserved. Added to this is public perception - the personal interpretation and knowledge of protected areas by the general population. To define the range of existing public perceptions, some polarised stereotypes are presented. First, some people believe that protected areas are playgrounds created for the benefit of the recreational user groups. These people resent and discount the protective aspects. Another group values them as a means of gaining income from tourists. This group wants to see as much development as possible and often feels threatened by increased public involvement. A third group is conservationists, who see protected areas as the basis for conserving natural resources and biodiversity. The fourth group views them as a disruption to their way of life and traditional values. This groups is fiercely protective of historic access and use rights, and is often wary of the changes that tourism can bring to the local community. In short, though all protected areas have an objective reality as physical places, what makes that reality is based on personal cognition, emotion, values and experiences.

All of these perceptual positions are valid. Combined they are integral to defining the visitor domain. Participatory planning enables us to recognise this inherent conflict, and still attempt to bridge the gap based on an accepted (compromise) vision of and for a place. At the same time, the confusion over the terminology has left us with an ephemeral representation - ecosystem - that is not beneficial to the harnessing of social considerations. To ensure the success of participatory planning initiatives we must be clear on social, cultural and political reasons of why these places are special. Furthermore, their place image must be accepted, and it must be popular.

On Visitor Management

The fact that many of us are uncomfortable with the concept of culturally constructed protection makes agreement on future strategies and objectives much harder. The use of scientific terminology undermines, in many respects, the kind of thinking that presupposes the boundary imposed by the protective designation. If an ecosystem lacks a central unifying principle, then what is the goal of visitor management? We are losing the image of that otherworldly place that offers respite from our daily cycle. To put it in another way, if we cannot create an image that is agreed on by all of the stakeholders, how can we discuss the placement of limits on use?

Here we would suggest that the popular image of protected areas is a visitor management tool we need. It is crucial for defining the visitor domain and for visitor management. It connects some people to wildland values, is a social force, and carries a constructed historical reality that has consequences. The process of creating and sharing meaning from “wilderness experiences” requires language, metaphors of self, nature and most importantly, the cultural frameworks supplied by the popular image.

Traditionally, management was concerned with human impacts to wilderness recreation experiences and to the plants and soil directly affected by this recreation, principally in campsites and trails. To mitigate these, managers generally had little compunction about closing campsites or re-routing trails. These actions are localised and do not impinge on most visitors' perceptions. In this manner, the last three decades have seen multiple attempts to quantify and optimise visitor management in protected areas. Yet, most managers today face a set of problems that are largely the result of significant long-term impacts. Few people would disagree that inside protected areas, weeds, pathogens, feral animals and pollution from external sources are as significant as tourism and recreation (Buckley and Pannell, 1990). The combination of these with the small-scale, traditional interventions, new recreation forms and increased visitation are calling into question the ability to maintain the wilderness recreation experience.

For example, many of us would say that for a wilderness experience, minimum area requirements are conditional, and depend on explicitly framing the desired condition. The general conceptual model is that user densities affect user perceptions of crowding that in turn, affect user trip satisfactions (Graefe et al., 1984; Manning 1985). If the goal is the provision of solitude for recreationists, the number of visitors dispersed within any one visitor's "viewscape" is the determining factor as determined by topography, and proximity to anthropogenic structures. Nevertheless, we live in a society where increased and increasing human density is a given. Whether you are walking down the street, sitting in traffic or waiting to enter a park there is almost always a mass of people surrounding you. If you accept that wilderness is socially defined, then a wilderness experience while surrounded by two hundred people can have the same inspirational aspects of the solitary wilderness experience. Furthermore, if we use the popular image as a measure, we can simultaneously define the experience through a series of socially affected expectations.

In this context it is revealing how the mundane affects the sublime. In *Desert Solitaire*, Edward Abbey described park rangers "going quietly nuts answering the same three basic questions five hundred times a day: (1) Where's the john? (2) How long's it take to see this place? (3) Where's the coke machine?" The toilet comes first, the coke machine a close third. We mention this in recognition of a fundamental human need, whether those humans are in a cathedral, a shopping mall, or park. Moreover, it is an often neglected reality. In all the time we argue over aesthetic sensitivities, carrying capacities and complex demands on even more complex resources, most visitors will ask comfort level questions first - and they may ask no others. If the questions are answered, and a basic comfort level provided we have already succeeded. By providing the basics, we give visitors the freedom to form their own version of the popular image. We have given them a chance to embrace the myth and the hype, and allowed them a rare glimpse into the wonder of a place.

In taking this forward, one of the options available as a visitor management tool is this: instead of trying to establish a range of acceptable visitor caused disruptions, we must re-establish the representational image. This is that one element that all stakeholders can be accept and understand. Only then can we manage visitors in and around protected areas. Only then can we get acceptance for use limits. This view is both broader in scope and narrower in focus than current definitions.

Furthermore, because protected areas are first and foremost, social constructions, participatory planning offers a way of obtaining consensus and agreement on the objectives and strategies that produce the best results for both stakeholders and the environment, while attracting visitors. That this is often a compromise vision, is a given in this type of process. The implication is that every visitor related conflict in the history of protected areas, and therefore, every suggestion of conflicts yet to come, can be traced to some compromise of the popular, ideal, image. To an erosion in the public acceptance of popular image and its socially inspired aspects.

In Conclusion

Combined, participatory planning and the image of a place inevitably connect us with the cultural and historical forces of societies. If you live in the US, the words and images created by John Muir, David Thoreau, Wallace Stegner, Aldo Leopold and Theodore Roosevelt define the political debate. For protected area management, ecosystem approaches, ecological management, social carrying capacity and conflict management reflect specific culturally bound facts and values.

Currently, tourism offers one of the best prospects for conserving wild places in most parts of the world. It is not an ideal tool for conservation, though in the short term, it is perhaps the only one with sufficient political and economic reach to be effective. Participatory planning offers a means for harnessing and shaping this social power. Tourism is a means to ensure conservation, and the partnership of conservation and political power is not, nor will it ever be, easy. In this context, it is also important to remember that management represents a vehicle for accomplishing goals. It is not a goal unto itself. The only way in which we can productively use this social power (to the benefit of protected areas) is by tempering our illusions.

In this sense, in terms of visitor management, the future of protected areas depends on a return to their past. We must return to the concept of protective designation as a social construction with implications on popular images and public imaginings. We must do so because the place image and its public acceptance allow us to define the characteristics of tourism in any locale. The management of stakeholder expectations through the popular image and a participatory process enables the achievement of reasonable social solutions for protected areas. The management of expectations is important here because for any given problem in a protected area, there will never be a permanent solution (to find that one correct answer). We can only establish temporary resolutions (to find more or less useful responses) that are fulfilled the matching of the personal experience with the popular image.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Some Problems of Tourist Activity in the Tatra National Park

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Abstract: Tatra Mts. is an unique alpine ridge in Poland.. The whole Polish part of Tatra is a protected area as a national park (Tatry National Park – TNP). Its area is 21,164 ha. Every year 2.5 millions of tourists visit TNP. Tourist activity is one of the factor of nature degradation in Tatras. The most transformed are the areas with the greatest tourist penetration: Morskie Oko lake, Kasprowy Wierch Mt. and Koscieliska valley. The paper presents preliminary results of the studies dealing with the problems of tourist penetration in the Morskie Oko (MO) and Kasprowy Wierch (KW) regions. In the MO area needs and desires of tourists, time budget during stay at the place and tourists' evaluation of infrastructure were studied with the use of special questionnaires. At Kasprowy Wierch the streams of tourists were observed. The number of tourists on each tourist track crossing KW was accounted. The results of the studies point to great diversity of tourist activity in TNP (making pictures, enjoying nature, walking in the surroundings, climbing, relax). The results can be useful for managing of tourist activity, for making corrections in TNP protection system and for establishing the methods minimising degradation of tourist tracks and its surroundings.

INTRODUCTION

The Tatras are the highest mountain massif of the alpine folding of the Western Carpathians. The area of the Tatras is about 750 km^2, of which 174 km^2 belong to Poland. This is the only alpine area in Poland. Tatras consists of two parts: the High Tatras with crystalline rock and the West Tatras with crystalline and sedimentary rock (Krzan et al., 1994). Great climate diversity, wide range of attitudes, varied geological formations and relief resulted in Tatras the great richness of flora and fauna. The Tatra Mts. is the centre of high mountain vegetation in Poland. Among nearly 500 mountain species of the vascular flora known from Poland, more than 90% occur in Tatras and nearly 50% (about 250 species) have their only sites in our country. At least 20% are very rare and mostly relict species (Mirek, 1996a).

In 1954 the whole Polish part of Tatras have become a status of a national park (the highest level of nature protection in Poland) - Tatra National Park (TNP). In 1992, the MaB Committee proclaimed both Tatra National Parks in Poland and in Slovakia as the Tatra Mountain International Biosphere Reserve. TNP is 27 km length and 12 km width. The area of the Park is 21.164 hectares. When considering the area of TPN it is similar only to a single medium-size valley in Alps, or to the area covered by Warsaw - a capital city of Poland.

Over 87% of the Park belong to the government, the remaining parts are the property of local forestry co-operatives. Forests cover about 70% of the park area and alpine grasslands, rocks and water – about 30%. Strict protection reserves cover 11.500 ha, including summits, alpine meadow zones, the dwarf pine zone and some of the upper and lower forests belts. They allow natural processes to take place in the environment at limited influence of man. Partial protection is implemented on about 45% of the Park area mainly in the lower forest zone which was significantly transformed in the past by the economic activity of inhabitants (Krzan et al. 1994). In 1954, when Tatras were taken under a law protection, they have been seriously transformed by the human activities. In the XVIII and XIX centuries mining and metallurgy works devastated the landscape. Sheep grazing and exploitation of forests were also intensive at that time. Sheep herding continued into the first half of XX century (Mirek, 1996b).

Both, the international definition and Polish low emphasise two basic functions of a national park: first - nature protection as a highest priority, second - providing the public with a limited access to the park for: research, education and tourism purposes. TNP is accessible for tourism, recreational skiing and other sport (officially there is 50 forms of tourist accessibility in TNP). The most encouraged form of tourism is hiking along established trails. Here is well developed and permanently marked trail system for summer hiking with a total length of about 250 km and with different levels of difficulty – from typical walking paths to routes experienced alpine climbers only.

In TNP tourists may walk only on marked routes. A developed tourist base is accessible in the vicinity of the Park (town of Zakopane and nearby villages). In the mountain themselves, there is a system of mountain hostels and lodges open year-round, and on the park borders there are parking places, viewpoints and restaurants. There is a well-developed infrastructure for recreational skiing (the cable car and chair lifts to Kasprowy Wierch) and competitive skiing: ski jumps, slalom slopes, downhill runs and cross country areas. There are designated areas for mountain climbing, with trainers' centres and camping at various elevations (Krzan et al., 1994). Tourism, concentrated in the most attractive and most easily accessible areas of the Tatras causes pollution, intensification of erosion and degradation of alpine vegetation. In the last years, the number of hiking-tourists constantly increases. Every year about 2.5 millions of tourists visit TNP, 75% of them during the summer season (Fig. 1). In comparison with another mountain regions in Europe the Tatras, and especially Dolina Rybiego Potoku (Rybiego Potoku valley), is under extremely great tourist pressure (Table 1).

The aim of the paper is to present preliminary results of the Student's Research Camp „Tatry'2000" which took place in August 2000. Researches were dedicated to the problems of tourist penetration in two regions of Tatra Mts. - Morskie Oko lake and Kasprowy Wierch Mt., which are the areas with the greatest tourist pressure in Polish Tatras (Fig. 2).

Country (area)	Mountain region area (km^2)	Number of potential tourists per 1 km^2 of mountains
Austria	60 000	126
France	60 000	916
Switzerland	29 000	222
Poland:	9 380	3955
TNP	211	15 000*
Rybiego Potoku valley	~ 10	~100 000*

Table 1: Average, potential number of tourists per 1 km2 of mountain region in some European countries and in the Tatra National Park (by Mirek, 1996b).(- actual values)*

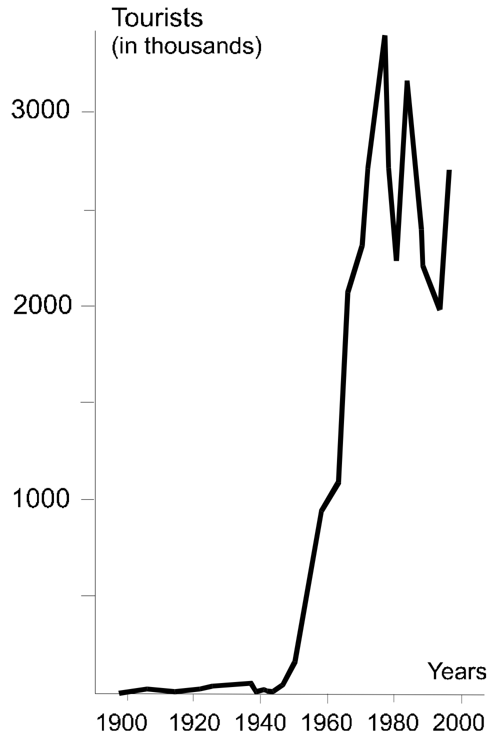

Figure 1: Number of tourists visiting Zakopane and Tatras in the years 1895-1995 (by Mirek, 1996b).

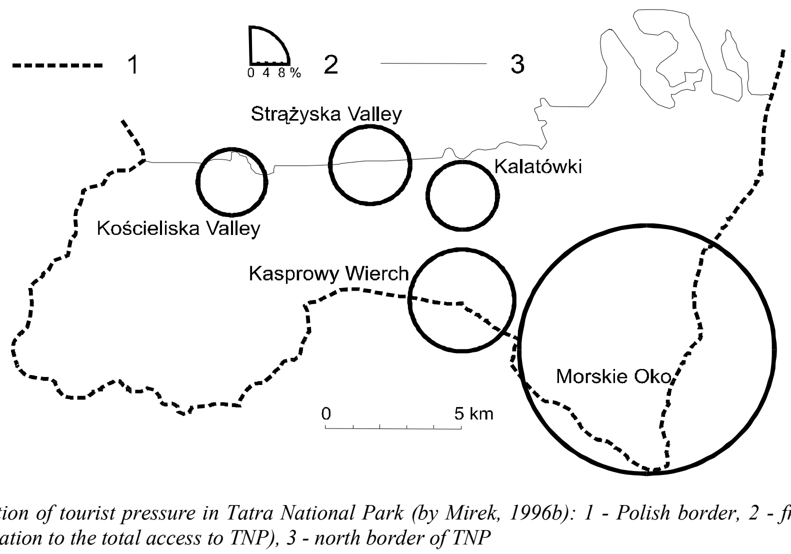

Figure 2: Differentiation of tourist pressure in Tatra National Park (by Mirek, 1996b): 1 - Polish border, 2 - frequency of tourists in selected places (in relation to the total access to TNP), 3 - north border of TNP

Kasprowy Wierch is located between High Tatras and West Tatras and is one of the most frequently visited and very easy accessible, by thousands of hiking-tourists, peak in the Tatras (by cable car, with max capacity of 190 person per hour, direct climbing rout from Zakopane, lot of trials from another parts of TNP) with great attractiveness (good start point and endpoint when penetrating another parts of TNP, year-round open restaurant at the cable car station, view point). By human impacts, resulting primarily from sport, tourism and recreation, the alpine vegetation and tourists routes has been degraded and destroyed in the region of Kasprowy Wierch.

Morskie Oko (Eye of the Sea) is one of oligotrophic lakes, which made a landscape of High Tatras very picturesque, and the largest lake in TNP (with area of 34.5 ha). It is surrounds by very attractive peaks and ridges: Rysy (the highest peak in Poland), Mnich, Mieguszowiecki Szczyt, Przelecz pod Chlopkiem, Wrota Chalubinskiego, Szpiglasowy Wierch. Some of them are accessible only for mountain climbing. There are 3 tourists' routes reaching Morskie Oko. The most frequented and easy route, which in the summer season every day about 10.000 person is climbing to MO, is the asphalt track along the Dolina Rybiego Potoku (Valley of Fish Stream). Two other are: track from Szpiglasowa Przelecz (Szpiglasowa Pass) and from Dolina Pieciu Stawow (Five Ponds Valley) (Krzan et al., 1994).

METHODS

At Kasprowy Wierch Mt. (KW) the streams of tourists were observed. There were accounted the amount of tourists on each tourist track crossing KW. 3 groups of observers were located in KW region (on the routes crossing points). Research was realised during typical summer working day, with medium tourist activity. The weather was typical for the summer season: air temperature - 12-17°C, wind speed - 3-7 m s^{-1}, wind direction - W-SW, cloudiness - 10-70%.

At Morskie Oko the selected individuals (with various age and sex) were examined with the use of special questionnaires. It was made 54 interviews with tourists climbed to Morskie Oko from the direction of Dolina Rybiego Potoku. In the questionnaire the following questions were done:

a. How much time tourists spend in Tatras?

b. How people spend time during summer in Tatras?

c. What are the purposes of visiting Morskie Oko?

d. How people spend time at Morskie Oko?

e. How tourists evaluate selected elements of infrastructure at the rout along Dolina Rybiego Potoku?

RESULTS

Kasprowy Wierch Mt.

During the studied day the total number of person going through KW or spending some time at its surroundings was 3341. There are some ways to reach KW. Results show, that tourists come to KW mainly by cable car (1900 persons). There were 605 persons, who reached KW from East (High Tatras), and 176 persons walked to KW from the direction of West Tatras. The number of persons climbed to KW from Zakopane through Hala Gasienicowa was 234, and 421 persons climbed to KW directly from Zakopane. From the direction of Slovakian Tatras climbed 5 persons only.

For relatively large group of tourists KW was the start point to penetrate another parts of TNP. 853 persons went from KW to the direction of High Tatras and 420 to the direction of West Tatras. KW is endpoint when penetrate another parts of TNP. Results show, which of the ways going down from KW are mainly chosen: 1506 persons back down by cable car, 356 walked down from KW to Zakopane through Hala Gasienicowa, and 206 went down from KW directly to Zakopane.

For large group of tourists KW was only the viewpoint and place of short relax stay. 465 persons spent there about 2 hours making short walks in the nearest surroundings and 1041 spent some hours sitting only at a top of KW. The tourists, for whom KW was only one of the stage in hiking, spend also several minutes at the top relaxing, and visiting restaurant.

Morskie Oko

It has find that majority of tourists (about 60%) spend in Tatra region several-days holidays, 15% - one week and 25% - more then one week (Fig. 3). During summer holidays the most of tourists choose hiking tourism as a main way to spend time in Tatras. The less popular recreation activity is biking along the established routes (Fig. 4).

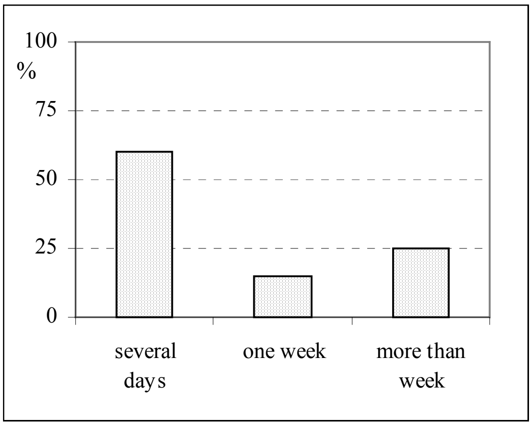

Figure 3: Duration of stay in Tatras

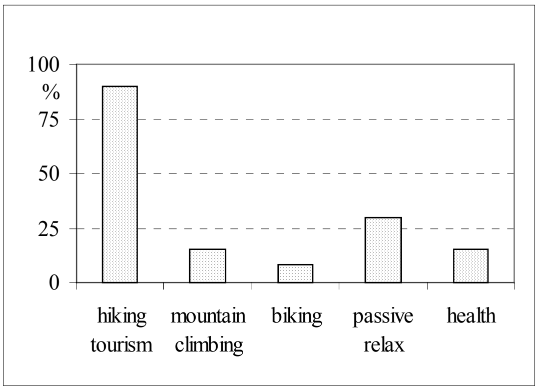

Figure 4: Tourists' preferences during summer holidays in Tatras

Every day thousands of tourists visit Morskie Oko. Results show that most of them need to enjoy nature at this place. For about 50% of visitors the most important was to see this popular site and to see the highest Polish peak – Rysy. About 50% of tourists intend to climb on the nearest peaks (Fig. 5). It was noted that large part of tourists have realised their hopes - 75% of them climbed to Czarny Staw (which is located at the foot of Rysy Mt.) and only 25% of persons stay at the shore of the lake (Fig. 6).

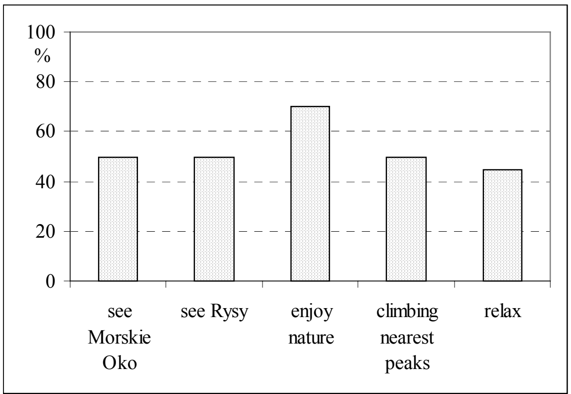

Figure 5: Provided purpose for visit at Morskie Oko

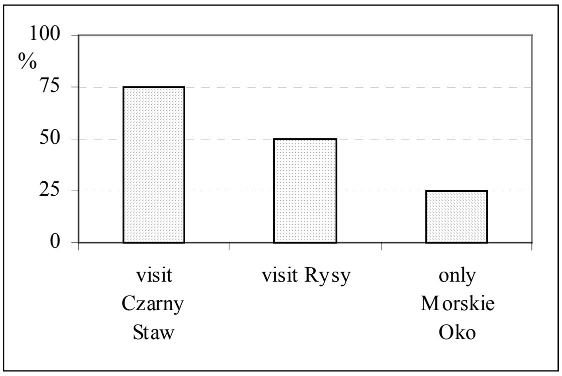

Figure 6: Realised hopes of spending time at Morskie Oko

The rout along Dolina Rybiego Potoku is most often visited track in TNP (about 1000 persons per hour) and it provides the most developed infrastructure. Tourists' evaluation of this infrastructure is important to set an eventually changes (Tab. 2).

CONCLUSIONS

The results of the studies confirmed great tourist penetration in two regions of Tatra Mts. Morskie Oko lake and Kasprowy Wierch Mt. Hiking-tourism is real the most popular form of spending time in Tatras. Taking into account that majority of tourists spend in Tatras only few days it is clear their needs to visit the most attractive sites in TNP. Additionally, Morskie Oko and Kasprowy Wierch are not only attractive but also very easy to access places.

The great tourist frequency on Kasprowy Wierch depends mainly on cable car station located on its top. So, most of visitors (>50%) reach KW in this way. The presence of cable car makes the Park easily accessible for various groups of tourists. Thus, one of the basic functions of a national park – „providing the public with a limited access to the park" – is well realised. However, great number of tourists affect degradation of nature on the top of KW and destroy of tourists routes (particularly route in the direction of High Tatras – with the most frequency).

The similar situation was observed at Morskie Oko. 9 km of asphalt route is relative easy to walk. Besides, this rout leads to one of the greatest regions of High Tatras with the highest Polish peak – Rysy. The flow of 1000 persons per hour is a serious threat for an environment and it is a great challenge for tourism organisers as well as for TNP and communal services (transportation, infrastructure, renovation of degraded sites etc.).

The open is question: how to continue to throw open to public these two regions and how to adjust the number of tourists to actual capacity of high mountain environment. The studies reported are only the first part of research which should be, and I believe they will be, continue in the future.

Infrastructure	Number			No idea
	suitable	insufficient	too much	
toilets	60%	30%	10%	0%
restaurants	65%	10%	10%	15%
places to rest	45%	30%	20%	5%
waste-paper baskets	30%	50%	10%	10%

Table 2: Tourist's evaluation of selected elements of infrastructure at the rout along Dolina Rybiego Potoku

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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From the Beginning Until the World Heritage Title: The Tendencies and Management of Visitor Flows at the Hortobágy National Park

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Abstract: The Hortobágy was always in the center of interest because of its special natural values and its characteristic landscape. Even since 1973, when the Hortobágy National Park was established (as the first national park in Hungary) the visitor flows has been significant. However, this mainly meant a 1 or 2 days mass visits. The successive management plans paid increased attention to the problems and issues related to the visitor flows and the possible solutions. The developed zoning-system and the management regulations based on this deal with the tourism.
The recently built Epona Rider Village and then the private tourism organizations appeared in increasingly large numbers, and require a new management approach. The important developments of the recent years (educational center, museums, demonstrational centers) also had a great influence on visitor flow management. The practice applied in each stage of the development process, their modifications and further developments, which is to meet the requirements of the World Heritage title, will be introduced.

BACKGROUND

The Hortobágy National Park (established in 1973) is the first, and until now the largest Hungarian national park with its 81,000 hectares. It received the “World Heritage” status from UNESCO in 1999. The Hortobágy “puszta” (i.e. “barren lands”) is an excellent example for the traditional land use being carried on for centuries, ensuring the lasting co-existence between human and nature. All these – goods, natural and cultural values acknowledged as the part of the national heritage – can not be isolated or disclosed from the society. It is necessary to ensure the opportunity for getting acquainted with these values, the learning process, the environmental awareness and the recreation. For a long while, experts are seeking for the solution that satisfy the needs of the nature conservation and recreation: for this reason the term “eco-tourism” has been developed.

In the Act No LIII of 1996 (Nature Conservation Act), Hungary declare the need to ensure the visitor access to the protected natural areas, as the part of information-flow, education, research and tourism. It is necessary to promote the widest possible public knowledge on the natural values, and the conservation activities carried on the protected areas, while performing various recreational activities.

DEVELOPMENT OF VISITOR FLOWS IN THE AREA

Due to its size, and besides the areas of high protection, the Hortobágy National Park is capable to ensure the visitor access according to the international standards, and to satisfy the needs of recreation. The first overall eco-tourism development plan was prepared in 1994, based on the IUCN zoning. Three zones were formulated according to the visitor flow:

- free access areas,
- guided access areas, and
- areas closed for visitors.

As the basis for visitor strategies, program packages were elaborated, and touristic developments were made.

PROGRAMME FOR THE TOURISM MANAGEMENT DEVELOPMENT

The Hortobágy area attracts some 200,000 visitors, most of them spend only one day in the area (day-trippers). For this reason the development of a new complex program that enables the sustainable tourism is of crucial importance. The key elements of such program are:

- due to infrastructure development formulation of four demonstrational centers representing the main territorial features of the area;

- the income of the locals is increasing (services, accommodation, guiding, selling of home-made goods, etc.);
- the local and regional natural values (habitats, species) receive more attention do to the presentation;
- the income of the National Park is also increasing;
- the realization of the planned developments will promote the conservation of landscape and habitat values, and the biodiversity will also increase;
- with the realization of the Visitor Centre that presents the Hortobágy National Park in its whole, the prestige, social acceptance (public awareness) and the national – international reputation of the of the nature conservation activities will increase and
- the environmental and natural awareness and behavior will further develop.

The tools for the control of visitor flows in the near future are:

- the Visitor Centre (when ready);
- in situ presentation of the “living puszta” (restored wetland, gene bank - presentation of ancient farm animals -, Przewalski horses, characteristic landscape elements, bicycle road, guide boat, etc.);
- bird-watching tours (avifauna of aquatic-, grassy-, and loessy habitats, alkaline ponds and marshes, migrating birds and bird hospital, etc.);
- renovation of narrow-track railway (in the fishpond area);
- further development of the “West Reception House” of the Hortobágy National Park (cheap accommodation for students, exhibition hall).

Long term development are as follows:

- realisation of ethnological and culture-historical exhibitions;
- launching of permanent nature conservation campus;
- full development of information posts (poster network for orientation, education and zones);
- bulletins, brochures and events;
- development of traditional fairs;
- continuous development of the ranger network.

The Hortobágy National Park, as the managing authority of the area is intends to strengthen the co-operation between the actors in the tourism of the area, by involving them into the commenting, preliminaries, decision making and realization process, in order to ensure the conflict-free visitor flow management of the area.

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Monitoring and Managment of Visitor Flows in Recreational and Protected Areas
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Managing Visitors Through Certification of Protected Areas' Business Partners - A Practical Application in Bialowieza National Park, Poland

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Abstract: WWF and its business partner, the Molecaten groep Bv initiated PAN Parks concept in 1997 to develop third party verification for measuring management effectiveness of protected areas. PAN Parks wishes to introduce a marriage between nature conservation and sustainable tourism. Business partners have an important role in the project as service and facility provider for visitors. The implementation of the concept of building cooperation between the management and local entrepreneurs started in Bialowieza National Park in 1998. 30 local entrepreneurs signed a letter of intent to work as candidate PAN Parks' business partners. The concept is that guests visiting these entrepreneurs can get extra information about the Bialowieza National Park, and also about the events in the region. Local entrepreneurs can join if they pay an annual fee, and if they fulfil certain criteria.

INTRODUCTION

Tourism is one of the largest sectors in Europe, and has the potential to become a key element of the preservation of rural European landscapes and social structures, through the regeneration of economically depleted areas with the economic input of tourism. Although coastal and city tourism are still the highest in terms of visitors numbers, it is rural and mountain tourism that is growing fast in the European context, and this is mostly around protected areas. The IUCN (1994) lists four reasons why the nineties have offered increased opportunities for protected areas, all of which apply to Europe:

- Human populations are relatively stable and affluent;
- There are declining pressures on land in many areas because of agricultural surpluses and reduced military activity;
- There is a high level of public support for conservation, and
- There is a climate of international cooperation.

WWF's vision for tourism is that it should maintain or enhance biological and cultural diversity, use resources sustainably, and reduce over-consumption and waste. In particular, tourism development and practice should:

- be part of a wider sustainable development strategy,
- be compatible with the effective conservation of natural ecosystems, and
- involve local cultures and people, ensuring that they have an equitable share in its benefits. (WWF, 2001a)

WWF believes that 'sustainable tourism' is currently an unachievable ideal, not least because of the significant contribution that air travel makes to climate change. It is therefore more useful to think about 'responsible tourism' within the context of a wider sustainable development strategy (see table 1).

Responsible Tourism
Responsible tourism is tourism that satisfies tourists, maintains or enhances the destination environment, and benefits destination residents.
Ecotourism
Ecotourism should be seen as a sub-set of responsible tourism and can be described as tourism to natural areas that is both determined by, and benefits local communities and the environment.

Table 1: Definitions (WWF, 2001a)

WWF reports tourism certification schemes provide a marketable logo to businesses that exceed (or claim to exceed) a specific standard. The logo enables businesses to demonstrate their environmental and social credentials, which, in theory, allows consumers to identify responsible companies. Tourism certification schemes can therefore play an important role in bringing about more responsible tourism by providing participating businesses with an action plan for improvement that is linked to a market incentive. However, certification is only one of a suite of tools required to make tourism more responsible. Even effective and credible schemes need to be complemented by education, regulation and comprehensive land use planning. In addition, the success of certification will ultimately depend upon sufficient consumer demand for more responsible tourism. A variety of certification schemes already exist and some are more comprehensive than others (Synergy Ltd 2000). The variety of tourism certification schemes that actually leads to confusion of consumers and problems with protected areas' management engaged WWF to start with a new concept in 1997 called PAN (Protected Area Network) Parks.

THE PAN PARKS CONCEPT

The PAN Parks concept was initiated under the umbrella of WWF's European Forest Programme by the World Wide Fund for Nature in 1997. Co-operating partners are the WWF, various protected area authorities and a Dutch leisure company the Molecaten Group. Based on a wide consultative process, in 2001 the PAN Parks Supervisory Board endorsed Principles and Criteria for certifying a protected area as a PAN Park (see table 2). The PAN Parks Organisation assists with gathering financial support for the sustainable use of natural heritage by implementing joint marketing and communication activities and with establishing a local organisation responsible for implementation.

Protected areas and business partners wishing to receive the PAN Parks label have to follow 5 guiding Principles split up into further Criteria and Indicators: Principle 1. PAN Parks are large protected areas, representative of Europe's natural heritage and of international importance for wildlife, ecosystems and natural or semi-natural landscapes. Principle 2. Management of the PAN Park maintains and, if necessary, restores the area's ecological processes and its biodiversity. Principle 3. Visitor management safeguards the natural values of the PAN Park and aims to provide visitors with a high-quality experience based on the appreciation of nature. Principle 4: The Protected Area Authority and its relevant partners in the PAN Parks region aim at achieving a synergy between nature conservation and sustainable tourism by developing and jointly implementing a Sustainable Tourism Development Strategy. PAN Parks Principle 5: PAN Parks' business partners as legal enterprises are committed to the goals of the protected area in their region and the PAN Parks Organisation, and actively cooperate with other stakeholders to effectively implement the region's Sustainable Tourism Development Strategy as developed by the local Executive PAN Parks Organisation or similar forum

Table 2: PAN Parks Principles to follow for protected areas and their business partners

In the first phase of the project, Principles and Criteria were developed to set guidelines as to which protected areas can earn the PAN Parks label. The draft was formulated based on literature, comments of experts, input from protected area managers and by examples of good practice. The third draft of Principles and Criteria was tested by 18 protected areas in 15 European countries that filled out questionnaires of self-assessment. The data was summarised in a report highlighting good practice, weak points and advise for future development. On these grounds and with the help of experts, Principles and Criteria 1 (Natural Values), 2 (Habitat Management) and 3 (Visitor Management) were finalised in 2 workshops and finally approved by the PAN Parks Supervisory Board in 2001.

Currently 7 protected areas have signed a letter of intent assuming the status of Candidate PAN Park, committing them to achieve PAN Parks certification by 2006. A further 5 protected areas have been designated Prospective Candidate PAN Parks, with certification expected by 2011 (see table 3). Candidates and Prospects fall within one of four European regions: Northern, Central and Eastern, Southern, and Western Europe. The PAN Parks Foundation will focus its resources in working with Candidates to realise certification; upon certification, the best Prospect in that region will jump up to the position of Candidate. By using this three-tiered system (Verified PAN Parks, Candidate PAN Parks and Prospect PAN Parks), the PAN Parks Foundation can better manage the growing network, and also sets strong incentives for improvement of park management. The first PAN Park certified by the PAN Parks Organisation is expected by 2002.

Candidate PAN Parks	
Finland	Oulanka National Park
France	Mercantour National Park
Italy	Abruzzo National Park
Poland	Bieszczady National Park
Slovakia	Slovensky raj National Park
Slovenia	Triglav National Park
Sweden	Fulufjällets Nature Reserve
Prospective Candidate PAN Parks	
Greece	Dadia Forest Reserve
Hungary	Duna-Dráva National Park
Poland	Bialowieza National Park
	Biebrza National Park
Romania	Retezat National Park

Table 3: List of Candidate and Prospect PAN Parks (PAN Parks Courier, 2001 Summer)

Once the network will be created, i.e. the first label is actually awarded, full promotion, marketing and communication, organised by the PAN Parks Foundation, will follow.

PAN Parks' objectives

The PAN Parks label intends to highlight large European protected areas with a minimum surface of 20 000 hectares, which are outstanding in terms of their natural values and management, as well as in their quality nature-orientated tourism products.

The PAN Parks Foundation is to lead to joint communication and marketing of these areas. The objective is to raise awareness and appreciation for European natural heritage and thus foster acceptance and financial support for conservation issues. Moreover the creation of sustainable tourism products should help regional economic development in the surroundings of the protected area.

The PAN Parks Foundation wishes to invite tourism businesses and other private sector organisations into the network as co-operating partners who then can use the label.

PAN Parks Certification

For a protected area to be certified by the PAN Parks Foundation, it must first undergo independent verification in accord with PAN Parks Principles and Criteria. A team of independent consultants will be appointed by the PAN Parks Foundation to carry out verification. A protected area must first submit an application form for verification to the PAN Parks Foundation, providing basic information such as management plans, and sustainable tourism development strategies. The independent verification body will perform a desk evaluation of the application form, and if deemed a quality applicant, will then visit the park and conduct field verification. The verification body will provide a report on the field verification to the PAN Parks Foundation, including a recommendation supporting or not supporting certification. The PAN Parks Foundation will certify a protected area based on the recommendation.

The PAN Parks Foundation is currently developing a verification manual, including checklist, which will outline regulations and steps to follow when conducting field-verification.

The PAN Parks Foundation is currently investigating the possibility of using the Europarc Federation's "European Charter for Sustainable Tourism in Protected Areas" as part of its verification system. Both the PAN Parks Foundation and the Europarc Federation recognise the potential benefits of joining efforts on sustainable tourism targeting European protected areas. An opportunity for co-operation also lays in setting common criteria for certification of local partners in and around protected areas. Talks between the organisations are ongoing following the autumn signature of a "Common Strategy under Parks for Life".

Target oriented approach

In order to establish a network of outstanding parks on the European scale, PAN Parks is following a target oriented approach: a protected area will be required to meet all Criteria set under the Principles before earning the PAN Parks label and the associated rights and obligations of certification (*see attached chart*). The Principles and Criteria set strict guidelines for member parks so to 1) guard the quality of the PAN Parks label; 2) establish long-term, committed partnerships between parks and communities; 3) preserve, restore and add economic value to European nature.

Earning PAN Parks certification requires serious commitment from a protected area and surrounding communities. The PAN Parks Foundation has hired regional co-ordinators tasked with working with Candidate PAN Parks and local communities to improve their conservation and visitor management and sustainable tourism development so to meet the Principles and Criteria by 2006.

PILOT IMPLEMENTATION

Prospective Candidate PAN Park Bialowieza National Park was established in 1921 and covers 10 502 hectares. It is famous for its rich primeval forests and the reintroduction of the European Bison. The park gets over 100 000 visitors a year who visit educational facilities as The Bison Breeding Centre and the Nature and Education centre. In winter they can take part in the snow tracking of wolves and contribute to the research data of the park.

In autumn 1999, 30 local stakeholders became local Candidate PAN Park partners of Bialowieza National Park, and thus become actively involved in the park's sustainable tourism development. As candidate partners they have signed a contract which obliges them to support the set Principles and Criteria, to seek to full-fill them and to take part in the development of a shared sustainable tourism strategy. The contract includes a yearly fee to the PAN Parks Organisation. The candidate partners show their commitment by using the PAN Parks sign

The current e-commerce pilot project "PAN Parks E-Passport to Bialowieza" will help partners to profit from the network. A jointly developed website will advertise tourism sector services offered by the partners. Visitors have the opportunity to book accommodation and activities in advance and to get information on the region. Apart from the booking system, the website contains news, maps, and a regional calendar of events ongoing in the park. The overall goal of the project is to strengthen support amongst park authorities and local communities for the future certification of Bialowieza National Park as a PAN Park.

The website is found at www.poland.panparks.org. In the long term, PAN Parks Foundation wishes to develop websites for all certified PAN Parks and their partners.

EVALUATION IN PRESENT STAGE

A mid-term evaluation of the project in June 2001 showed the followings (see also table 4):

Generally most of the partners during last holiday season appreciated our e-commerce project and many said that it requires patience, and accepted that clientele cannot be build up in short time.

- Partners, which have cancelled participation during the pilot phase, had enough guests and were already used to manage bigger scale of business as it was being offered at presence by PAN Parks.
- Most of the partners are looking forward and are optimistic, but most of them are still expecting assistance and trainings. Others are ready to move more or less independently.
- Signals are there that new people would like join PAN Parks, but during this year they were not able provide tourist services (they have been not finishing yet with improving their accommodation, investment to reconstruction, etc…).
- The website (www.poland.panparks.org) should be improved, more regular update of information needed. Some partners complain that website should be made more attractive, more interactive. Many partners mention that website is missing map to navigate guests how to get to particular partners.
- Some partners recommended create links to the others travel agencies in Poland/abroad.
- Some of partners are already presented on different websites running by Polish companies for free.
- Some partners have already own web page and some are preparing own web page, these partners asked to create links between e-commerce and their web page.
- Some partners living in state forestry houses where they pay rent to forest office complained that they invest money into reconstruction (bathrooms, etc), and after rent finishes and they moved the investment will be lost, others complained that forest office officially do not agree that their buildings should be rent for guests…
- Some partners complained that information which were delivered to PAN Parks Foundation has never or slowly been put on the website.
- Some partners mentioned that marketing effectiveness of PAN Parks logo is quite low, because guests did not have any knowledge about it.

Effectiveness of PAN Parks e-commerce website through comparing number of nights provided by PAN Parks partners:

- Total: 1323
- Through e-commerce website: 155
- Through other channels: 1168
- Percentage of effectiveness: 12%

Table 4: number of nights provided by PAN Parks partners

CONCLUSIONS

Lessons learnt

It should be noted that PAN Parks Foundation is only learning from pilot e-commerce project. The goal is to use this experience to develop a wider e-marketing strategy for the whole organization. Other WWF Initiatives such as the Gites Panda in France could also be good case studies for further improvement. A full project evaluation will of course be carried out at the end of 2002 and will lead to the development of a guideline, toolkit for similar projects. As soon as this guideline is available PAN Parks Foundation intends to enlarge the project for all Candidate and Prospect PAN Parks. Next steps in the pilot are as follow:

- Evaluate experience in Bialowieza
- Modify criteria for business partners
- Clearly set criteria what/who should be our future ideal partners (this include rules and standards how to renovate partners accommodations respecting local tradition and architecture, how to create partnership with protected area managers, etc)
- Find local coordinator on the ground who should manage project on every days base

PAN Parks Foundation's role is to coordinate, shape strategy for project, manage/advice contacts towards national park and others partners, and keep eye that project will not slide into pure tourist promotion activity, but guarantee connection with nature protection in particular protected area.

Opportunities to proceed in 2002

PAN Parks Foundation continues financing the project and playing a feature role in it until end of 2002. However contracts, which were signed between the Foundation and local partners will be expire at the end of 2002. Due to the high expectation of local partners the project will most probably continue with the different organizational structure.

During the coming year (2002) it must be defined who can play dominant role in this project. At present following scenarios seem to be possible:

- PAN Parks Foundation – although it was decided that it should step out of this project beginning of 2003.
- WWF Poland – WWF Offices can play a vital role in tourism project as described earlier in case of Gites Panda in France.
- Bialowieza National Park authority – probably not the best alternative due to lack of marketing and tourism expertise in the management body.
- One of the present business partners, which runs a travel agency can create its own e-commerce branch, which could lead to a win – win situation, but it needs more time.

Recommendation for 2002

WWF Poland is interested in taking over the leading role in e-commerce. WWF has started a project aiming at enlarging Bialowieza National to the whole Bialowieza forest complex. One of the project objectives is to get the support of local stakeholders for the enlargement process.

From 2003 PAN Parks Foundation keeps its role as advisor in the project by sharing experiences from other protected areas, and providing trainings. Part of the recommendations is to form a Steering Committee for supervising the e-commerce after 2002. This body must include representatives of local partners, management of protected area, WWF office, and PAN Parks Foundation.

The Steering Committee should be responsible for shaping future of the project, provide consultancy, advice, and supervision. It should meet once per year. The role of PAN Parks Foundation in this new situation should be:

- Shape future of this project in Bialowieza National Park
- Careful advice to partners – standard of services, unifying promotion, keep eyes on respecting local tradition, architecture, etc. in a future on website should be only the best partners.
- Help with marketing
- Help in cooperation among subjects (WWF, BNP and others)
- Manage international connections

After the final evaluation all partners will receive an evaluation document with feedback from PAN Parks Foundation so that they know we are following this whole issue and that it will send positive signal and increase credibility of e-commerce.

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APPENDIX

PAN Parks Principle 5: PAN Parks' business partners as legal enterprises are committed to the goals of the protected area in their region and the PAN Parks Organisation, and actively cooperate with other stakeholders to effectively implement the region's Sustainable Tourism Development Strategy as developed by the local Executive PAN Parks Organisation or similar forum (hereafter EPPO).

Criterion 5.1: PAN Parks business partner follows all national legislation related to its business.

Indicator 5.1.1: Describe the location of your business, and the relevant verified PAN Park.

Indicator 5.1.2: Indicate that you comply with all relevant national and regional legislation and other legal obligations and duties.

Indicator 5.1.3: If business partner is not situated in or around the verified PAN Park, describe your interest in the area, and in being PAN Parks business partner.

Criterion 5.2: PAN Parks business partner supports the relevant verified PAN Park and its management goals.

Indicator 5.2.1: Indicate in details; how you contribute to the relevant verified PAN Park management goals.

Indicator 5.2.2: Submit a support letter signed by the director of the relevant verified PAN Park as part of the PAN Parks' partner application form

Indicator 5.2.3: Describe your support for concrete conservation project(s) so far.

Indicator 5.2.4: Indicate how your business encourages its clients to learn about the verified PAN Parks, and natural values of the region.

Criterion 5.3: PAN Parks business partners are committed to the PAN Parks Organisation and its goals.

Indicator 5.3.1: Indicate how your business participates in the work of EPPO.

Indicator 5.3.2: Describe your plan to participate in trainings and meetings organised by EPPO.

Indicator 5.3.3: Submit a proof of your annual fee for EPPO.

Indicator 5.3.4: Please submit a support letter signed by the coordinator of EPPO.

Indicator 5.3.5: Describe your plan about how to encourage your clients to learn more about PAN Parks.
Indicator 5.3.6: As a monitoring indicator, submit annual report of business improvement and contribution to STDS to EPPO.
Criterion 5.4: PAN Parks business partners actively participate in the implementation of Sustainable Tourism Development Strategy as developed by EPPO and verified by PAN Parks Organisation.
Indicator 5.4.1: Describe your action plan, which defines the contribution to the Sustainable Tourism Development Strategy.
Indicator 5.4.2: Indicate how your action plan links to the STDS.
Indicator 5.4.3: Describe what existing certification system your business is member of.

Criterion 5.5: PAN Parks business partners are pioneers and continuously contribute to the improvement of the region's tourism offer.

Indicator 5.5.1: Describe your plan to improve comfort, safety and quality standards of your business taking the traditional local lifestyle into account.
Indicator 5.5.2: Indicate how your business continuously improves its environmental standards including water/waste water, energy, waste treatment, shopping, and use of existing infrastructure.
Indicator 5.5.3: Indicate how your business contributes to the sustainable use of the land in and around the relevant verified PAN Park.
Indicator 5.5.4: Business partners act on a socially and culturally responsible manner by promoting local economy and traditions in the region.
Indicator 5.5.5: As a monitoring indicator, prove that you follow all PAN Parks Administrative standards as defined in the signed contract.

Monitoring and Managment of Visitor Flows in Recreational and Protected Areas
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Recreational Use and Wildlife Movement near Mountain Park Communities: Integrating Social and Ecological Management Objectives in Banff National Park

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Abstract: The proximity and easy access to recreational areas are special features of communities in parks and protected areas. In Canada's Mountain National Parks, communities are often located in valley bottoms that are important habitat for a wide range of terrestrial wildlife. Managing the spatial and temporal distribution of recreational users near park communities presents a challenge for managers faced with the conflicting objectives of providing recreational opportunities while maintaining the quality of habitat for wildlife. To address land use issues between recreational users and wildlife, we develop management objectives that integrate recreational opportunities with wildlife habitat requirements. We outline methods to collect baseline recreation and wildlife data for an integrated land use plan and describe subsequent steps in the planning process.

INTRODUCTION

In many mountain parks and protected areas, the relationship between high and low levels of recreational use is often a function of distance from roads, parking lots or visitor service centres. As one travels further into backcountry areas, the numbers and density of recreational users decrease, reflecting an increasingly wilderness experience. Some recreational planning and management frameworks reflect this relationship between access and recreational use (Clark and Stankey 1979). Park managers often accept that human use near roads, parking lots and visitor service centres will be greater than what may be appropriate in more remote areas of the park. An exception may be where park facilities overlap ecologically sensitive areas. To reduce impacts associated with high levels of human disturbance, lower levels of recreational activity may be required in such areas to protect park resources.

In mountain parks with urban communities, the management of recreational use near ecologically sensitive areas may provide a unique challenge for land managers. The proximity of recreational opportunities is often a natural attractant for residents and visitors to park communities. The easy access to natural areas may result in high levels of recreational activity that extends beyond the ecological footprint of the community. In mountain environments, communities are often located in ecologically significant montane valleys. Integrating social and ecological management objectives, therefore, becomes a significant challenge to land managers tasked with optimizing recreational opportunities while maintaining ecologically sensitive habitat near mountain park communities. In Banff National Park, diverse recreational opportunities overlap important wildlife habitat in peripheral areas of the town of Banff.

In this paper, we first identify land use issues between recreational users and wildlife. We then develop management objectives that integrate recreational opportunities with wildlife habitat requirements and discuss methods to collect baseline recreation and wildlife data for an integrated land use plan.

PEOPLE, WILDLIFE AND THE TOWN OF BANFF

Banff National Park, in the Central Canadian Rockies, is Canada's premier National Park, with annual visitation exceeding 4.5 million. The town of Banff is the main urban community in the park, with a resident population of 7500 that increases to over 25000 with visitors during the summer tourist season. Recreational activities in peripheral areas of the townsite include walking/hiking, cross-country skiing, mountain biking and horse riding. Access may originate from any location around the townsite, as many residents use the area on a daily basis. The opportunity to access natural areas 'from their doorstep' is a community attribute appreciated by a large number of residents. From a visitor perspective, peripheral lands are often the most convenient way to experience the aesthetic resources of the park.

The townsite is situated in the Bow River Valley, a flat montane valley with steep mountain slopes rising over 3000 metres. Several carnivore species use montane habitat in the Bow River Valley, including Grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), wolf (*Canis lupus*) and cougar (*Felis concolor*), in addition to ungulate (*Cervus spp.*) species. Lands adjacent to the town of Banff are important habitat for wildlife at multiple spatial scales. At a local scale, ungulate populations provide an important prey source for carnivores in the Bow River Valley (Paquet 1993). At a regional scale, the Bow River Valley is a principal travel corridor for wildlife in the Central Rockies Ecosystem (White et al. 1995).

The development of a land use plan for peripheral areas of the town of Banff followed principles similar to the Limits of Acceptable Change (LAC) planning system (Stankey et al. 1985). As a first step, we identified issues between recreational use and wildlife habitat requirements to assist in the development of management objectives.

SOCIAL AND ECOLOGICAL ISSUES

The ecological footprint of the townsite, coupled with its location in a narrow part of the Bow River Valley, limits available montane habitat for wildlife movement on the periphery of the town. These peripheral areas also provide some of the most accessible recreational opportunities for residents and visitors in Banff National Park.

The following issues were identified as significant in the development of management objectives for an integrated land use plan:

Landscape fragmentation: roads, facilities and the recent proliferation of trails radiating from the town of Banff has fragmented wildlife habitat, reducing landscape connectivity important for wildlife movement in the Bow River Valley.

Wildlife-human conflicts: the frequency and intensity of human use in peripheral areas has altered wildlife behaviour and predator-prey relationships, resulting in wildlife displacement, habituation, and mortality.

Recreational behaviour: the easy access to peripheral areas from the town of Banff has resulted in a long-term pattern of use and increasing recreational expectations by residents and visitors.

INTEGRATING MANAGEMENT OBJECTIVES

It has been recognized that clearly stated management objectives are important in guiding the development of a recreational land use strategy (Manning 1986). In addition, the complexity of managing for recreational opportunities and wildlife habitat requires an integration of social and ecological objectives. In this respect, the primary management objective was to optimize recreational opportunities while maintaining the viability of wildlife habitat near the town of Banff. To assist in the preparation of an integrated land use plan, two key sub-objectives and supporting social and ecological indicators were identified.

1. Objective: to provide recreational opportunities that respect the spatial and temporal requirements of wildlife in movement corridors.

Indicators: wildlife use in corridors; predator-prey interaction; change in wildlife displacement, habituation and mortality.

2. Objective: to promote appropriate recreational behaviour and expectations through education and communication initiatives.

Indicators: compliance with management actions by recreational users; improved understanding of park objectives; shifts in recreational user expectations.

DEVELOPING A SOCIAL AND ECOLOGICAL BASELINE

To measure the success of management actions and evaluate changes in social and ecological conditions, baseline information is required. To describe existing patterns of wildlife and recreational use in peripheral areas of the town of Banff, information was collected on wildlife movement patterns, trails, recreational use of trails, and resident and visitor use patterns.

Wildlife movement patterns

To determine the status of wildlife movement near the town of Banff, data was used from wildlife monitoring research in Banff National Park (Duke 2001). The spatial and temporal patterns of wildlife movement were determined using radio-telemetry data in summer and transect monitoring and backtracking techniques in winter. These data provided detailed movement patterns for a suite of carnivore species using habitat near the town of Banff. Data was then compiled using a geographic information system (GIS) to allow spatial and temporal comparisons to recreation use patterns.

Trail inventory

To better understand the spatial distribution of recreational users, trails near the town of Banff were inventoried, classified and mapped using a GIS. Trails were first ground-truthed using a geographic positioning system (GPS). This included both linear features (e.g. trails and roads) and point features (e.g. parking areas, viewpoints, and trailheads). Trails were then classified into four main categories:

1. *Primary*: trails maintained by park management,
2. *Secondary*: trails not maintained by park management, but well established due to frequency of recreational use,
3. *Tertiary*: trails branching from primary and secondary trails that appear to receive infrequent recreational use,
4. *Game*: trails that appear to be wildlife (game) trails but show some signs of recreational use.

In addition, trail attribute data was collected on the type of recreational activity occurring on trails (i.e. hiking, horse riding, mountain biking, cross-country skiing) and information related to surface material (i.e. natural, asphalt, wood chips). A GIS was then used to spatially compare recreational use with data on wildlife movement patterns and other ecological factors such as soils, vegetation and hydrology.

Recreational trail use

The spatial and temporal patterns of recreational use on primary trails were determined using a combination of active and passive trail counters, remote photo stations, and observational reporting. This provided detailed information on the frequency and intensity of recreational use near the town of Banff.

An active and passive electronic trail monitoring system, combined with a remote camera, was used to record the date and time of recreational users entering and exiting trails. Photographs of trail events allowed the distinction between recreational and wildlife trail use. Observational reporting conducted bi-weekly, provided an opportunity to validate trail counters and classify recreational user groups.

Resident and visitor use patterns

Two survey questionnaires were developed to collect information from recreational users near the town of Banff. The first focused on gathering data from motorists exiting day-use recreational areas. This survey data provided information on user profile, time spent at the site, site familiarity, recreational activities and places visited. In addition, users were asked to rank the importance of factors influencing their decision to visit the site with respect to visitor motivation, site attributes, and place attachment. Vehicle counters were used to record the total number of vehicles entering and exiting an area, the time of day, and vehicle type (e.g. recreational vehicle, car, bus, and motorbike).

The second survey focused on developing a recreational profile of town of Banff residents (Mauro in prog.). Residents were asked to identify favourite trails, most common recreational activity and the time and frequency of participation. Respondents were also asked for their reasons for choosing a particular trail, familiarity with the area and attitudes toward trail management techniques. In addition, focus groups were conducted to obtain information about trail use in the area, thoughts relating to the phrase ‘trail management’, the impact of various user groups, and trail issues.

NEXT STEPS

The steps taken to identify issues, define management objectives, identify indicators and determine the spatial and temporal patterns of use are integral in the development of a land use plan for peripheral areas of mountain communities such as the town of Banff. The analysis of the trail monitoring data, resident and visitor surveys and focus group discussions is presently in progress. Subsequent steps in the planing process will include identifying management alternatives, developing and implementing management actions and monitoring social and ecological conditions. A stakeholder working group has been established to assist in the planning process and to ensure public involvement in decision-making.

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Dajti National Park
A Recreational Area for Citizens of Tirana, Albania

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Abstract: Dajti National Park is one of the 12 National Parks of Albania, declared as a protected area in 1961. From the administrative of view, it is included in the Tirana District. This Park is managed by the general Directorate of Forestry (Ministry of Agriculture and Food). Total protected area reaches 10,269 ha. It represents an important additional to the presentation of natural wealth Park.
The intention of this paper is to provide visitors with the essential information on natural history and cultural importance of Dajti National Park. It should come into hands of every single visitor and draw his attention to numerous attractions of the first Albanian National Park (field trip, visitor observation, interviews etc.). The results showed that various methods allow a thorough analyses of visitor activities as a basis for the ecologically and economically sustainable management of recreation and conservation areas.

INTRODUCTION

Dajti National Park (DNP), crossed by Tirana-Bizë road, a key route connecting Central Albania with north east of the country, is an area of great scenic value: Mt. Dajti is nick-named "the natural balcony of Tirana", as it dominates the capital of Albania with green mass. (Photo 1).

It is positioned at the eastern part of the broad plain of Tirana (26 km east of Tirana and 50 km from the Rinas International Airport).

The zone comprises three mountain chains (whose main peaks are Mt. Brari, 1214 m, Mt. Dajti 1513 m, and Mt. Priska, 1365 m). Divided by two valleys: one was excavated by Tirana river, forming impressive deep gorges (Photo 2); the other is crossed by the road to Biza (Priska pass).

The geological base of the area, which is located within the borders of the DNP, as its large surrounding area, is part of a large limestone environment with layers of Mesozoic era immediate surface .The basic kinds of stone that we can differentiate are limestone and dolomite with a number varieties which are visible in relief differences and in either absence or presence of water on the surface. The area contains many characteristic limestone (karst) rocky formations that are particularly well represented on the plain or slopes and include some remarkable swallow holes of 20-30 m in diameter and up to 50 m in depth. Water percolating down through the rocks from these holes has eroded a complex system of underground caves, some of which have still to be explored. The area behind the Dajti mountain contains one of the most important high quality aquifers for Tirana Capital.

PLANNING AND IMPLEMENTATION OF DNP MONITORING PROGRAM

Last year, a training course was organized at the National Agency of Environment in Albania. Participants included specialists from the Hydrometeoreological Institute, the Geographical Studies Center, General Directorate of Forestry, Regional Environmental Center, Museum of Natural Sciences, ECOTOUR Agency and WWF, International Mediterranean Program. This project is funded by European Union's Phare Program, which provides grant finance to support its partner countries in central and eastern of European Union membership.

The training course defines analytical methods used for analyzing various parameters. Results of the monitoring of the DNP must accurately present the state of the Park and its habitats, potential risks for the Flora and fauna and its organisms, risks for the visitors, tourists, and people that inhabit the Park, and present the unique ecosystem to the scientific world. Rich wildlife, rare or endemic animal and plant species, exceptional scenic beauty, high biodiversity, rich cultural values, traditional villages, live traditional activities. All this features of DNP have attracted tourists since the early 70s. Nowadays, although the Park's infrastructure remains very poor, many visitors come to the Park in order to learn about it and enjoy opportunities but lodging facilities and other infrastructure are still lacking . In addition, the people of DNP lack knowledge and experience in the services sector. Yet, the threat of a destructive uncontrolled tourism is always present.

Aiming at promoting quality tourism as well as raising visitors' environmental awareness the Ministry of environment together with INSEEA have started a series of initiatives in many levels. A lot of people were trained to be able to work as eco-guides. Contacts were made with ecotourist offices and NGOs in Albania, Kosovo and Macedonia, so that an ecotourism network is being established. Efforts were made towards the promotion of educational tourism. The efforts for the development of an alternative tourism are actively supported by the Government and European NGOs, members of which participate as volunteers in pilot ecotouristic programs.(Photo 3).

Publications for the DNP include a second edition for visitors, published in 1998, with title: "Dajti National Forest Park" (Eco-Guide), in Albanian and English, also posters, booklets, leaflets, and other important materials.

DEVELOPMENT OF DAJTI NATIONAL PARK MANAGEMENT

The need for maintaining the integrity and the interconnectedness of all types of habitats in the DNP is unquestionable, but they are rare and more liable to destruction or degradation than the others. Such habitats in DNP are remnants of the old gallery forest like beech wood with Fagus Sylvatica and Ilex aquifolium, on the higheraltitudes of the Dajti mountain. Pine wood-stands of Balkan pine with Pinus leucodermis lokalized in the middle of beech forest. Deciduous submountain wood with castanea sativa on NW slopes of the Dajti mountain, Mixed deciduous wood-stands of oak forest with Quercus trojana. Mediterranean Juniperus oxycedrus on the lower altitudes. Aiming at the conservation of these sensitive and very important areas for wildlife, the Ministry of Environment initiated a research program for the conservation and the management of DNP. The study will concern the existing situation of the Park, and investigate the parameters which effect their preservation and it will propose measures for their protection. Emphasis will be given to activities around the Park in order to ensure better management.

The main goals and objectives will be:

- Develop an integrated, comprehensive DNP management program including program and project evaluation which includes an action plan to identify and prioritize those areas of the Park at risk, and to achieve and mountain Park health,
- Improve communication among affected private individuals, interested citizens and representatives of local and state agencies;
- Establish a process for the coordination, cooperation, education, and involvement of citizens residing in the Park,
- Conserve and improve the wildlife habitat,
- Support the socio-economic needs of Park residents.

DNP must be considered as one of the best places in Albania for environmental education activities because a high biodiversity exists in relatively small area. Among priorities of the Institute for Natural Studies and environmental Education in Albania (INSEEA) is to promote in DNP and to establish a Center for environmental education activities in Tirana Capital.

Thus, in the year 2000, INSEEA launched an environmental education program for schools which visit Dajti mountain during their field excursions. The program contains a slide show presentation, "playing" educational games at the information Center of INSEEA and guiding in the National Park. This program continued in 2001 and its main characteristic is that children have the opportunity to appreciate some of Park values and enjoy wildlife and endangered species on site, without of course causing any disturbance. This is the only environmental education program running on a permanent basis in a National Park. The program is flexible enough to be organized according to the time schedule of schools and in some cases when schools stay for more than one day, a different program is followed with more outdoor activities. Some weeks before the arrival of each school at the National Park, a printed educational portfolio about DNP is sent to them, so that pupils are introduced to the main issues. This portfolio contains a booklet on the values of National Park for teachers and a series with exercises, games, on all the specific elements of the area i.e. fauna, flora, agriculture, monuments etc. which can be used in the classroom.

RESULTS AND DISCUSSIONS

The vegetation of the Dajti mountain region shows a central European character at higher altitudes, characterised by beech forest Fagus Sylvatica and hornbeam Carpinus Orientalis. On higher ground, the heaths are dominated by the Junipers oxycedrus and Junipers communis, and by ericaceous shrubs including Erica arborea and Arbutus unedo. At lower altitudes, the vegetation becomes sub-Mediterranean type, characterized by mixed oak forest, including Quercus cerris, quercus frainetto and some standes of Quercus trojana an the southern facing slope. Pinus leucodermis, a specie which is restriced to the Balkan Peninsula and to few localities in southern Italy, is also present.

On the southern slopes, sub-Mediterranean Quercus pubescens with manna ash (Fracinys ornus) and Mediterranean Junipers oxycedrus are frequent.

The region of the DNP is one of last areas in Europe with extensive woodland pasture. This management system, widespread in Europe since the Mesolithic times, involves the pollarding young trees, mostly oak, hornbeam and beech. It can be considered an appropriate use of sustainable resources in a wooded region although in the Dajti area, at present, overgrazing damages both trees and pastures with consequent environmental degradation, particularly on the eastern side of Mt. Dajti.

The dense sibiljak characterized by clumps of evergreen shrubs, that covers vast areas of the hills and lower mountain slops, derives partly from this management region.

The beech forest, which extends from 1000 m a.s.l, can be considered as an almost untouched forest, where it is possible to distinguish two different belts of trees: the first one with quite old individuals (more than 200 years) which have diameter of a meter or more and height of 25-30 m and the second one with young trees succession. The endemic elements are particularly important.

A characteristic and widespread endemic species of this mountain is Ramonda serbica, of the Gesneriacea Family, which is distributed in the eastern part of the Dajti mountain on the rocks at the altitude of 1500-1550 m a.s.l

Agriculture within the existing boundaries of DNP does not really exist, if we exclude the present of a considerable number of goats, that are apparently abandoned and spread without control in and outside the forest. Their presence causes serious damage to the natural forest regeneration and creates erosion problems along the steeper Park slopes. (Photo 4).

Sheep, cows and horses graze on the eastern side of the Park, mostly outside the borders (but in an area that could be included in the protected area, without any need for specific restrictions to agro-pastoral activities).

The agriculture in the areas surrounding the NP is unfortunately very poor, especially in the valleys behind the Dajti mountain. Animals such as horses, mules or donkeys are bred and used as a means of transport, especially with no road existing (only mule tacks or paths connect most of villages or isolated houses around the Park to the two existing main roads). The farmers mostly grow products for self-consumption, products that are also sometimes sold in the small markets of Tirana.

The Park is very interesting from the faunistic point of view, with many species considered of "relevant naturalistic and conservation values", (4 amphibians, 8 reptiles, 11 birds and 9 mammals). Some of these species are present in quite restricted habitats. Such habitats include ponds and small water streams, which an area between a few square meters to thousands, that nevertheless are vital for the breeding of rare species of high naturalistic value. Another habitat relevant is the rocky environment of the river Tirana gorges. This is the breeding habitat of two diurnal birds of prey: the Golden Eagle and Peregrine falcon.

Furthermore, this habitat represents a potential area of shelter and is the location of lairs of two big carnivores, the brown bear and the wolf, whose presence is oftn recorded in the area. The bend underneath the beech forest holds low density bushes of forest formations, and all along some slopes like Mt. Priska or Mt. Brari.

The rivers (Tirana, Tërkuza, Erzeni) present in the plain area, outside the existing Park border, are suitable for stable fish communities and include typical vertebrate communities such as Bombina variegata or rana balkanica. The rare Otter, endangered all over Europe, still lives with few specimens along the river Erzen. (Map 1)

CONCLUSION AND OUTLOOK

- Formation and feature of today's relief in the DNP is the result of numerous occurrences in geological past which took place in a large area of Albanide ranges during the formation of mountain chains. While that was happening, very porous and low porous areas were created by movement and erection of large blocks of stone, broken by regional and local faults. The compact or imporousness of mostly dolomite stratums of Mesozoic era had, as a consequence, water penetration up to the different depths in existing mountain ranges and the other areas with changeable superficial and sub-terrenian water flow, and more or less visible process of karstening that was taking place of the rocky relief.
- Specific hydrogeological characteristics of dolomite rocks have conditioned the possibility of sub-terrenian spring waters creation, but also canyon incision in the
- cholky layers of Cretaceous age.

Transitive type of climate between coastal and continental with microclimatic diversities makes summer pleasant and sunny, while on the other side winter is relatively harsh and snow. That is why the Dajti National Park very a convenient place to spend summer vacation at, particularly for the individuals and citizens from Tirana and its surroundings who can hardly bear hot summer weather and for whom vacation at the sea would mean too heavy thermic burden. Spring and Autumn are the most convenient seasons for active vacation walks and sport activities. At that time, mornings and evenings are mostly fresh, in early Spring and late Autumn also cold, while during the day it is either pleasant or fresh. Even if the average sensation of agreeableness is cold in winter, at the same time winter days could considerably differ from each other. However, the vacation at DNP could be also pleasant in the winter under the most adverse biometeoreological conditions, should the clothes be appropriate and the physical activity increased.

THE MAIN VEGETATION TYPES PRESENT IN THE PARK				
COMMUNITY	CHARACTRISTIC SPECIES	PLACES	ALTITUDE	EXPOSURE
BEECH WOODS	Fagus sylvatica Ilex aquifolium	Dajti Mountain	1000 – 1500 m	North – West
PINE WOODS	Pinus Leucodermis	Dajti Mountain	1100 m	West
DECIDUOUS SUBMOUNTAIN WOODS	Castanea sativa	Dajti Mountain	600 – 900 m	West
MIXED OAK WOODS	Quercus cerris Quercus frainetto Quercus trojana	Dajti Mountain and Priska Mountain	600 – 800 m	North East
SIBILJAK WOODS	Carpinus orientalis Ostrya carpinifolia	Dajti and Priska Mountain	600 – 800 m	West
HILLS EVERGREEN WOODS	Erica arborea Arbutus unedo	Lower slopes of the Tirana gorges	300 – 600 m	West
RIPARIAN WOODS	Platanus orientalis	River Tirana	200 m	West
CONIFEROUS WOODS	Pinus nigra Pinus sylvestris	Dajti Mountain	1500 m	North – West

- The characteristics of the Park are a variety of the plant and animal species. Plant species are layers of trees, bushes, low vegetation and layers of mosses. There is a very intensive life in the ground where we can find roots of high plant species mushrooms and bacteria as well as part of animal world, which decomposes dead plant and animal stuff. Very important are dead standing trees which represent a home for numerous birds, insects, rodents and other animal species.
- All fundamental things that do determine the Park, make a very fragile structural and functional complex, sensitive to natural changes and to prohibit human actions.
- The Dajti National Park according to the convention of IUCN is obliged among other things:
  - to protect the natural and landscape value of area of natural and international importance for spiritual, scientific educational and tourist activity.
  - To respect geological, geomorphological, fundamental and esthetic attributes of classification.
  - To ensure the future of visits and spiritual, scientific, educational-recreational activities in harmony with the natural and cultural environment.

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Estimating Visitor Occasions and Recreational Visits at an Urban Park District

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Abstract: The need for a committed system to monitor and track visitation over time is increasingly recognized by agencies that are responsive to staffing, budgeting, and public relations. This paper highlights a process that a metropolitan park agency uses to monitor visitation within its jurisdiction. The importance of a long-term and regular counting effort is highlighted as well as a brief discussion of trade-offs made between validity and reliability in the formative years of establishing a new use estimation system. The paper concludes by identifying some of the advantages and limitations inherent when estimating urban park visitation with inductive loop counters.

INTRODUCTION

Park and recreation agencies frequently concern themselves with the amount of visitation that their facilities receive. There is a growing body of literature concerning park visitor estimation methods and counting equipment. Accurate and reliable visitation estimates can aid an agencies decision-making related to new exhibits, facilities, and maintenance schedules. Accurate user data can also communicate to funding organizations and citizens the extent that parks are used and valued. Many private and public funding sources request that use statistics be provided as part of a grant proposal.

Even though numerous counting resources and systems have been created, many agencies still express a need for reliable and sustained visitation counts. Often, existing park use estimates are generated based upon best guesses or through limited visual observations covering a few days per year. However, there can be significant changes in visitation patterns across a season, month, week, or even within a single day (Gregoire & Buhyoff, 1999; Hornback & Eagles, 1999). Park districts would benefit from feasible counting systems that account for the majority of park visitors and track use over a sustained period of time. For today's information-driven organizations, it is no longer sufficient to conduct a major visitor counting initiative every 10 - 15 years in conjunction with master planning processes. Creating and providing resources for committed counting procedures (either within an agency or through contracting with a research firm), is needed to track recreation use over time and provide a regular account of park use. There is considerable variation in the level of resources that park agencies can commit to counting and estimating visitation. This paper discusses a continuous effort that a metropolitan park district has undertaken in order to establish a use estimation system which tracks the extent of and changes in use at regular intervals.

A DEDICATED USE ESTIMATION SYSTEM

In 1993, Cleveland Metroparks sought to improve its visitation counting effort by creating a systematic process, which combined visual counts with inductive loop traffic counts to generate use estimates for all of its fourteen parks. Previously, the Park District had relied on extrapolations from survey data to estimate visitation (i.e., percentage of people who said they visited a park and how many times they said that they visited). This information was combined with limited traffic count data to estimate visitors who drove through the park district but did not stop for recreational purposes. However, Cleveland Metroparks desired a new process to count use from both commuter traffic and recreationists more accurately and regularly. This effort was supervised by Cleveland Metroparks, Manager of Research & Program Evaluation with the assistance of three part-time attendance counters and a data entry specialist.

CLEVELAND METROPARKS USE ESTIMATION PROCESS

There are six basic steps used in generating Cleveland Metroparks' visitation estimates. These steps can be applied at other Park Districts with similar resources and site characteristics:

- Determine park entrance and exit points and their characteristics of use.
- Visually count entrances for the number of people per vehicle and the percentage who enter through each roadway entrance within a particular park.

- Install inductive loop counters at strategic and representative park entrances.
- Check and maintain mechanical counters on a monthly basis (i.e., take counts and reset the meter, adjust for sensitivity, change batteries, and ensure that the box is secure and/or undamaged).
- Create use estimates by combining mechanical counter data with vehicle multipliers and entrance weights in computer spreadsheets.

(For example a park containing one mechanical counter with a reading of 10,000 vehicles, with an entrance weight of .25, and a vehicle multiplier of 1.5 people/vehicle would yield a visitation estimate of 60,000 people for that park).

- Tabulate these estimates by park, by type of parking lot, and across time.

Cleveland Metroparks uses this counting procedure to estimate the following types of use:

- Visitor Occasions - people who enter the park district for any reason (i.e., includes commuters, other non-recreational use)
- Recreational Visits - People who enter the Park District <u>and</u> visit parking lot and recreation areas

Recreational Visits is considered a sub-set of Visitor Occasions, although it is possible that some parking lots can get used as a turn-around for parkway commuters.

Given that walk-on traffic may represent a considerable sub-group (and that they cannot be counted with inductive loop counters), an upward adjustment of 3% - 5% is currently added to this Recreational Visit statistic. However, this arbitrary adjustment is subjective so Cleveland Metroparks is making efforts to conduct surveys within a sample of parks to determine the percentage of visitors who access the park by walking, bicycling, etc. The Park District is also exploring options for infra-red counters at specific walking path access points connecting neighborhoods to parks.

Visitation Data for Cleveland Metroparks is presented in Table 1. The reader is cautioned that while visitation estimates have increase each year, most of this increase is likely due to adjustments made in the counting methodology at specific parks within the Park District. It took approximately four years to generate visual estimates and to install counters at all of the fourteen reservations within the Cleveland Metroparks' system. Agencies who have multiple parks under their jurisdiction, should also expect a similar start-up period unless they: 1) only have a few parks with easily defined entrances, or 2) have extensive staffing to conduct visual counts throughout the year. At Cleveland Metroparks, visual re-counts were also needed at some of the parks due to dramatic changes in traffic patterns and facility construction. When these improved use estimates were integrated into this fledgling system, there were instances where some parks would have their estimates increased by 50% based upon a new entrance weight and vehicle multiplier.

After five years of counting with the same multipliers and entrance weights, visitation showed much slower growth or, in some years, decline. The lesson here is to take time and effort to generate valid visual estimates and provide counting coverage at the on-set of a counting initiative. The first years of a counting effort should focus on the validity of the estimates without trying to place too much emphasis on changes over time. It is likely that changes in visitation will be due to refinements made in the counting methodology, rather than any real increase/decrease in visitation. However, once the methodology is established and used consistently, subsequent estimates are more likely to be useful in tracking visitation trends over time.

Changes in the character and type of park use over time will necessitate that re-counts be taken. Therefore, the problems associated with validity can never fully removed, only minimized. However, once a counting system is established, slight adjustments should be all that is required to maintain accuracy. Minor changes made after the counting system is established will have a smaller impact on final estimates than changes made during the early years of forming a system (when early estimates are based more on guess work until more accurate counts can be integrated into the estimates).

Year	Visitor Occasions	Recreational Visits
1993	34,238,948	9,792,339
1994	34,793,894	9,950,228
1995	40,068,920	11,977,726
1996	49,778,861	13,749,994
1997	50,391,541	14,005,832
1998	48,516,922	15,740,462
1999	51,948,608	15,865,587
2000	53,018,261	15,884,991

Table 1. Cleveland Metroparks Attendance (1993–2000)

ADVANTAGES/DISADVANTAGES OF INDUCTIVE LOOP COUNTERS

Inductive loop counters are appropriate for park districts whose visitors enter through multiple vehicular entrances. These mechanical counters are economical in terms of their unit cost ($300 to $500 USD, depending on the model/features available). Their solid state design makes them more resistant to vandalism and varying climates than other counters. However, inductive loop counters are not without their limitations. They require personnel resources to install, continually monitor, and adjust for sensitivity. Moreover, unless a census is provided (by placing counters at each park entrance), their use requires visual counts to generate entrance weights and vehicle multiplier estimates. Another limitation is that these counters do not count non-motorized traffic into a park (i.e., walking, in-line skating). Park areas that receive substantial non-vehicular visitation (i.e., 40% or more), should be counted with visual counts and/or infra-red counters.

Future visitation counts at Cleveland Metroparks will refine the methodology outlined in this paper by conducting visual re-counts and by conducting visitor surveys to estimate the percentage of non-motorized traffic. Recreation use within specific park areas (i.e., pavilions, swimming areas) will also be counted to help managers understand visitor flows at a more site-specific level. Creating both an accurate and a reliable visitor attendance tracking method takes dedicated resources, time, and commitment on the part of an organization's leadership and constituents. The reward for such an effort will be accurate information that can be used for multiple purposes. More detailed information on Cleveland Metroparks' park visitation methodology and the *2001 Park District Visitation Report* may be obtained from Cleveland Metroparks, Research & Program Evaluation Division.

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Conflicts of Interest on National Parks and Protected Areas during the Transition Period in Albania

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Abstract: National Parks of Albania are the most frequented by visitors, because patches of virgin forests, high biodiversity, landscape beauties and nature monuments are present within their areas. During the hard transition period some conflicts of interest have risen on parks and protected areas, which delay their proper management and in a certain degree they affect the flow flux of visitors. The rural appraisal method was mainly used for identification of conflicts. The analyses of factors and causes of these conflicts allow to give some recommendations for their solution, which will influence, in parallel with other measures, on the sustainable management of parks and protected areas, evaluation of their multiple values by the society, and increasing the income of the local communities.

INTRODUCTION

National parks and protected areas of Albania cover 166,000 hectares, or 5.8% of the country's area. The flow of visitors is increasing continually due to their multiple values like biological diversity, landscape beauty and natural monuments. Many areas are natural or virgin ones. Within them are found specific habitats (at least 30 types and sub-types of habitats, and over 540 communities), 27 species and 150 sub-species of endemic plants for Albania, and over 540 rare species of flora and fauna. (Albania - Convention on biological diversity, 1999).

There are 13 national parks at present, with an area of 53 000 ha (1.84% of the total land area). All parks and protected areas are state owned and managed by the national forest service. Parks are managed mainly for ecosystem protection and recreational purposes, but they have multiple values and functions. Among others, some forest patches considered as sacred forests, where people have always prayed, or gathered in meetings or local holidays have been organized, still continue to be protected and considered such as in the old times. Tomorri Mountain, where thousands of peregrines come here from Albania and other countries as well, since ancient times till today, is considered and continues to be called as a "Sacred Mountain". Also, some other ancient historical places are well known like Butrinti, where, according to the Roman Poet Virgilius, have stayed the hero of Ancient Troy, Enneas. While in Llogara, the place where stayed to rest Julius Caesar during his incursion against Pompeius to the Base Illyria, even today is called "The Caesar's Pass".

By the beginning of 1990' the surface of protected areas was not more than 2% of the total land, and only 6 national parks were declared with a surface of about 10,000 hectares. But, within their areas there were cases when improper activities have taken place, like: the industrial exploitation of bauxites, stone and gravel mining in Dajti, sand excavation and resin collection from pine trees in Divjaka, collection of medicinal plants, litter collection for fertilizing soils, grazing of military units livestock, besides wood cutting and livestock grazing on peripheral areas of protected areas by surrounding villages.

Some efforts on conservation and protection of parks and protected areas have led to the maintenance of their integrity and wilderness, the previous ones being enlarged and new ones have been declared in recent years.

However, these areas like other natural resources in Albania, after '90 on are suffering the consequences of the hard transition from a centralized and planned economy to the market economy. Besides some damages through cutting trees, livestock grazing, fires and other injuries, some conflicts of interest are present. Such conflicts delay the proper management of the parks and protected areas and in a certain degree they affect the rate of visitors' flow.

This study aims the identification of conflict types and gives some recommendations for their solution, which would have their impact on sustainable management of parks and protected areas, in parallel with other measures, on evaluation of their multiple values by the society, and contribute on increasing incomes for the local communities.

METHODS

For identification of the main issues and conflicts on parks and protected areas the following methods were used:

Rapid rural appraisal method, personal observations in the place and informal interviews with diverse people on villages close to the parks of Dajti, Llogara, Divjaka Pine and Valbona, as well as in diverse protected areas have taken place, through which the information about the ownership traditions and use in the past and present of these areas that were declared as protected areas (after “60), present conflicts and claims of local communities.

The investigation of the forest service experience on parks and protected areas conservation and management, problems and possible solutions.

Examination of laws, regulations and documents related to parks and protected areas, identification of cases of conflicts because of discord among them or lack of enforcement of laws in power.

RESULTS

The results of diverse applied methods during the implementation of this study pointed out that parks are the recreational areas the most visited almost during all the year. The public pressure for recreational purposes is increasing especially in some areas of parks with the infrastructure, where there are parking and camping places, hotels and restaurants. Also, it is observed a high seasonal concentration of visitors. However, it is not yet used the entire carrying capacity of parks due to difficult economic situation of the population inherited by the past times, insufficient infrastructure, and minimum funds allocated. The most visited parks are: Dajti, situated 29 kilometers from the Capital City of Tirana, Llogara on Vlora District, Divjaka Pine on Lushnja District, and that of Prespa on Korca District.

The study pointed out that a series of conflicts are taking place within recreational and protected areas, partly inherited from the communist regime and partly generated during the transition period.

Conflicts have been generated between the state and ex-owners regarding ownership questions and financial compensation issues in the course of the ongoing restitution of forests and pastures. Part of the parks and protected areas declared during the communist regime have been in ownership of individuals or traditionally used by villages adjacent to them. They were nationalized without any compensation. While the majority of the surface area has been state owned.

After the democratic changes by “90s and adoption of laws based on market oriented economy, only ex-owners have the right for compensation in kind or in value, while villages have no such right. According to the 1992 legislation, protected forestlands were not to be used for compensation to the ex-owners (except for construction purposes), but were to remain state-owned. In the meantime, activities of construction and services within parks and protected areas have been privatized.

There is no accurate evidence on the surface areas restituted to the ex-owners or for their compensation. The biggest surface restituted (before declaring the Prespa Park) is 100 hectares of forest (the maximum surface of forest area that can be restituted). In fact, ex-owners claim for the restitution of all their properties.

Conflicts have been generated between the objectives of private forest use situated within the parks and protected areas and the inefficiency of the state for compensating the economic loss of owners. Even those private forest owners, who are small in number, not yet have management plans for the objectives of forest management to be in conformity with objectives of the protected areas. On the other hand, no legal provisions exist to enforce or the state to compensate the owner for the economic loss which might have as a consequence of such a use.

Serious conflicts are between recreational, protection objectives and the objectives of other users for diverse purposes. The use of agriculture, forest and pastureland by villagers situated within the protected areas is done without any plan or goal related to protection objectives of the last ones. For example, there is a village within the Thethi Park and farmers are dealing with agriculture and livestock management using their own land and park’s resources on defined plots, collect medicinal plants and a little tourism, but without having any harmonized planning. The same is the situation at the Prespa Park, which is a cross border park with Greece and Macedonia. A part of the park’s forest area of some thousands of hectares is transferred from the state to the community and given in communal use to villages, but not full measures have been undertaken yet for harmonization of this use with the park’s objectives.

Many villages around the protected areas continue to cut trees for fuel wood and graze the livestock on margins of these areas.

Some conflicts occur because of non-conformity between forest law and other laws, i.e. the law on tourism – according to this law, the committee for the tourism development approves the construction of touristic villages and other constructions even within parks and protected areas without the consent of forest service; the law on city planning – the council of city planning approves constructions without the presence of forest service representatives; on the other hand, there are cases where the land is illegally occupied for construction on the most visited places of the parks; the law on mines – the approval of opening new mines including stone–quarries even close to parks occurs without the consent of forest service and without considering great damages caused to the park and the environment in general (noise caused by explosion of mines for stone excavation, as well as dust; the wildlife is perturbed, the landscape is deteriorated, the visitors are restrained for certain periods).

(Akte ligjore mjedisore ne Shqiperi/ Environmental related laws in Albania, REC, 2000)

The owners of private hotels, restaurants and bars constructed within the parks, in the near past have paid only the fiscal obligations, while nothing for the parks, because of no legal provisions for this purpose were in place. Later, they have begun to pay to the park administration the leasing rate of the land where the building was constructed.

The law allows the government bodies to lease plots from the parks and protected areas, but it is not yet applied.

Some issues related to conflicts of interest will be illustrated through aspects evident on Dajti National Park, situated adjacent to Tirana, the Capital City of Albania.

Against the park objectives, before '90 there were opened some galleries for bauxite extraction. Partly situated within the park, a stone-quarry has been functioning where the stones were excavated and lime was produced. The military unit has managed sheep and horses, which grazed within the park. The villages around the park have cut trees for construction and fuel wood and have grazed the livestock on peripheral areas. Nevertheless, the number of visitors has reached to about 50,000 persons per year.

During the transition period in this park occurred the destruction of some state owned buildings caused by irresponsible people, as well as illegal wood cutting and grazing in some areas. In addition, two big fires broke out burning all the wood in tens of hectares. The number of visitors decreased dramatically.

However, the park has important recreational and scientific values. The forest service has already put order and is strengthening the measures for the protection and management of this park. In general, the illegal cutting has been stopped. There are constructed some private hotels and restaurants. There are a number of government residences and the number of visitors is increasing day by day. Based on the survey done, it results that about 80% of the visitors to the Dajti Park are inhabitants of Tirana, whereas about 20% from the other cities of the country. In the Year 2000 was applied for the first time the entrance fee to the park for the visitors and vehicles. The sports associations, which conduct their activities in this park, pay the camping fee. However, during the Year 2000 was collected only US$2.100 from the fees.

There is still a number of pending issues and identified conflicts that require solution for the Dajti Park.

Conflicts between the ex-owners and the government bodies; 10 individuals claim to have properties in the meadows of the Dajti Park and only one claims to forest land.

Conflicts between the recreational objectives and the interests of other users: in the stone mine of Qafe Priske which is in the edges of the current boundary, but within the proposed extended park boundaries, there is an intensive stone excavation activity that is disturbing the fauna and the visitors and is damaging the environment. Recently, an agreement was made between the General Directorate of Forests and Pastures and the General Directorate of Mines to shut down the quarry within one and a half year and rehabilitation of the affected area.

Some buildings within the park territory continue to remain ruined and have not been privatized yet. In the military unit territory, which is a very pretty area, the visitors are not allowed to pass.

A management plan for the Dajti Park was drafted in 1997 as a model, but it needs to be revised in order to take in better consideration the interests of visitors and of local population.

There have been requests from private companies for hotel, restaurant and bar construction. There has been a request from a private agency to take by rent the park management, but there has been no support from the government bodies.

There exists an idea for the establishment of the "Friends of Dajti" Association, which would manage the park and its revenues generated, and pay all the required financial obligations.

But by law, the associations are not entitled to conduct this activity. Another idea is to create a special government administration unit with self-financing and financial obligations towards the government, whereas the General Directorate of Forests and Pastures to play only the role of the supervisor. In the meantime, is being established the center of information, education of the visitors and museum. (See: Plan for conservation and management of Dajti National park-Albania, 1997)

Based on the evaluation of this study were become evident the main causes of conflicts of interest in parks and other protected areas as it follows:

(i) It is not legally resolved yet the problem of property restitution and compensation to the ex-owners who claim ownership over certain areas in the protected areas.

(ii) There is no complete legislation on parks and protected areas, or some laws fall in contradiction with the law on forests, the application of legal clauses leaves much to desire favored also by the existing corruption.

(iii) The community and local government, the groups of users and NGO-s, have been almost not included in the planning and management of protected areas. From the surrounding villages, only a number of workers is engaged the forest cleaning and improvement, waste disposal and services for protection from fire. The local population put on sale for the visitors within the park their agricultural, livestock and fruit production. They collect forest fruit, mushrooms and medicinal plants with no charge applied on them. And that is all.

(iv) A critical issue is the little work done for the education of public, mixed this with the difficult economical conditions. (See: Muharremaj, V., 1998: Strategies for developing and supporting nature conservation management in Albania).

(v) Massive migration of the population from the mountainous areas and their settlement in the low areas, especially close to the protected coast areas and lagoons in a chaotic way and with no planning, has created social problems and different conflicts. Among others, in this areas there is illegal wood cutting, reduction of flora and fauna, environment pollution, the coastal forest belt is very much damaged especially in Velipoja, Kuna, Tale, Patok, Gryka e Erzenit, etc. Also, the conditions of this belt have been deteriorated more from coastal erosion. In some areas the sea has entered 300-400 meters in land and 1/3 of the bunkers constructed years ago are now subsided in water. The underground water level is lowered and there is increased salinisation of soils and water. The water wells opened years ago used to get water from 10 m depth, whereas now not. On the Kune coastal area, numerous trees of diverse species are becoming dead.

However, there exist the possibilities and potentials for the resolution of the conflicts generated. The government institutions and less the Non-governmental Organizations, have been committed for the resolution of some conflicts in general for the ownership on land, including the those conflicts in the protected areas. The policies and law making to favor nature protection and the technical and financial support of some international institutions, in particular for the protected areas, are a basis for further changes and progress.

CONCLUSIONS AND OUTLOOK

Some difficulties are faced for the protection and management of natural resources, including parks and protected areas, during the transition period in Albania. However, some efforts are in place for the improvement of the situation and gradually the experience is gaining. The interest of government bodies and non-governmental organizations is increasing for the care towards protected areas. It is proposed the declaration of new protected areas and their extension to occupy 14% of the land surface.

A great contribution is giving the Forestry Project funded by World Bank through the technical assistance of FAO for restructuring of the protected areas, the improvement of their infrastructure and management plan preparation in many of the protected areas.

The establishment of the Ministry of Environment by the midst of 2001 will contribute to the improvement of legal framework, the control of a better management of protected areas.

Through the analyses accomplished as above, for the solution of conflicts of interest identified in parks and protected areas the following recommendations would be useful:

The improvement of legal provisions regarding the private properties, parks and protected areas and in harmonization with other laws would be necessary, and their enforcement as well. The Constitution of 1998 requires for legal improvements on property issues. It is foreseen for the Parliament to make some improvements on the law on restitution and compensation of properties to ex-owners.

Specialists are discussing on the preparation of a special law on national parks, involving environmental agencies and NGOs, users' groups and local communities.

The institutional and infrastructure improvement will be a priority for recreational and protected areas and consequently the law enforcement would be more effective.

The proper identification of conflicts for each specific park and their appropriate alternative resolutions are necessary, creating and enabling environment where stakeholders, policy makers and local communities can negotiate as equal partners and reach equitable solutions.

The planning and management has to move from an exclusive reliance on the protected areas professional to a partnership approach to protected areas (Parks for life, 1998).

Conservation agencies should recognize the rights of communities to benefit directly and equitably from the conservation and ecologically sustainable use of natural resources contained in their areas.

Local communities and interested stakeholders and groups should be solicited for active participation on the management plan preparation and implementation.

A permanent campaign for public awareness, including publications, especially for the communities situated close to parks and protected areas, for interested user groups and young people will be launched, taking into consideration the local traditions. The public should be informed on the benefits and importance of recreational and protected areas (See: The strategy for the development of the forestry and pasture sector in Albania).

Resolving disputes appropriately through a consensus building process and in line with defined objectives of multiple values will facilitate the sustainable management of parks and protected areas in Albania.

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Nature Protection in the Service of the Visitors who visit National Park Mljet

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Summary: National park «Mljet» is proclaimed in 1960., for sake of wooded areas and two picturesque sea lakes. Located on the one third of the western part of the island Mljet, it takes up the region of 3000 hectares. The region is wooded and systematic protection of nature has been realised there.
Every jear visitors arrive at this area and we make efforts to give them pleas-ant and substantial stay. So boards with educational matter have been placed in the Nacional park. The notices educate visitors about characteristics of lakes, the protected sea parts, archeological locality, possibility of sightseeing … Signs, texts and maps with description of ecological paths are installed to give better information about the Park.
Ther are the ecological round path Fontana – Vrbovica, cca 4000 m long, the ecological path to belvedere V. Sladin Gradac and the ecological path Pomena – Soline.
Apart from improvement of educational subjects, we work permanently on preventive protection against forest fire, cleaning rubbish and protecting entire region from dirt.

INTRODUCTION

In 1960, within the programme for the protection of both natural and cultural heritage, he western part of island Mljet (about 1/3) was proclaimed a national park, which included 3,000 ares of land as well as 100 ares of the Large and Small Lakes, and the Bay of Soline. The 1987 physical plan basically protected the sea water area, while in 1997 The Sabor (the Croatian Parliament) formally extended the borders of the National Park to a sea belt 500m off the coastal line of islands, capes and islets, altogether 2,275 ares of sea area. Systematic protection of nature has been conducted in that zone ever since; forests are allowed a natural development, and only a sanitary felling is permitted. Activities of The Public Institution National Park "Mljet" are the following: maintenance of forest straight clearings and paths, arrangement of lanes, waste management and cleansing of the shores.

Every year we have visitors here, and we try to make their stay as pleasant and as interesting as possible. To that purpose, boards with educational posters are placed in the National Park, enabling the visitors to get acquainted with the values of the natural and cultural heritage. The posters are stationed at the following points: Pristanište (Landing Place), Montokuc, Mali most (Small Bridge), Veliki Gradac, Otočić sv.Marije (St.Mary's Islet), Polače, Križ (Solinski zaljev) /Cross (Soline Bay)/ and the village of Goveđari.
(see Map 1: Island Mljet)

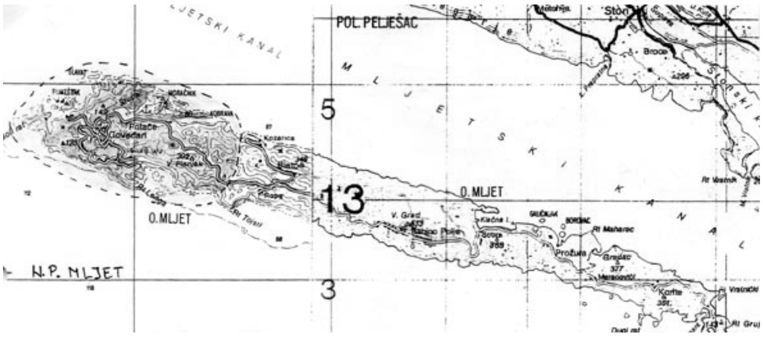
PRISTANIŠTE - LANDING PLACE

Foto 1: Pristanište

In 1960 the Sabor (parliament) of the Republic of Croatia proclaimed Mljet a national park for its natural beauty, densely forested areas, a two-sea-lakes phenomenon and historical monuments. The national park covers an area of 31 sq.km ie about one third of island Mljet (Official Gazette no's 49/60 and 54/76). For its forests it is called "green island". In 1997 the waters surrounding the island 500m off the coastal line were also included into the territory (O.G.no.13/97), adding another 27.35 sq.km to the area.

Mljet belongs to the Dubrovnik archipelago and it lies at the end of the Elaphite islands (Lokrum, Koločep, Lopud, Šipan, Jakljan and Olipa)[1], although it is clearly an open-sea island. It is about 36 km long, 3-5 km wide, and has an area of 100.4 sq.km. Distance from the Pelješac peninsula is 8 km, from island Korčula 18 km, and from Dubrovnik 30 km. In the north, the Mljet Channel separates it from the Pelješac peninsula.[2]

Mljet belongs to the area of the Mediterranean climate characterised by warm and dry summers, and mild winters. Autumn and winter periods are cool and rainy, which enables flourishing of vegetation.[3] Temperature below 0°C and snow are very rare. Average annual temperature is 16.1°C,



Map 1: Island Mljet

while average annual precipitation is 765.00 mm. Typical winds are bura, jugo and maestral. Bura is a north, usually dry wind; jugo (sirocco) is a south wind bringing humidity and rain, and maestral is a typically summer wind bringing freshness to the coastal region.

The Large and the Small Lake are virtually submerged karst depressions filled with sea water, that resemble two bays running deeply into the land.[4] They are linked by a passage 2.6m wide and 0.6m deep, while the Large Lake is connected with the Soline Bay by a passage 13.6m wide and 2.6m deep. At the entrance to the Large Lake once stood an old stone bridge with the remnants of an old grain mill driven by the tides, so that this place is still called The Big Bridge. Ebb and flow in the lakes cause a strong stream in the passages, which pushes the seawater in and out of the Lakes.

National park Mljet has two outstanding historical sites that must not be missed: a Roman settlement at Polače that was continually inhabited from the 1st c. to the 12th c.[5], and a Benedictine monastery from the 12th c. on the islet of St.Mary in the Large Lake. The Roman complex at Polače comprises a palace, two basilicas, thermae, and two structures of undefined title.[6] The islet of St.Mary with the Benedictine monastery is a unique example of architecture merging with landscape.[7] The location of the monastery is also unique, the monastery being situated on the islet in the Large Lake.

Tour of the NP Mljet can be started from Pomena - a walk through a pinewood to the Small Lake, and then by boat to the islet of St.Mary in the Large Lake. If you start from Polače, then tha path takes you to the Large Lake and Small Lake. The path round the Small Lake is 2,600m long, and round the Large Lake 9,240m. Those who like walking can go to Montokuc peak (258m) taking the educational/ecological path Vrbovica-Fontana. From this path there is a superb view of the Small and Large Lakes, Pomjenta field, Soline place and the channel of Mljet, and when the weather permits, of island Korčula and peninsula Pelješac. The path leading to the peak of Veliki Sladin Gradac (157m) is near the Large and Small Lakes; it is not too tiring, and offers a chance of enjoying the scenery below. Nature lovers ought to see the cliffs on the shore facing the open sea, either from a boat or walking all the way to them.[8]

MONTOKUC

Foto 2: Montokuc

Foto 3: M. panorama

On clear summer days after rain, when the summer bura blows over the sea, a view breaks on the open-sea islands of Lastovo and Vis in the distance, while Korčula is seen quite clearly. During summer season, when there is a greater danger of fire, the experienced fire watchman is on a round-the-clock duty in order to prevent the least chance of flames catching the vast stone pine forests and maquis.

There are two basic types of sylvan communities occupying large areas: climazonal communities of holm oak and black ash (Orno-Quercetum ilicis H-ić,58) and the community of Aleppo pine) with an underbrush floor of maquis (Pinetum halepensis Anić 58). On a very small area there is hop hornbeam (Ostrya carpinifolia) that is typical for the Mediterranean-mountain belt on neighbouring Pelješac, and a stone pine wood (Pinetum pineae, Anić 59) at the southernmost end of the island (Pinjevca, Saplunara).[9]

Holm oak wood on Mljet is mostly a degraded phase of maquis, born by cutting of seedling and regenerating from tree stump. We find it mostly on the northern, shady locations. The more frequent the cutting, the smaller height of trees and the smaller wooden mass. The low wood (*panjača*)on the Velika Dolina and Valakija localities looks nice and can seem to be a medium wood (some trees grown from the seeds, and some from the stumps), but this appearance is mostly due to the stand conditions and the position the locality has on the terrain.[10]

Maquis is an underbrush wood comprised of evergreen (rarely deciduous) sorts caught by thorny climbers, so that it is very often impassable. Typical maquis sorts are holm oak (Quercus ilex L.) and black ash (Fraxinus ornus L.), and the accompanying sorts are mostly: lurustinus(Viburnium tinus L.), strawberry tree (Arbutus unedo L.), briar (Erica arborea L.), myrtle (Myrtus communis L.), phillyrea latifolia (Phyllyrea latifolia L.), mastic tree (Pistacia lentiscus L.), and laurel (Laurus nobilis L.). The following climbers can be found in maquis: sarsaparilla (Smilax aspera L.), madder (Rubia peregrina L.), honeysuckle (Lonicera implexa Ait.), black bryony (Tamus communis L.), and evergreen rose (Rosa sempervirens L.).[11,12,13]

Aleppo pine wood comes usually with the underbrush of maquis, and we find it on northern, shady sides. Aleppo pine is a sort that is prone to occupying new grounds, and in the past it was often used for afforestation. Its seeds are light and it accepts new soil very well, especially after fire. In the NP Mljet special attention is paid to the preventive measures for fire protection.

THE SMALL BRIDGE

Foto 4: The Small Lake

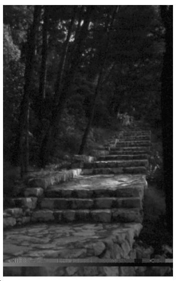


Foto 5: S. L: The path

The Small Lake (the total volume 3,349,000m^{3}) is a karst depression filled with seawater. It is connected with the Large Lake by a passage about 20m long and 0.5m deep. Its surface area is 24 hectares, the biggest depth is 29m, and the shoreline length is 2,600m.[14]

The Large Lake is also a karst depression filled with seawater that enters it through the Soline Bay and the Big Bridge. The total volume of the Large Lake is 36,730,000m^3, the surface area 145 hectares, and the shoreline length 9,420m.

The temperature in summer months is higher than the one on open sea; for instance, in the Small Lake the temperature of 27°C was recorded, in the Large Lake 29°C, and in the Gonoturska Cove 17°C. The salinity is also higher - 27‰ in the Small Lake, 28‰ in the Large Lake, and in the Gonoturska Cove 17‰ (T.Vučetić, The 1985 Mljet Symposium). In the rainy season (winter) the salinity in the Small and Large Lakes is somewhat lower due to fresh water springs and inflow of rainwater. The average annual temperature of the sea surface in the Small Lake is 26°C, which is higher than on the open sea. The average winter temperature is about 4.5°C, which is lower than on the open sea. The salinity of the Small Lake increases towards the depth, which leads us to a conclusion that there is a direct underground connection with the open sea. The explorations of the Lake in 1953 confirmed for the first time the presence of H_2S in the waters of the Adriatic.[15]

Prof.Schulze, who made explorations in the Small Lake in 1984, found the pollen of Aleppo pine dating back 2,000 years. In his study he explained the connection with the open sea ie located the chasm.[16]

VELIKI SLADIN GRADAC (ARCHAEOLOGICAL SITE)

Foto 6: The educational poster

Foto 7: V.S.G. Panorama

The Illyrian period in the history of Mljet left its trace in form of many ruins of ancient cities located on hilltops, which usually bear the name of Gradac.[17] Illyrian graves were found at Ivanje Polje, on Glavica near the village of Goveđari. The Illyrian period had lasted till 35 B.C. when the island of Mljet got occupied by the Romans. We learn from Appian's work *De rebus Illyricis* how the Illyrian tribes were conquered, their city Melitusa destroyed (its location still unknown), and the population taken for slaves.[18] Name *Melitusa* has its origin in the Latin name for honey (*mel, melis*), which tells that in the past the island was known by the production of honey.

"Before the arrival of Antiquity civilisations, our coast was populated by native Illyrian tribes. We could not talk of a particular type of arrangement that would be significant for the history of landscape gardening of that period, but some historical structures do exist, and in a way, their characteristics might fall within the scope of interest of landscape architecture in general. Here we refer to the prehistoric stone mounds, which appear individually or in the form of necropolises on many locations on our coast and islands. Very often they stand on elevations, plateaux, and smaller and bigger hills that is, on prominent spots in the landscape.

If, on one hand, we consider cemeteries parts of landscape architecture (and these mounds are primitive tombs), and if, on the other hand, using an attractive area of the landscape for the surroundings of a structure or for the emphasis of an object's significance represents one of the specific issues of landscape architecture that varies in certain periods of its development, then we have reasons to consider these primitive prehistoric monuments the oldest objects in our coastal region which are in certain way interesting for the history of both landscape architecture and landscape gardening."

Ruins of Illyrian cities are always situated on elevated grounds from which there is usually a superb view on the surroundings. They were built on elevations in order to have a good control over enemy's movements below and also to organise an efficient defence.[19]

THE ISLET OF ST.MARY

Foto 8: The islet of St. Mary

Foto 9: Panorama

In the 12thc. island Mljet falls into the power of Neretvan people. King Desa gives the island to the Benedictines from Mt.Cassino on the peninsula of Gargano in Apulia to be their exclusive property.[18] Three Benedictines of Ragusan descent come from Italy and choose the islet in the middle of the Large Lake for their permanent residence. There they build St.Mary's church and a monastery in Romanesque style.[21] Originally, the church and the monastery are not connected. The portal and two windows of the first monastery can be seen in the cloister of the present monastery.

In 1345 the abbot of the Marian monastery makes a contract under which the monastery remains the owner of one third of the island, while in its other part the *Universia* (municipality) is founded.[20] Every year the Universia of Mljet has to pay the monastery 300 hyperpers, donate one hen per household for the Festival of St.Blaise, and provide 2 shepherds at the discretion of the monastery for the whole year. This contract is immediately followed by another document, the Statute of Mljet, and from then on three kinds of books are kept in the Mljet's office: *Documenti, Vendite* and *Testamenti*. Island Mljet definitely goes to the Dubrovnik Republic in 1410.[18]

In the 16th c. the church and the monastery merged into one, because the church got a Renaissance vestibule and porch, while the monastery became a spacious Renaissance building with cellars, ground floor and first floor.[22] The defence tower and wall were probably added in the 17th c. for the protection from Turkish pirates. Although the structure has the appearance of a Renaissance summerhouse, actually, it was also a fortification, completely closed, with the apse of the church built into the defence wall. During the conservation works it was opened so that the architectural structure of the Romanesque church of St.Mary could be revealed. In the very front of the building there was a Renaissance porch serving as shelter for boats. The building was once connected with the sea because one could gain access to the cellars from the Large Lake using a boat and passing under the porch. As poet Ignjat Đurđević describes, one could fish from the monastery windows.[23] In the 18th c. the church underwent some changes - the chapels were added, so that the floor plan of the church got the form of a cross. Besides, a Baroque balcony was reconstructed, which has been preserved till today.

This monastery was the seat of the Mljet Congregation (Congregatio Melitensem or Melitanam) from the day of its establishment at the beginning of the 16th century. The first chairman was abbot and poet Mavro Vetranović Čavčić, who was summoned from Rome to lead the Congregation and revive its monasteries.[18] The Congregation comprised four man's monasteries in the area of the Dubrovnik Republic (St.Michael's on Šipan, St.Andreas's on the open sea, St.Jacob's near Dubrovnik, and St.Mary's on Mljet). This step was aimed at subjecting the monasteries to the direct power of Rome in order to avoid the Venetian influence on the Dubrovnik Republic. Later, the seat of the Congregation was moved to St.Jacobs's monastery near Dubrovnik. One of the abbots was poet Ignjat Đurđević from a distinguished patrician family of Dubrovnik. He wrote a satirical epic "Tears of Marunko's" in which some geographical names from Mljet are mentioned, which shows that the characters from the epic had ties with the island.[24] The Congregation was definitely abolished in 1808, when Napoleon's army occupied Dubrovnik. Then the big library and archives were raided and burned down, so that some data are lost.[25] Only a small fragment has been saved in the Franciscan library in Dubrovnik.[26] The Benedictines were retired and moved to the Franciscan monastery in Dubrovnik, while the building had changed the owners. The Statute of Mljet was taken to Vienna, and the monastery on

Mljet served as the headquarters of the Austrian Forest Administration till WWI. The building was then given to the Dubrovnik Bishopric. After the WWII it was taken away from the Bishopric and stood empty till 1961, when it was converted to a hotel that operated till the beginning of the Patriotic War 1991.

At the end of the islet of St.Mary there are a few more structures, but their purpose and age are unknown. The whole islet is in fact an olive grove with paths for strolling and stone benches for resting.

POLAČE (ARCHAEOLOGICAL ZONE)

Foto 10: Polače – panorama

Foto 11: Polače - roman palace

Polače port is a natural harbour confined with four islets (Kobrava, Ovrata, Moračnik and Tajnik) and protected from direct wind blows. About 150 years ago in the archaeological zone rose the old settlement of Polače. Four stone houses, leaning against the walls of the very palace, had merged with it into an architectural structure. Later, a few more houses were erected in the immediate vicinity. In order to protect this archaeological site, a new settlement was put up along the coast east of the old one.

On a hill above the settlement, the Illyrians had their castle that probably served as a lookout, and from which foreign boats entering the port of Polače were controlled. The people from the Illyrian times left many traces of their life on the island[17]: ruins of their cities, their graves, remnants of castles. All elevations bearing the name of Gradac hide traces of living of the Illyrians; legend has it that they belonged to the extinct tribe of Roguđani (for instance, Sladin Gradac and Vilin Gradac).[18] Such traces of *Gradina* exist on Veliki Sladin Gradac peak, to which leads one of our educative ecological paths.

According to a book by Roman author Appian, *De rebus Illyricis*, Mljet fell into the Roman power in 35 B.C., in the time of Emperor Augustus. It also says that the Illyrians were conquered: their city Melitusa was burnt to the ground, and the population put into slavery. It is believed that the survived inhabitants in the island's interior melted with the Roman newcomers.

At Polače we have an important archaeological site from the Roman times with the ruins of a palace, thermae, two basilicas, and another structure of undefined title. The palace probably dates from the 4th or 5th century (according to Danish explorer Dyggve).[27] It had two towers in the façade, with the gate facing the sea, and two rooms for the guards. It also had a large central hall with the span of about 12m, and a round tower at the rear of the building. The remains of the walls in the rooms preserved are really impressive. Central walls were much larger than the side ones.[28,29] Not far from this were found the remnants of thermae with a mosaic depicting a crane bird, which is the symbol of the Ostrogoths. They ruled Mljet from 493 A.D, after the fall of the Western Roman Empire. Island Mljet, along with Dalmatia, fell under the Eastern Roman Empire in 535 A.D.

Record has it that during the reign of Emperor Septimius Severus, an Agesilaus from Anaserb in Kilikia (Asia Minor) was expelled to Mljet together with his son Opianus. Here he built a magnificent palace, the remnants of which still adorn this cove. According to legend, poet Opianus wrote an epic on fishing in Greek titled "Halieutica".[18]

The ruins of the two basilicas near the palace, which are of rather large dimensions, tell that quite a number of people stayed here. One of the basilicas was partitioned (the site of Nodilo's shed), which leads us to the conclusion that at a time the number of inhabitants was reduced so that the space for prayer was reduced accordingly. On another site are evident the expansions the structure underwent, so that we can conclude it existed from the 1st c. to the 12th c.[30] The remnants of a font for adults are preserved, and also a place where stood bishop's seat that was found there. As bishops always went with emperors, this is also a proof that in the Roman times Mljet was imperial property.

It is stated in a document dating from the 5th c. (consequently, from the Roman period) that the annual revenue from the property on Mljet is 200 solidi, which was a substantial sum. The income was earned from olive oil, wine, dried meat, cheese, goat- and sheepskin, dried and salted fish, honey, barley, wood for fuel and lumber. Thanks to honey, the island's name was Melita because in Latin *mel, melis* means *honey*.

Mljet remained under the Roman power till the 12th c., as part of the Eastern Roman Empire, although its eastern end was populated by newly arrived inhabitants - Croats from the Neretva Valley.[17] The old legend of the island tells about the battle of King Dešin and Duke Remin on Bijeđ hill, where probably was stationed a Roman patrol. The final combat happened on the St.John's Day, 24 June. The legend does not state the year, but it tells that the combat took place in Ivanje field, and that blood flowed over the Draginje threshing floor to the Velika Tatinica cove, some 1,000m away.[18]

Polače has a water spring, in which the water is rather low during summer months, but still sufficient for living. The spring is right off the palace. On the locality of Vodice above Kneževo field is a more bountiful spring that was taken care of in the Roman times, the traces of its utilisation being still visible. The spring was protected from the pollution, perhaps even completely enclosed.

THE CROSS (THE BAY OF SOLINE)

Foto 12: The Cross

Foto 13: The Bay of Soline

In the 14th c. a stone cross was placed at the entrance to the Bay of Soline.[18] It bears an inscription in *Bosančica (*early Cyrillic letter in Bosnia*),* today partially illegible. The cross stands on a spot where the shore is shaped by the influence of the sea, strong waves and winds. The vegetation there is flattened and adapted to resist the strong gusts of waves and winds.

From this spot the view stretches over to Soline place and the Big Bridge where once stood a stone bridge and a tide-driven mill. It is set on a spot directly exposed to south winds. The vegetation is flattened to resist strong blows of waves and winds. On the rocks grow distinct halophytes, plants adapted to a life influenced by the sea.

The exact age of the mill and the bridge at the entrance to the Large Lake is not known, but it is supposed that the mill dates from the 16th c. that is, from the time the monastery and St.Mary's church were restored. We find a description of this unique tide-driven mill on the Adriatic in *Machinae novae* by F. Vrančić:

"**A mill placed in the straits**

Who could manage to force the sea to drive mills, and to be used as driving force for other purposes too? I think that it still can be accomplished, not everywhere though, but at places where it is narrow. One should see to it that the place is not open or exposed to the least force of waves. There is another way to make the sea useful. A hole should be dug out on the shore, with the sides as high as the level to which the sea usually rises, so that the flood tide would fill the lake (hole) with water, while during the ebb tide the water would be receding through a groove or a pipe and drive the mill. This will be, however, much better done in the ocean because of its rise and fall. I have recently heard of this from a good friend of mine."[31]

GOVEĐARI (ETHNOLOGICAL ZONE)

Foto 14: Goveđari

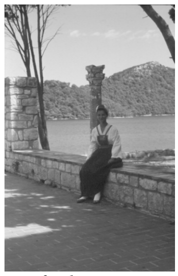


Foto 15: National costume of Mljet

The village of Goveđari was founded about 200 years ago, when the Benedictines from the monastery of St.Mary exchanged their houses and property above Veliko Polje for work on their estates. A contract has been preserved, signed by Milić brothers and Vincenco Basto, who were first to settle at this place. The Benedictines promised to give them houses, a portion of the fields and estates in exchange for working in the field and guarding the monastery cattle. The village expanded to the present size, and today it is a precious rural entity containing ethnological values, ancient garments and national costumes, and also a mill for the production of olive oil.

The national costume of island Mljet is a union of red and white colour. Woollen skirt (*gunj*) in a vivid red colour is original part of Mljet costume, probably evolved from the Dinaric coarse cloth *(raša)* that was originally worn over the head as a dress. The skirt has a front and a back part, tied up by strips over the shoulders.

A white shirt, adorned with embroidery and lace is put over . A skirt with side slits is fixed round the waist with a belt. An embroidered headgear (*škufija*) is placed on the head, and atop of it a kerchief in white embroidery (*krpa).*[32]

CONCLUSION

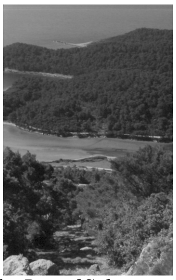


Foto 16: The forest in the Bay of Soline

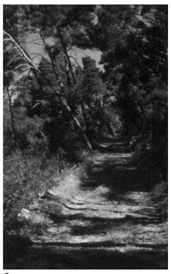


Foto 17: The forest trail

Putting up of educational posters with the descriptions of localities and their significance is a big step towards providing information to the visitors who come to this area during summer season. This way they are able to learn as much as possible about the values of the natural and cultural heritage of the National Park they came to visit. Apart from the value of the forests, the sea and the sea lakes, the historic localities, too, are important, because they lend a special stamp to this area. Founding of the National Park in the northwest part of island Mljet has opened a new chapter in the entire development of the region, and emphasis is placed on a continuous protection of nature. Building is restricted in the region of the basic phenomenon. This is especially evident around the Small Lake, which has remained unbuilt - a natural landscape preserved untouched for the posterity.

In addition to the educational posters and ecological paths, the National Park has many other possibilities of improving its activities on the protection of nature. One of them is marking the finds of rare or endemic plant divisions such as woody wolf's-milk (Euphorbia dendroides L.) blue *lasinje* (Moltkaea petrea Tratt. Gris.), Greek strawberry bush - hybrid (Arbutus andrachnoides Link.), fragile *kositernica* (Ephedra campylopoda C.A.Mey.), and a general awareness of the values of wood vegetation. So far, a lot has been done on fire protection, and this practice should be maintained at the same high level. A continuous monitoring in the season of fires and regular reports to persons on duty in the field are good safeguards against wood fires.

The values of the natural and cultural heritage should be brought closer to the visitors by way of strictly aimed excursions in the whole area of the National Park, because there is a heavy pressure on some of the points of interest.

Foto 18: Moltkaea petraea

Foto 19: Arbutus x andrachnoides

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Interaction of Land and Water Ecosystems in Recreational and Protected Areas

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Abstract: The experience of monitoring and management of visitor flows is stored enough large for land ecosystems in recreational and protected areas. An estimation of influence of visiting flows and choice of optimum loadings for water ecosystems are connected to some difficulties. This difficulty is predetermined, first of all, by complexity of interaction of land and water ecosystems and by complexity of performance of monitoring of environment for such ecosystems. Interaction of water and land ecosystems we will consider on an example of the Dniester River Basin and coast of the Black Sea, which are popular recreational and protected areas.

TOP DNIESTER BASIN. (FIG. 1A,B).

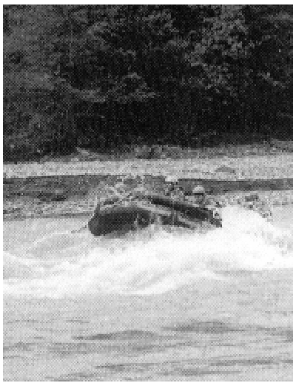

Figure 1a. Top Dniester River Basin

Figure 1b. Top Dniester River Basin

The Dniester Basin is located in west, southwest part of the Ukraine and east part of the Republic Moldova. Common catchment area of Dniester River Basin makes 72100 km2, from which 63030 km2 concerns to the Ukraine. Total length of the Dniester River is equal 1362 km, from which 705 km concerns territory of the Ukraine. Dniester divide usually into three parts: top (Ukraine), average and lower (Ukraine and Moldova) by character of river's valley, coastal landscapes, water conditions, biodiversity.

The Dniester River begins on northern slope of East Carpathians at height about 900 м and in the top part flows in the narrow canyon valley which is natural border between Carpathians and Podolsk Hills. The top part of the river has mountain character in all area.The high diversity of plant species, which have different age and origin, is a result of geographical location of Top Dniester Basin where three floristic region (Carpathians, Polissya and Podilsk) are mutual junction. Flora includes more than 1500 species of top plants and more than 700 species of vascular plants. The flora houses about 50 endemic and 70 rare species listed in the Red Data Book of Ukraine. The mountain and alpigenous elements of flora are most ancient extant from the tertiary period.

AVERAGE DNIESTER RIVER BASIN

Figure 2. Average Dniester River Basin

The Basin of the Average Dniester covers partially-wooded and steppe natural zones. The most part of this territory, rich natural vegetative and animal complexes, was transformed in agrocenoses for last decades. The gradual extinction is marked for many kinds after destruction of steppe areas, began degradation of steppe and meadow communities by pastures and by plough of soil. Strong influence on steppe and partially-wooded ecosystems have rendered drainage and pollution of natural reservoirs of this area. The natural communities and populations were kept as fragments on different parts of area that complicates a survival of many fauna and flora species. The vegetation is characterized by great diversity of species and plant alignments, among which forest, that make the base of the landscape and are the nature-functional of the partially-wooded. Oak, hornbeam-oak, nornbeam-oak-ash and beech phytoconose, peculiar steppe alignments, including feather grass, original grassland plants formed vegetation.

LOWER DNIESTER BASIN

Figure 3. Lower Dniester River Basin

Two zone such as - wood and steppe take part in addition of a vegetative cover of territory of the Lower Dniester. The rarefied oak forest of the Mediterranean type from an oak fluffy and accompanied by retinue of the mediterranean-balkan species prevail in wood ecosystems. The prevalence of black soil specifies distribution of large open steppe spaces in the past which now are ploughed up. Many from kept until recently "islands" with steppe vegetation nowadays also are engaged by windbreak. Rare relic steppe of savanna type generated by the mediterranean - balkan species meet now in the kept steppe islands. Dniester River crosses a narrow strip by rich different grasss of feather-grass steppes. Here steppe zone is transformed into a cultural landscape, in which steppe vegetation and flora, as the natural resources, almost have disappeared. Deprived variants of steppes were kept as small islands contiguous to the agricultural areas and placed on unsuitable soils for agriculture. Not zone types of ecosystems: the valleys woods of the rivers, meadow, water-marsh, vegetation of the salted marshs meet in conditions of the Lower Dniester.

PROTECTED TERRITORIES OF THE DNIESTER BASIN

The natural landscapes both biodiversity of flora and fauna anthropogenous loadings in the rivers basin last decades. The degradation process of landscapes and biodiversity cannot be stopped without creation of network of reserved territories in the river basin. Three natural reserves ”Rosztochya”, “Medobory”, “Horgany” and two national nature parks “Vyzhnytsky” and “Podilski Tovtry” are in Ukraine in the Dniester Basin and only in the top part of the basin. The reserves and national parks are absent in average and lower parts of Dniester Basin in territory of Ukraine. Three natural reserves ”Kodri”, “Jagorlik”, “Plual Faguluj” are in Moldova in the Averege Dniester (Fig.4).

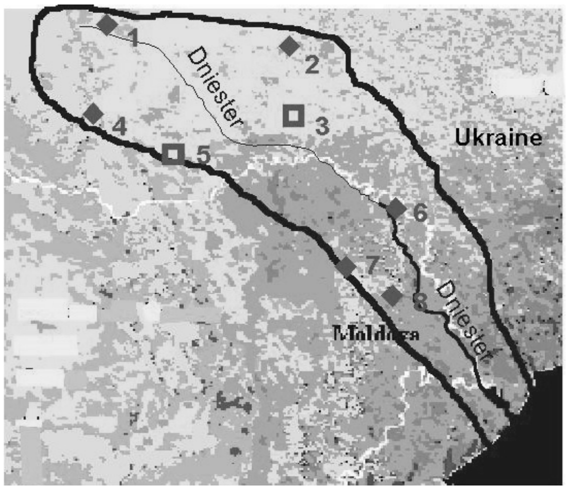

Figure 4. Map of the distribution of natural reserves, national nature parks and Atmospherically-resistant Vegetation (ARVI) in the Dniester River Basin;
1-”Rosztochya”, 2-“Medobory”, 3-“Podilski Tovtry”, 4-“Horgany”,
5-“Vyzhnytsky”, 6-“Jagorlik”, 7-“Plual Faguluj”, 8-”Kodri”;
(red rhombs - natural reserves, red quadrates – national nature parks).

Natural reserve and the national parks are absent in the lower part of the Dniester Basin. The amplified attention to the top and average sites of the Dniester Basin for preservation of biodiversity is defined by residing of bulk of rare species of fauna and flora in these areas. However use of the given criterion in an estimation of importance of different areas can have negative legs. The natural ecosystems in areas with a small amount of rare species remain without a due guard that reduces in reduction or even to vanishing species. Reserves and national parks is not present in the lower part of Dniester. This area is characterized by a rather low amount of rare species. Nevertheless there is a set of criteria which force to convert the special attention and on this area of Dniester River Basin.

The vormela, sturgeon, spoon-bill (recorded in the List of the Bern Convention) is species registered now only in this part of the Basin (Fig. 5 a-c). The species of an ancient ecosystem of the Pontocaspian Sea and species from terrestrial ecosystems of tertiary phase were kept in ecosystems only of this part of the Basin. Dniester delta of together with deltas of Danube, Dnieper, Bug and deltas of the rivers of the Azov Sea form the marsh zone and zone of species ancient of the pontocaspian ecosystem.

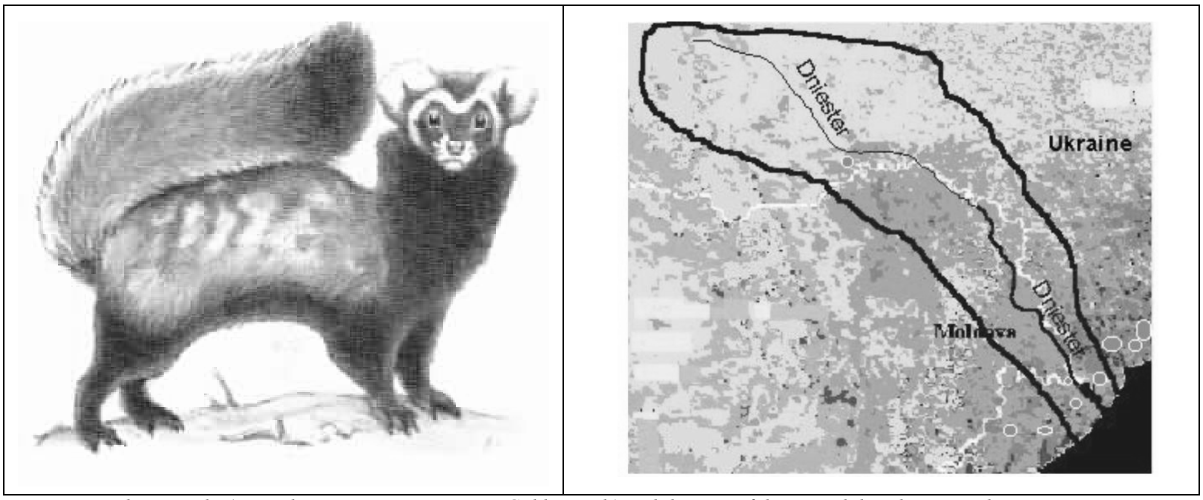

Figure 5a. The vormela (Vormela peregusna peregusna, Guldensuedi) and the map of the spatial distribution in the Dnieter River Basin.

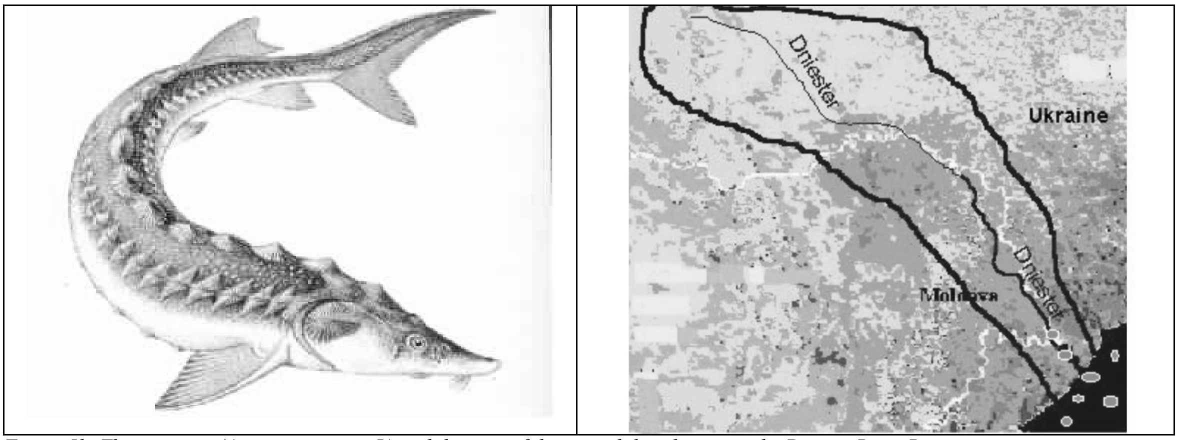

Figure 5b. The sturgeon (Acipenser sturio, L) and the map of the spatial distribution in the Dnieter River Basin.

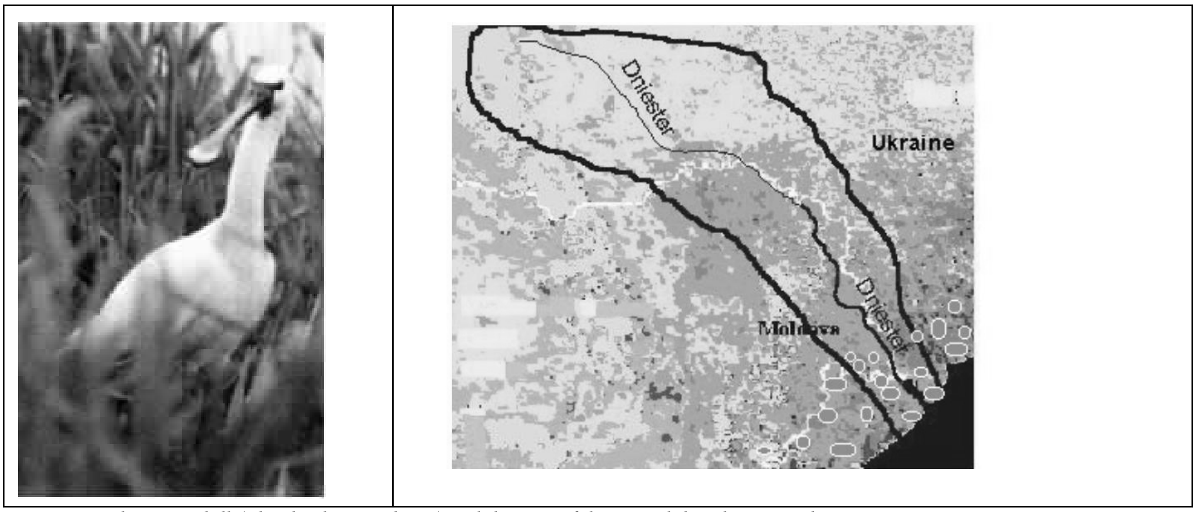

Figure 5c. The spoon-bill (Platalea leucorodia, L) and the map of the spatial distribution in the Dnieter River Basin

The high biological efficiency ensures steady functioning of terrestrial and water ecosystems. This site of the Dniester Basin is the important place of a nesting of marsh birds, rest and fattening on paths of migrations of a great many of species of migrant birds, place of a spawning both fattening of many river and anadrom fishes.

Therefore initiatives of the Ukrainian and Moldavian nature protection structures, scientific, public on creation of National Park "Lower-Dniester" in the lower part of the river basin is rather urgent. Obviously that the expansion and development of existing reserved territories of Ukraine and Moldova in the Dniester Basin in uniform reserved natural network is necessary.

The analysis of structures, the functioning of different populations and ecosystems of the Dniester River Basin specifies necessity of development of complex criteria for an estimation of condition of natural ecosystems for their guard, preservation of biodiversity and creation of natural ecological network for all the Basin as component of uniform of the European Ecological Network. The planning of tourist flows, as a rule, is based only on local estimations of possible stability of natural ecosystems without the account of large-scale ecological processes in region. Water ecosystems, besides direct influence of the campers (bathing, motor boats, collection of exotic organisms), have indirect loadings from adjoining industrial and agricultural areas. The recreational and protected territories of the Dniester River Basin are in environment of areas with intensive anthropogenous loading. The pollution are transported from these areas in recreational and protected areas of the river basin. Therefore choice of optimum loading from visiting flows for recreational and protected areas is necessary to carry out considering of anthropogenous loadings from adjoining areas.

The flow of the tourists is not summarized in scale of the basin, and its influence on all ecosystem of the basin is not analyzed. It is considered to the sufficient analysis of loadings on local protected territories. If the flow of the tourists is possible roughly to count in the lower part of the Dniester River, it is impossible to receive the clear information for area of the Lower Dniester. The definition of sufficiency of protected territories remains also by important problem for preservation of steady functioning of the large-scale ecosystem of the Dniester River Basin.

The terrestrial ecosystems and anthropogenous loadings of the River Basin influence not only on river but also sea ecosystems, on natural and recreational resources of sea coast. Four large rivers of Europe, namely the Danube, Dnieper, Dniester and Bug rivers, discharge their water and effluent into the Black Sea (Fig. 6). In addition the river plumes are turbid and carry a high load of suspended particles. The suspended sediment is colloidal and on its surface pollutants are absorbed. These include pollutants such as pesticides, hydrocarbon, heavy metals, organic matters and radioactive isotopes. By this mechanism the polluted river waters of the large rivers can be transferred to marine areas of Ukraine, Romania, Bulgaria and Turkey where they damage the natural ecosystem and worsen the condition for the recreational resources.

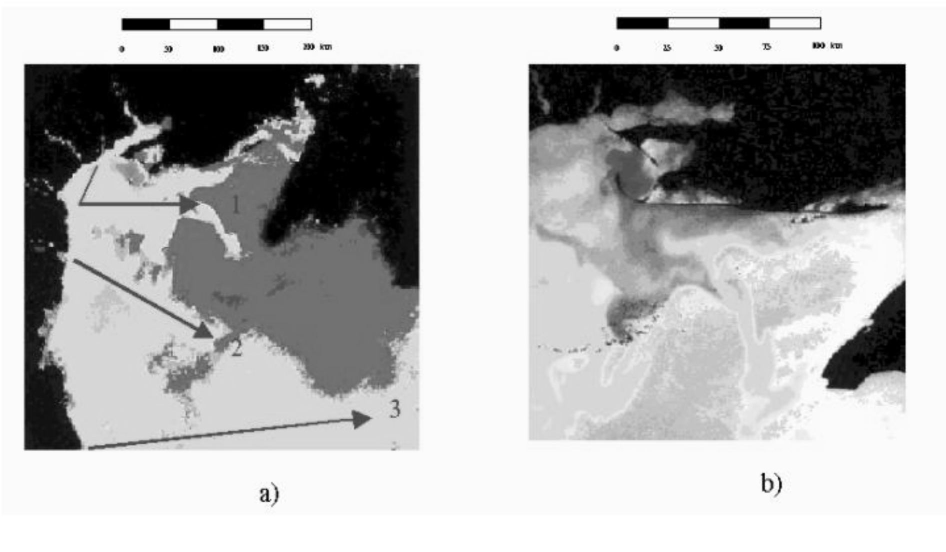

Figure 6. Satellite observation (NOAA-AVHRR) showing water turbidity indicating the extent of river plumes (red = high concentrations; blue and purple = low concentrations) in the Black Sea. a) 1- Dnieper and Bug River plume, 2 – Dniester River plume, 3- Danube River plume (regional scale); b) Dnieper and Bug river plume (local scale).(From Shalovenkov, 2000)

Such a dominant pollutant is the organic matter on the surface of the suspended particles. They result in eutrophication on the northwest shelf, sea coast in summer and autumn. This eutrophication generates major changes in condition for sea coast ecosystems and recreation. The flows of the tourists and vacationists are planned for the sea coast without the account of large-scale influence of the large rivers and scales of eutrophication. Not only the large-scale ecological processes are not considered at planning rest at sea coast, but also the comprehensively local ecological processes connected with development of a coastal infrastructure of rest are not taken into account.

The development of coastal infrastructures for rest is connected frequently to increase of household drains in water ecosystems. The pollution of water ecosystems by rain drainage practically is not considered, which are transferred by mud flows of rain from surface of land. Examples of the not taken into account for local pollution of coastal sea ecosystems will consider for two sanatoriums at coast of Crimea taking place near to protected natural areas.

THE COASTAL AREA OF THE "DOLPHIN" SANATORIUM, SUDAK

Figure 7. The coastal area of the "Dolphin" Sanatorium, Sudak

Oil-hydrocarbon, asphalt-resinous substances, cadmium, chromium, polychlorbifenils, lead, zinc had the maximum accumulated concentration in coastal parts of water area with gradients from north rain drainage in beach zone of the «Dolphin» Sanatorium (Fig.8).

THE COASTAL AREA OF THE "AI-DANILI" SANATORIUM, JALTA

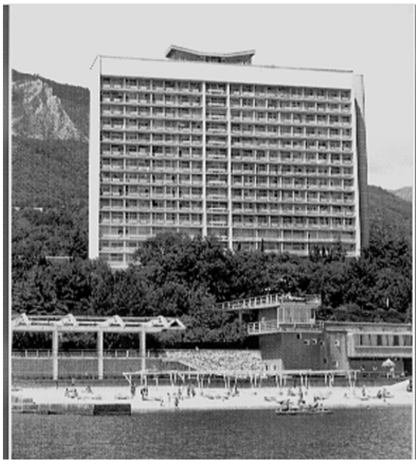

Figure 9. The coastal area of the "Ai-Danili" Sanatorium, Jalta

The basic source of pollution and accumulation of pollution is the coastal drain in northeast part of beach of the "Ai-Danili" Sanatorium The maximal accumulation concentration of oil-hydrocarbon, $\alpha+\gamma$ pesticides, zinc, lead, mercury, asphalt-resinous substances is registered in northeast part of this water area (Fig.10).

Spatial distribution of biomass of bottom animals is evidence of constant influence of rain waters with polluting substances in the condition of the coastal ecosystem for two sea water areas. (Fig. 11).

From the given results followed, that the basic coastal source of pollution for water areas are of the rain drains. It will well be coordinated by results of biological indication (fig. 11a,b) of the ecological condition of coastal ecosystems, and also to accumulation of polluting substances in bottom sediment (fig. 8 and 10). These pollution are distributed by coastal currents as well to the adjacent protected natural sea ecosystems.

The rain drains are caused short-term changes of ecological conditions in coastal sea ecosystems, worsen sanitary conditions of beach zones and can be sources of human diseases depending on volumes of rain fall, area of a drainage and hydrological conditions in the sea. The given factor is rather important also for taking into account at modeling and forecast of processes of interaction of terrestrial and sea ecosystems. The volumes of carry of pollutants depend on quantity of atmospheric precipitations, rain catchment area and development of coastal infrastructure.

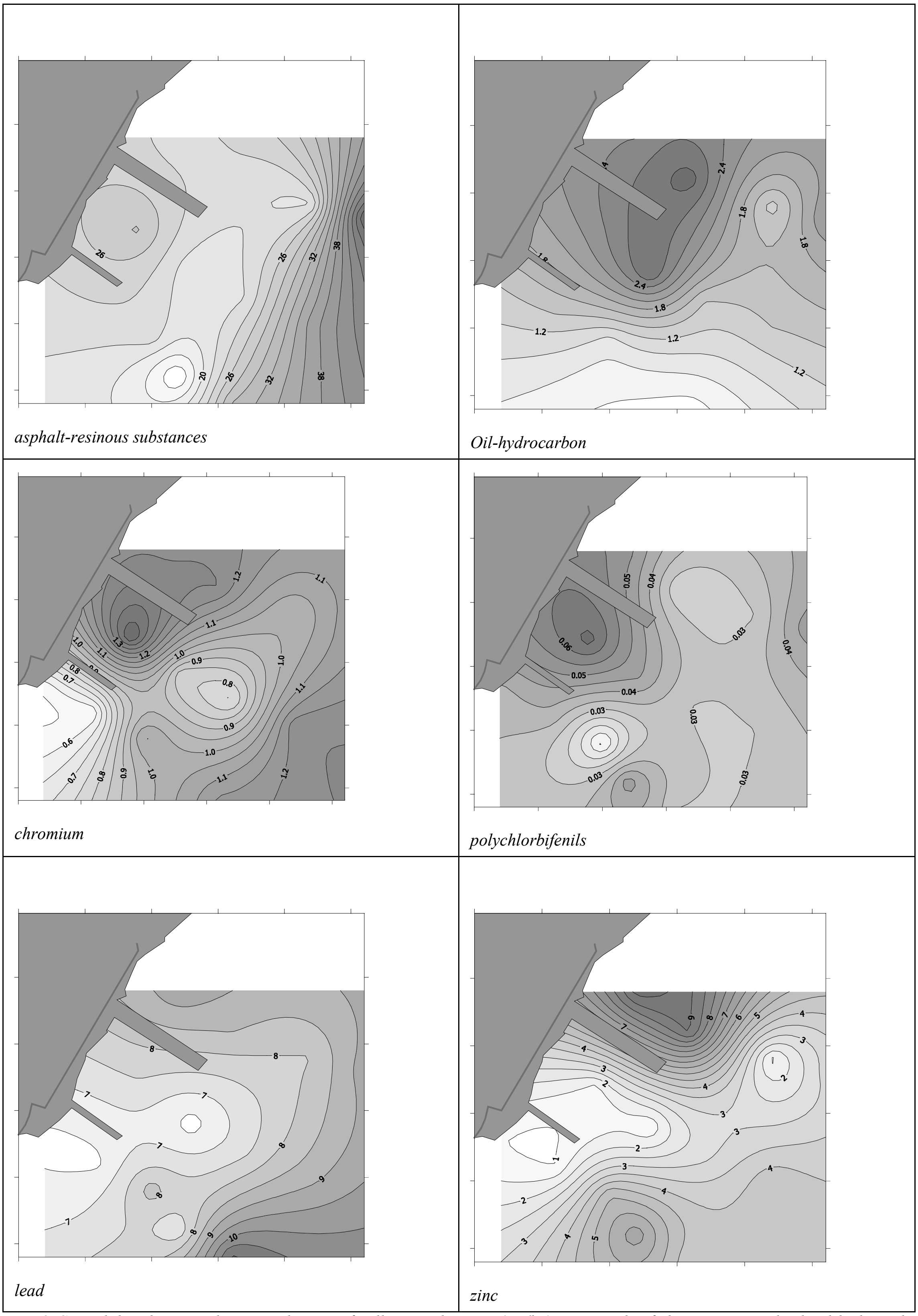

Figure 8. Spatial distribution in bottom sediments of polluting substances(mg/kg) on example of chromium, zinc, lead, oil-hydrocarbon, asphalt-resinous substances incorporated in coastal area of the "Dolphin" Sanatorium.

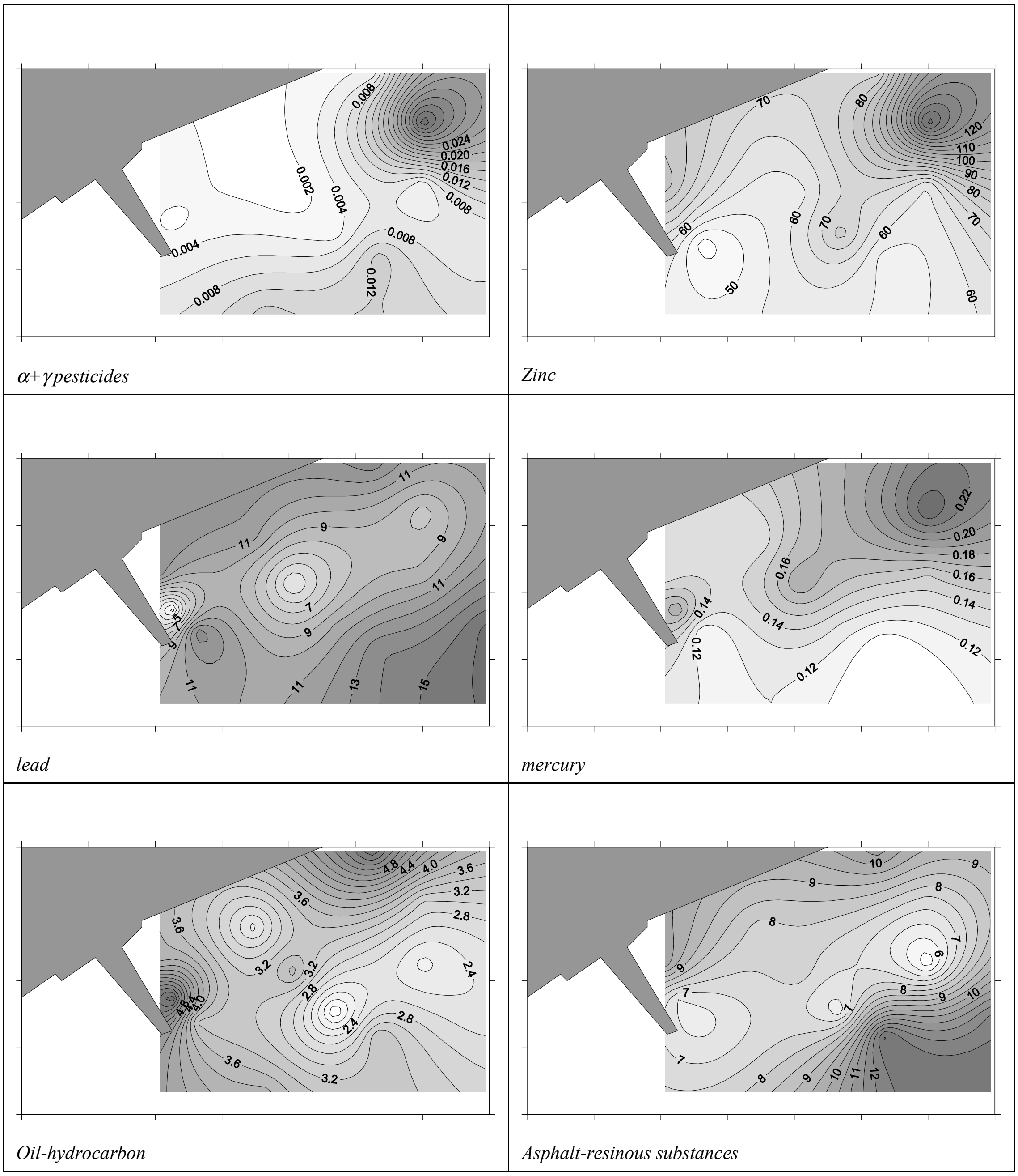

Figure 10. Spatial distribution in bottom sediments of polluting substances(mg/kg) on example of $\alpha+\gamma$ pesticides, zinc, lead, mercury, oil-hydrocarbon, asphalt-resinous substances incorporated in coastal area of the "Ai-Danili" Sanatorium.

CONCLUSION

The water ecosystems of recreational and protected areas test anthropogenous loadings not only with contiguous of land territories, but also from all of catchment basin of river, lake, sea. Stability of natural populations, communities and ecosystems in recreational and protected areas depend not only from local, but also from large-scale (for example, regional) ecological processes. Therefore it is necessary to take into account total influence of many factors in choice of optimum visiting flows for support of ecosystems in steady condition. It requires the complex approach in management of visiting flows of camper and in development of computer Support Systems for recreational and protected areas.

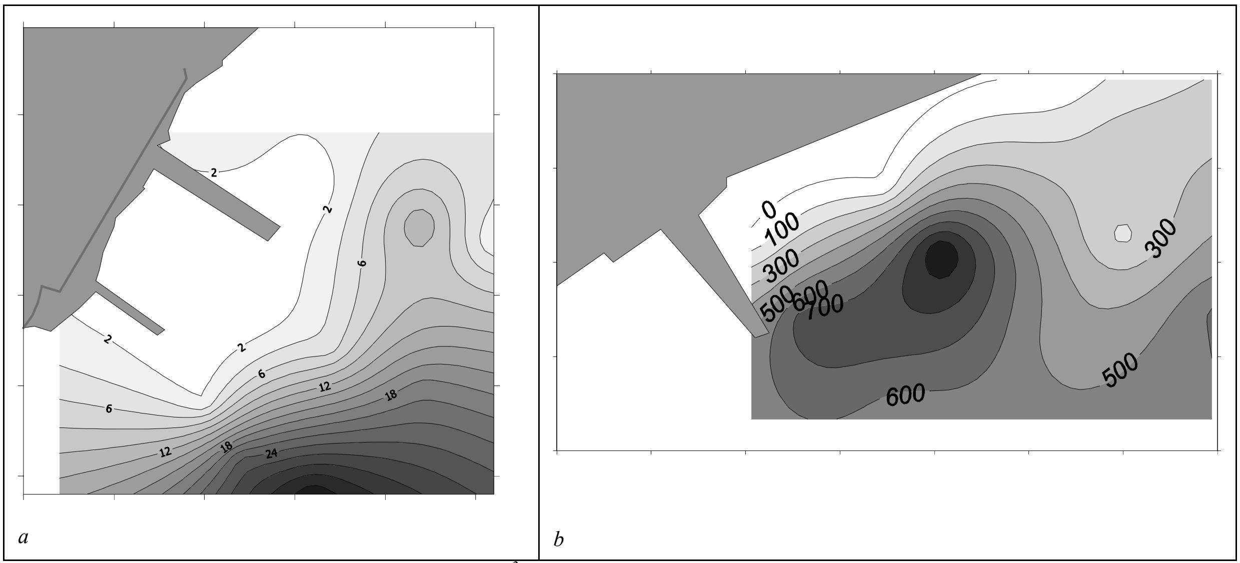

Figure 11. Spatial distribution of benthic biomass (g/m²) in the water areas of the "Dolphin" Sanatorium (a) and the "Ai-Danili" Sanatorium (b).

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Water Sports Activities and their Effects on the Avifauna of the Danube Floodplains National Park, Austria - First Results

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Abstract: Sustainable management of protected areas requires combining standardized ecological observations with quantitative data about the number of visitors and their behavior. Austria's Danube Floodplains National Park is a prime example for the importance of accommodating a high volume of recreational use with concerns about ecological integrity. Wetland ecology is of particular concern to park management. Within the scope of this study, boaters in the old branches of the Danube were observed en route and questioned when leaving the area. These observations provided quantitative data, such as the number of boaters, their spatio-temporal distribution and their behavior. At the same time, disturbances to water birds were inventoried using standardized ecological observation techniques. These observations were interlinked with visitor use data provided by a constant video recording of the recreational activity at the main entry point. Thus, data on the number and the temporal distribution of the boaters for the overall observation period was made available. The result of this study was, that through the simultaneous presence of different user groups, there is a permanent burden placed on the old branches by boaters, which scarcely permits rest for the avifauna.

INTRODUCTION

Impact of recreational use on fauna in the Danube Floodplains National Park

Uncontrolled and intensive leisure time pressures lead to an extreme burden being placed on the sensitive fauna of an area. Animals are able to compensate - up to a certain level - for disturbances resulting from anthropogenic leisure time activities. This can occur through a temporary change of location, a spatio-temporal modification of activities or through becoming accustomed to human presence (the so-called "national park effect"). This familiarization effect, however, is dependent on the predictability of the sources of disturbance and their parameters such as frequency, intensity and remoteness (Frühauf, n.d.).

The specific sensibilities of individual species, over the year, influences the reaction modus and the magnitude of the disturbance. Brooding birds, for example, have inhibitions about leaving their nests or, as a result of the disturbance, can not return to their clutch. Parent birds are more inclined to take risks with the incubation and raising of their young, swarms of birds flee more readily than individual animals. Several disturbances often occur at the same time which amplifies these effects (Kempf, Hüppop 1998, Schemel, Erbguth 1992).

In the Danube Floodplains National Park the large variety of leisure time activities which are carried out results in disturbances to the various species and their habitat. An ecological competition has developed, particularly in the old arms and side arms, between animals and park visitors. Two sources of disturbances principally interfere with the avifauna of the old-arm systems.

- Passing paddlers or walkers briefly startle the birds
- Anglers and swimmers burden the fauna through their long, continuous presence.

According to Eichelmann (1993), the flight distance is that distance below which a bird takes flight when startled. Prior to this, the disturbance manifests itself through nervousness and an increase in the heartbeat rate. Grey herons (*Ardea cinerea*) stretch out their necks, mallards (*Anas platyrhynchos*) quack first of all before swimming away; as a final consequence they take flight. Mallard ducks have a critical flight behavior in straight watercourses because boaters, through their permanent startling, practically drive them continuously onwards before their boats. If several canoeists are en route in the same old arm, these birds suffer permanent stress. During the main molting period (from the middle of May to the beginning of June), ducks are completely incapable of flying for 3-4 weeks. At this time, mallards suffer the most stress caused by disturbances (Eichelmann 1993). Zwicker (1983) observed grey herons in the Danube Floodplains that went looking for food not near to their colony but much further afield. He attributed this to the fact that the birds were unsettled by the presence of visitors and disturbed during their food intake.

Experiments using rowing boats, in the old arms of the National Park, showed that stationary sources of disturbance were more intense than moving ones. The radius of disturbance around an angler in his boat was much greater than that of a moving dinghy (Eichelmann 1993).

Eichelmann (1993) was able to show considerable differences between the flight behavior of birds in protected areas and those in fishing sections or areas open to boating in the region under observation. Those birds in the areas which were used for leisure time activities showed a reduced flight distance and thus, a familiarization effect.

Linkage of visitor behavior and disturbance influence

Deblinger et al. (1991) linked ecological and social influences on the habitat of shorebirds in a coastal area of the USA. Due to their proximity to major urban regions and their scenic quality, these beaches were strongly frequented by boaters, which led to the destruction of the ecosystem and also influenced the quality of the impressions gained. Based on the results of the survey and observations of shorebirds, a management plan was developed to restrict boaters from areas frequented by these birds. Educational programs were implemented to increase the boaters' awareness of the impacts they caused.

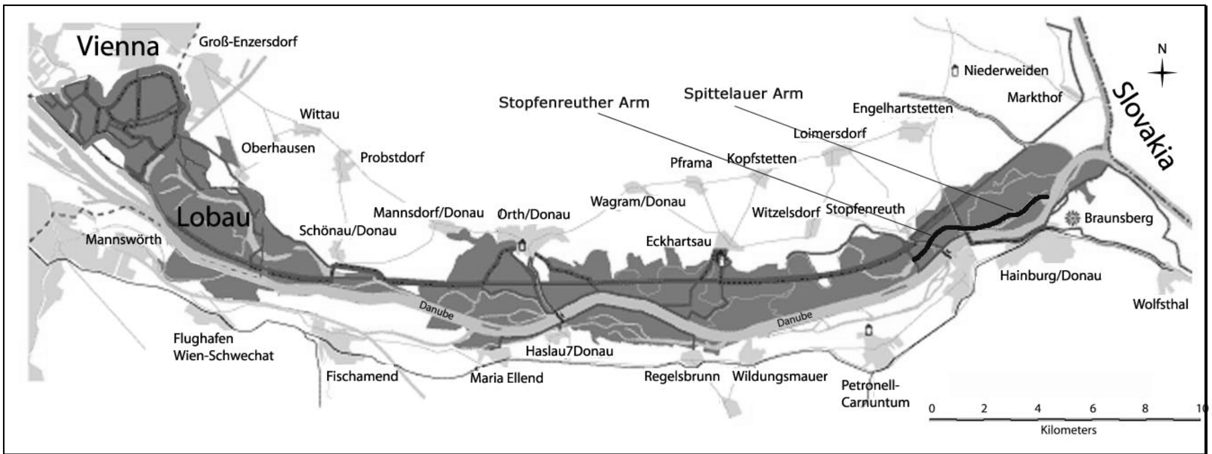
Within the scope of a visitor monitoring project in the Danube Floodplains National Park (Arnberger et al., in print), visitors to the park were observed, counted and questioned. Because of the large number of visitors to the National Park, other people seeking recreation avoid high visitor loads by using side-roads or by visiting the area in the evening or early-morning hours. This increases the spatial and temporal stress placed on the fauna of the National Park. Future management measures will have to take visitor behavior in highly-frequented protected areas into consideration.

Therefore, in conservation areas with a strong visitor frequency it is particularly important to have accurate information on the visitor structure. It is only possible to arrive at acceptable management measures for all concerned when there is a linkage of the data available on those seeking recreation with ecological data on the anthropogenic disturbances to the natural area.

STUDY AREA

The Danube Floodplains National Park lies between the two conurbations of Vienna and Bratislava and extends over a length of 38 kilometers. The floodplains cover 65% of the area of the National Park, 20% are watercourses and the remainder fields. The management of the Danube Floodplains National Park faces many special challenges in dealing with leisure activity demands, resulting from the traditional usage patterns of people living in the vicinity and the easy accessibility by land and water.

In the eastern section of the National Park lies an old-arm region (the Stopfenreuther and Spittelauer Arm), which represents the longest connected stretch of water, where boating is permitted, in the Park. The Stopfenreuth Floodplain lies to the southwest of the village Stopfenreuth and is easily accessible over an asphalt road.



Map 1: The Danube Floodplains National Park (Source: Nationalpark Donau-Auen, n.d., modified)

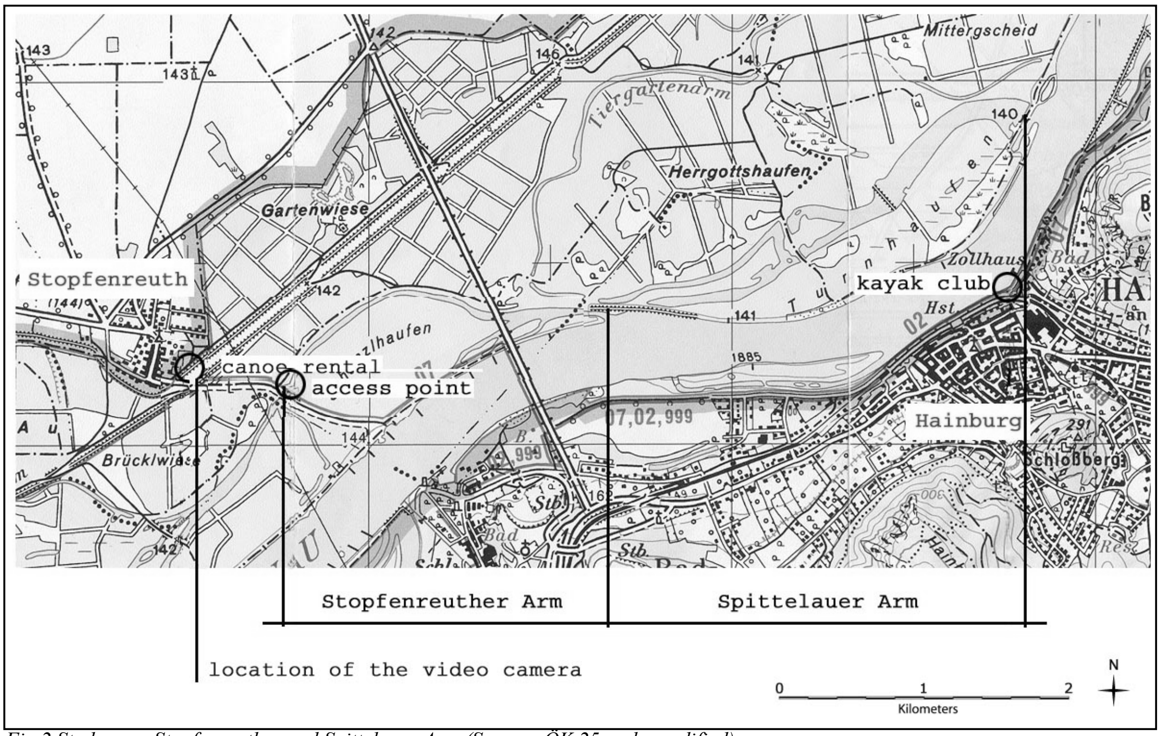


Fig.2 Study area Stopfenreuther and Spittelauer Arm (Source: ÖK.25, n.d., modified)

This accessibility for boaters is further facilitated by an entrance with a ladder. After approximately 2 kilometers, the arm reaches the Danube, where it is easily possible to traverse into the next arm, the Spittelauer Arm. This arm is interrupted at three points by traverses and stretches for a length of approximately 2.5 kilometers to the northwest before reaching the Danube.

The immediate proximity of the main entry point to a canoe rental (in Stopfenreuth) and to a kayak club in Hainburg on the opposite bank of the Danube has led to these two old arms having the highest boater frequency in the National Park region and, therefore, there is a much higher stress placed on this old-arm system than on other waterways in the National Park where boating is permitted. This was the reason for carrying out the first investigations into the impacts of leisure time activities on fauna in this old-arm system.

METHODS

For this study, the combination of monitoring and survey data, obtained by various methods, allowed a thorough analysis of boater activities in the National Park.

Survey

On eleven days, boaters leaving the old arm were interviewed, using a standardized questionnaire, to obtain data on their route, duration of their journey, origin, motif for the visit, behavior and impressions. Only one member of each group was questioned. In addition, the type of boat was recorded in order to blend this survey data with the results of personal observations and video surveillance. The total sample size was 77 boaters.

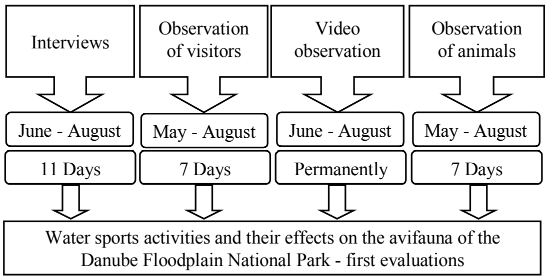


Figure 2: Types of data collection

Visitor monitoring

The monitoring took place throughout the day. A total of 63 boating groups was observed on 7 days. The observations were intended to record the behavior of the visitors and the reaction of the animal world to individual human behavior patterns. The size of each group was documented on the questionnaires; place and time of the encounter, size of the group, its composition (male and female persons, children, dogs), the type of vessel and activity were also recorded.

Observation of the disturbance reaction of the animals

During the observation days, not only the behavior of the visitors, but also the reaction of the animals to this was observed by boating in the old branches. This survey was carried out on seven days. The goal was to observe the bird species (mallards and gray herons) and to use this to arrive at conclusions concerning the level of disturbance.

These animals were chosen to be the indicators for this study, because they are easily distinguishable and because of the research which has already been made into their reactions to disturbance (Eichelmann 1993). The observation record on the animals reaction to disturbance is linked with observation records on the visitors, using date and group number. The following data were registered: species, group size, flight distance (estimated) and reaction.

Video observations

In addition to the questionnaires and observations, day-long permanent video surveillance was carried out over a period of three months which registered visitors entering the National Park. The evaluation of these recordings provided information about the means of transportation the visitors used to arrive at the Park, their number, as well as of the number of boats and their temporal distribution. The classification of visitors, according to the type of boat, enables a linkage of this data with that obtained from observations and questioning.

INTENSITY OF LEISURE TIME USAGE

The goal of the three-month-long video observation was to document the quantity and temporal distribution of boating, according to boat type, in the old arms. This determined, on the one hand, the magnitude of the influence of leisure time usage on the fauna in the old arms and, on the other hand, the linkage of video data with the results of questioning could determine the temporal distribution of boat and visitor categories.

In the three months under investigation, 689 boats entering the National Park were identified. The categories included small canoes, large canoes, rubber rafts and kayaks. Small canoes accounted for 80% of all boats registered. The most boats were observed in June. On an average, 3-7 boats entered the National Park each day during the week, on the weekends and holidays this rose to 12-18 boats.

Boat type/ month	Canoes for 2-3 persons	Canoes for 10 persons	Dinghy	Kayak	Total	Mean per day
June	198	58	1	14	271	9.0
July	139	20	2	2	163	5.3
August	229	8	11	7	255	8.2
Total	565	96	14	23	689	

Table 2: Boat types recorded in the National Park per month (Video recording)

The average daily progression of the temporal appearance of boats represents the daily boat frequency in the old arm. On the average, on every weekday between 9 a.m. and 6 p.m. there is at least one boat en route in the old arms. On weekends, between 9 a.m. and 5 p.m., there are at least two and an average of three or four boats en route.

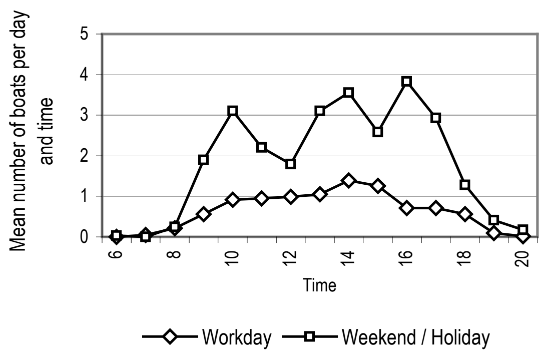


Fig. 4: Average daily number of boats entering and leaving - ordered according to weekdays and weekends and holidays (Video recording) .

The average duration, ordered according to type of boat (see table 3), permitted an exact calculation of the number of hours all boats spent in the old arms. During the week, boats were, on the average, en route 11-24 hours in the old arms. At the weekend this increased to close to 50 boat hours per day and, on the holidays, to almost 65 boat hours. This shows that, on holidays, on the approximately 4.5 km long old arm section, one must reckon permanently with one boat hour per old arm kilometer between 8 a.m. and 8 p.m. It follows that, during this period the avifauna has no - not even a brief - period of tranquility.

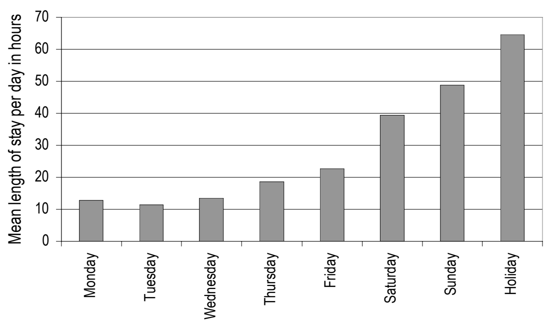


Fig. 3: Average weekly number of boat/hours in the old arm (Video recording) .

CATEGORIES OF BOAT USER AND VISITOR BEHAVIOR

The majority of visitors who go boating in Stopfenreuth come from Vienna or other areas close to the National Park. Almost all visitors arrive in their own car and, usually, in groups of two persons. The relationship between the sexes was balanced. The majority of the visitors is between 31 and 45 years old. More than one half of the visitors rented a boat on the spot. The main reasons for these boat trips are a family outing or to experience nature. The boaters are all satisfied and enthusiastic about their outing. Those questioned assumed that, through their presence, they caused no notable disturbance to the old-arm system.

During the week, comparatively few visitors came, the majority took advantage of the weekends and holidays to go boating.

The linkage of the results of questioning and observation (counting, video observation) permitted us to define four individual types of boaters. The type of boat was the main criterion which permitted the simple linkage of data obtained from observations and questioning with that from video observation.

Behavior of the boaters

In general, the observations of the groups showed no major deviations in the behavior of the visitors in respect to their influence on the fauna. The majority of the visitors behaved in a peaceful and appropriate way. However, the rules concerning swimming (only permitted in the traverses) were not always respected. We could not establish any connection between inappropriate behavior and the type of boat and size of the group. The longer a group stayed in the old arms the more likely they were to have a rest or go swimming.

The boating experience of those seeking recreation was recorded on only one day, because it only became apparent, within the framework of our observation, that this also was an interesting parameter in characterizing the boaters. It can be summarized, without having observed it systematically, purely from the point-of-view of the observer, that those people who visit the Danube Floodplains with their own boat have experience in boating. Those who rent a canoe are difficult to categorize in respect to their experience; there are both experienced and inexperienced persons among them.

	Family excursions	***Hobbyists***	***Large groups***	***Regularly coming solo paddlers***
Type of boat	*Small canoe, for 2-3 persons*	*Kayak, canoe, rubber boat (also suitable for white-water rafting)*	*Large canoes (for up to ten persons)*	*Kayak*
Boat private / rented	*rented from the canoe rental in Stopfenreuth*	*private*	*rented from the National Park*	*private*
Users	*Twosomes, small groups*	*Groups of 2-3 persons*	*School classes, company excursions, organized tours*	*mainly single elderly men (or women)*
Motivation for the visit	*Recreation, family outing*	*Nature experience, sport, recreation, partially family outing*	*Nature experience*	*were only observed, not asked*
Type of route	*Short routes, radius of action - mainly the Stopfenreuther Arm*	*Travel throughout the entire old-arm system and also the Danube*	*Short routes, radius of action - mainly the Stopfenreuther Arm*	*Cross the Danube near Hainburg, travel through the old-arm system and then return.*
Boating experience	*None - medium*	*Experienced*	*Experienced – inexperienced (except the guide)*	*Experienced*
Arrival time	*All day*	*All day*	*Usually arrive in the morning one hour before the other boaters*	*All day*
Duration	*Approx. 3 hours (mean 3.2 hours)*	*Up to 6 hours (mean 4.2 – 4.6 hours)*	*Up to 4 hours (mean 4.3 hours)*	*Short periods (approx. 2 hours)*
Arrival	*Car*	*Car*	*Car, bus*	*Boat*
Knowledge of the surroundings	*None, or map provided by the renter*	*Map, good knowledge*	*The guide has good knowledge*	*Good knowledge*
Percentage of boaters	*82%*	*6%*	*12%*	*/*

Table 1: Type of boat journeys (Wagner et al. 2001, video-recording)

DISCUSSION

Particularly on the weekends and holidays - which accounted for approximately one third of the days under observation - the stress is extremely high. Lengthy periods of time when the water-dependent fauna, such as water birds, can come to rest did not exist in the three months of our survey in the old arms. Boats are constantly in transit in the old arms and this results in the water birds being permanently scared up and driven in front of the boats through the linear old-arm system. Eichelmann (1993) determined that, during a one-hour canoe tour, mallards were disturbed 3-4 times by the same boat. This means a disturbance every 15 to 20 minutes for the birds. On holidays, during the periods we researched, where on the average 2 to 4 boats are en route each hour, the birds are not even granted this brief respite.

Other groups of boaters, who were not recorded by our video observations because they entered the old arm at other points, further increase the stress placed on the fauna of the region. Based on the observations and results of another study (Arnberger, Brandenburg 2001), kayak paddlers were almost as frequent as canoeists using boats for 2-3 persons.

The group of dinghy owners, who visit the old arm for angling, could also not be registered because their dinghies are moored permanently in the old arms. These dinghy owners usually carry out their hobby in the early morning or in the evening - even during inclement weather - increasing the stress placed on the fauna of the old arms.

The results clearly show that the potential of the old-arm system as a habitat for species and individual animals can not be exhausted if there is more intensive exploitation. This exploitation is the result of the spatio-temporal interaction of various categories of users - particularly during the weekend and holidays.

Inevitably, as the results of observations into the disturbance behavior of animals show, some species have become adjusted to the high number of visitors. The average flight distance of mallards - observed by the authors - is 10 - 60 meters, that of gray herons 20 - 60 meters (Wagner et al. 2001). Approximately 10 years ago Eichelmann (1993) calculated the flight distance of mallards as 100 - 370 meters and, 80 - 250 meters for gray herons, if startled by a paddler. The sample size of the observed flight distance is, however, too small to provide an authoritative statement. The reduction of this flight distance, as shown within the framework of the authors' studies is due, to a large degree, to the usually peaceful behavior of the visitors.

Even though the potential of the old arm can not be fully utilized, due to the large number of visitors who, therefore, only see a limited number of animals, satisfaction was still very high. The attractive environment and the, compared with urban waterways, smaller number of visitors, could also play a part. It could also be because only a portion of visitors come to experience nature; many boaters gave a family outing or recreation as their motive for the visit. However, they would not need a national park to satisfy those desires.

MANAGEMENT

We could discuss many possible management scenarios but, in mainly, the protection of nature and the leisure time demands of the population should be taken into consideration, particularly because this area is an important regional recreation area for the inhabitants of Vienna and Lower Austria. When discussing limitations of leisure time usage in the old arm; the possibility of boating in the old arms should, however, still be made available, as the Spittelauer and Stopfenreuther Arm are, more or less, the only possibilities for boating. Consequently, all paddlers are concentrated here, but most of the other old branches of the national park are not stressed by recreational use.

Quantitative and temporal limitations of leisure time usage in the old arm

Even though the visitors all behave in an appropriate manner, the high boating frequency in the summer months leads to disturbances to the avifauna. In principle, the time when the old arms can be used should be more compressed to grant more peace for the fauna. A ban on boating on specific days, or a limitation to certain times of the day, based on further studies on the affect of the implication of leisure time usage on the avifauna, could be other considerations. If a temporal concentration of boat usage is considered, this would lead to a major diminishing of recreational quality and the nature experience of the individual because he would come across fewer varieties of animals but even more boaters. An additional limitation on the number of boats would, therefore, seem desirable.

A further approach could be to include the Danube in the boaters' routes. If all the boaters in Stopfenreuth first had to travel downstream on the Danube the old arms would only be reached at a later time and the boat frequency would be halved because the boaters would not travel in both directions over the same route. Admittedly, security considerations speak against this solution because one needs a certain skill to boat on the Danube.

An additional possibility would be to offer regular trips to the old arms in a large canoe - every two or three hours at the weekends. The large capacity of such a boat would reduce the number of individual trips and the visitors could be informed about the ecological system of the old arms by qualified personnel.

Information

According to the results of our survey, 75% of the visitors to the National Park did not know their way around. It is, therefore, necessary that tourist maps be placed at neuralgic points to show more clearly which arms can be traveled and, in general, to provide more information on what is permitted, particularly regarding boating. An additional important indication of "dos and don'ts" could be signposts at critical points of the waterway system. An information center at the entrance to the National Park and old arm in Stopfenreuth could provide facts on the impacts of leisure time activities on the old-arm system.

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Types of Conflicts between Recreational Use and Nature Conservation in National Parks and Biosphere Reserves

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Abstract: Conflicts between recreational use and nature conservation vary in their causes, development and impact as well as in the people or groups involved and finally in the strategies and methods of resolution. They are neither generally avoidable nor can they be solved in an absolute way. However, most of them can be moderated by communication and discussion. The conflicts in national parks or biosphere reserves do not develop independently of each other. Usually several conflicts exist at the same time, in the same region and maybe between the same people. Therefore strategies of park management should be directed not only to an isolated conflict alone but to the entire system of conflicts in the region. Predicting and examining conflicts can help to avoid or reduce severe conflicts. The typifying of conflicts between recreational use and nature conservation in national parks or biosphere reserves can be used to describe relations between conflicts and strategies of solutions.

THE CONCEPT OF CONFLICT

Social science speaks of a conflict only when there exist a clash over antagonistic and/or irreconcilable interests, targets or values between at least two parties. Recreational activities in sensitive landscapes and damage caused by tourism are therefore not to be considered as conflicts but rather to be regarded merely as problems, differences or potential conflicts.

Conversely, the conflicts between recreational use and nature conservation are distinguished by their subject from other fields of conflict. Subjective issues alone are not being disputed, but also the protection and utilisation of actually existing landscapes. Ecological and utilisation factors (structural conflict potentials within one region) are the grounds for conflicts as often as are the interests and targets of the subsequent parties in such a conflict. Therefore a conflict between recreational use and nature conservation can only be understood when social and regional-structural factors are considered in combination.

STRUCTURAL CONFLICT POTENTIALS WITHIN ONE REGION

The potentials for conflict, as with conflicts themselves, consist of divergent elements, which can be characterised by the following pairs of opposites:

- The same landscape is assessed as both deserving of protection and attractive for recreation and leisure-time use.
- There exists an unfavourable balance between the sensitivity of a landscape and the intensity of its touristic use.
- The countryside and space utilisation requirements for specific activities are in opposition to nature conservation restrictions.

The qualities of deserving protection and being attractive are not objective characteristics but the results of assessment. Their similarity is based on the use of practically the same assessment criteria, in particular the proximity to nature, variety, uniqueness and rarity. These criteria are used as reasons for nature conservation as well as for the claims of its utilisation by those seeking recreation and the tourist industry. The demands for conservation and those for utilisation may be compatible or competitive, or on the contrary they may also be mutually exclusive.

The main problem of nature-related recreation and leisure utilisation exists in the relation between sensibility and intensity of use. Conflicts do not result from the tourist utilisation per se, but from the amount of utilisation, its distribution within one region, seasonal use and from the types of leisure-time activities. Here the term "utilisation" includes the tourist infrastructure as well as the activities of those seeking recreation or other leisure activities. The more sensitive a landscape is to anthropogenic influences, the sooner the critical burden is reached. Therefore the conflicts do not arise only in extremely sensitive areas or regions of mass tourism, but also in circumstances of differing intermediate phases.

Another constellation for conflict arises in cases where claims to use a special area for leisure-time activities are in contrast to legal restrictions, for example in conservation areas. Limitations arising from that do not concern only the feelings of individuals, but are much more a matter of basic rights such as the use of water resources for aquatic sports, ski facilities or the demands for airfields for recreational flying.

CONFLICT PROCESS AND CONFLICT MANAGEMENT

Dealing with the parties to a conflict, interactive processes, personal and situational conditions do not differ fundamentally from other fields of conflicts which have been examined more thoroughly by social science. By using sociological and social-psychological approaches and models not only important realisations about the course of conflicts and possible solutions in the fields of recreational use and nature conservation can be gained, but socio-scientific views can be introduced into a field of research which until now has been dominated by the natural sciences.

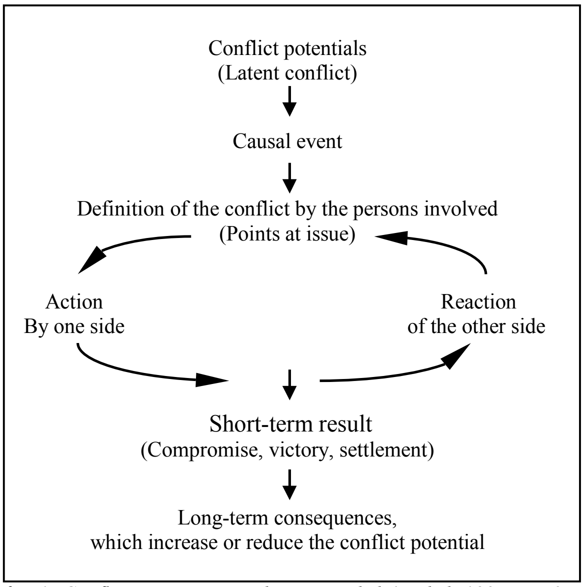

fig. 1 Conflict process according to Berkel (Berkel, 1997, p. 40 modified)

Conflicts between recreational use and nature conservation often exist over long periods of time and are rarely settled in a lasting way, but mostly by compromise, temporary or permanent regulations. Their dynamics are characterised by the alternation of phases of escalation and phases of quiet (latent conflicts). Conflict management and resolution are inherent parts of the conflict process (see fig. 1).

TYPES OF CONFLICTS

By grouping conflicts by type typical conflict situations can be described which have common features in their causes, their course of development, in the ways and methods of their settlement and finally in the results of the conflict. It is the basis for

- the structuring of the conflict field between recreational use and nature conservation in the same region,
- identification of general tendencies and of regionally-specific arguments,
- description of affected relationships between conflicts, and the
- development of regional conflict strategies, which involve potential conflicts and their effects in planning and management from the inception.

On the one hand, the grouping is based on the characteristics of the conflict structure – subject of the conflict, conflicting parties, conflict type, relations of area and time, conflict results, conflict effects – and on the other hand on the systematisation of the subject conflicts in the regions to be examined (combination of deductive and inductive processes).

At this point the eight types of conflicts in respect of area utilisation shall be represented (see fig. 2). Conflicts of interest and aims which are the background to this have to be further analysed because of their complicated structures.

The first four types of conflicts are of a structural type and usually are present in a permanent way, even when their intensity varies. The second group of conflicts is determined more by individual actions. The third group of conflicts concerning touristic and nature conservation projects arises from expected changes in the status quo, when either disturbances to the countryside or restrictions of leisure-time and/or commercial activities are feared.

Wherever **leisure-time activities** are done **in sensitive countryside areas** the recreation and leisure-time activity demands conflict with nature conservation targets. First, conflicts arise when ecologists and environmentalists notice the over-use of waters, dangers to embankments, dry areas or swamps, and restrictions of use are demanded or announced (e. g. the closing of hiking trails, the shift of ski trails). In the wake of the implementation of nature conservation measures conflicts break out which were latent until then. They are settled by the intensified public relations work by the conservation area administration and the involvement of leisure-sports associations in revising of concepts for hiking or ski trails.

At **heavily frequented and very popular destinations for outings,** e.g. the *Brocken* (Harz mountains), the *Königsstuhl* (Rügen island) or the *Wasserkuppe* (Rhön mountains), the ecological effects of mass tourism and rivalries for utilisation between recreation-seekers and those engaging in leisure-time activities, add up to a complex web of conflicts with a multiplicity of people and entities involved (recreation seekers, the tourism industry, leisure-sports associations, communal administrations, nature conservation entities, reserve administration). Concepts for utilisation, disciplinary and regulatory measures can significantly reduce conflict potentials. However, these can be partial solutions only.

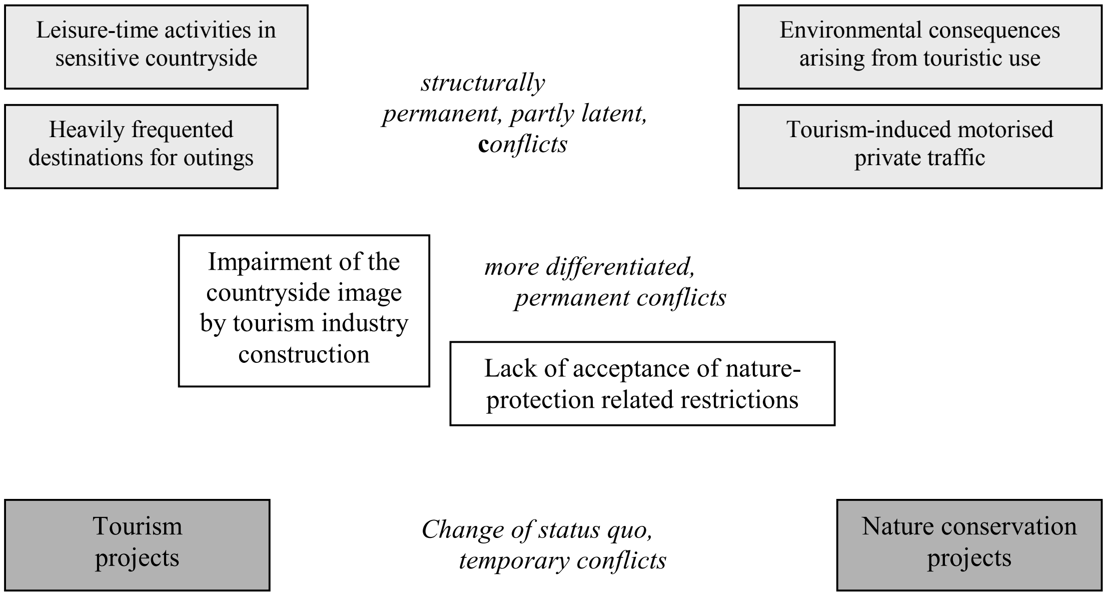

fig. 2 Types of conflict

Conflicts concerning **consequences for the environment because of the use for tourism** are still too seldom topics for discussion, especially in consideration of the increased use of countryside and consumption of resources and problems of waste disposal and dumps. When water pollution could be significantly reduced through implementation of sewage plants, other conflicts, as for instance about drinking water production or surface impoundment, flare up only sporadically. Most the time they are not solved completely but are rather neglected after the more serious problems have been dealt with.

The **impairment of a countryside's image by constructions for the tourism industry** is still a potential for conflicts despite the general improvement in construction design. Attracting criticism, for example, are the dimensions of leisure-time facilities or the increasingly dense construction of more and more buildings along the coasts of the Baltic Sea. More aesthetic aspects make the dispute much more difficult than it would be in cases of pure scientifically provable ecological interrelations. They require an individual assessment of the concrete regional situation. These conflicts are more latent, proceed less dramatically and can be resolved at least in the long term.

Conflicts, which arise due to the disregard of regulations to stay on paths, or leaving ski trails or unleashed dogs, are the result of a **lack of acceptance of nature conservation based restrictions**. Often they are to be disputed only with individual – a majority of the time – domestic recreation seekers and leisure-time users. However, they can further escalate (up to a lawsuit) and can diminish the acceptance of the conservation reserve or its administration. Such conflicts cannot be solved but can be reduced by intensified information and clarification.

Tourism projects – in this category medium-sized and large projects are especially considered. They do not only have effects on the environment but also on economy and society. Thus not only environmental organisations reject them. Conversely, **nature conservation projects** (e.g.. designation of national parks or biosphere reserves, plans for extensive state-sponsored nature conservation projects) evoke resistance from the users involved. In both cases the conflicts are dealt with in an open fashion. They include many people in the region and can escalate quickly. The parties in the conflict form coalitions for or against the project. However, such conflicts exist only for a limited period and will be settled (e.g. by modifying the project, by imposing constraints, by compromises in the regulations or by the project’s refusal).

TOURISTS IN NATIONAL PARKS AND BIOSPHERE RESERVES

Comparable interviews of tourists in five regions under examination shall further complete the image of tourists in national parks and biosphere reserves:

- Spreewald (534 interviewees),
- Rügen (Rügen island 530 interviewees and Hiddensee island 306 interviewees),
- Neusiedler Lake (401 interviewees),
- Harz mountains (640 interviewees) and
- Rhön mountains (589 interviewees).

Main areas of investigation were the characterisation of groups of leisure-time users, cognition of nature conservation measures and protective territories and the use of various means of transportation within the region (see Ziener 2001).

Given alternatives	all interviewees	Spreewald	Rügen island	Hiddensee island	Neusiedler Lake	Harz mountains	Rhön mountains
Recreation	87	83	87	89	89	89	85
Nature – walking/bicycling	83	88	77	93	75	88	81
Country and people – museums/culture	68	74	63	75	62	69	68
To be active, sports	34	33	32	27	48	34	33
Variety of leisure-time offers	27	28	25	11	28	35	26

Table 1 Holiday interests of people seeking recreation and leisure-time activities (shares in percent)

Spreewald	Rügen island	Hiddensee island	Neusiedler Lake	Harz mountains	Rhön mountains
Prohibitions 11	Prohibitions 17	Coastal protection 37	Prohibitions 22	Signs 13	Signs 15
Streams 8	Signs 13	Barriers 28	Signs 12	Forest measures 13	Prohibitions 10
Signs 7	Coastal protection 11	Signs 22	Landscape preservation 11	Barriers 10	Landscape preservation 9
Infrastructure 6	Barriers 7	Prohibitions 10	Barriers 10	Prohibitions 8	Infrastructure 8
Cleanliness 5	Protected areas 7	Infrastructure 8	Nature conservation 5	Re-naturalisation 7	Nature conservation 4
Nature conservation 5	Infrastructure 6		Waste disposal 5	Infrastructure 5	Barriers 4
Landscape preservation 5	Cleanliness 4		Infrastructure 4	Nature conservation 3	Forest measures 4
Barriers 3					Visitor guidance 4
Re-naturalisation 3					Named places 3

Table 2 Groups of measures which were stated by at least 3 percent of the interviewees (in percentages)

When questioned "What is of special importance for you when you make holidays?", the interviewees were not to answer with individual leisure-time activities, but were presented structured sets of interests to chose from. The result was a clear differentiation (see table 1). One half of the interviewees exclusively want recreation, want to move outside in the natural environment and/or want to visit cultural events or sites. Sports and various other leisure-time activities were of interest primarily for young people under 30 years of age, who visited the region only for daytrips or short holidays. From the combination of these holiday interests six groups of leisure-time users could be derived:

- Recreation, nature and culture related interests (31 % of the interviewees, primarily elder interviewees from 50 years +),
- Variety of holiday interests (28 % of the interviewees, more elder interviewees from 50 years + and families),
- Recreation and nature-related interests (13 % of the interviewees, more elder interviewees from 50 years +),
- Recreation, nature and sports or the variety of activities on offer (7 % of the interviewees, primarily younger interviewees, under 30 years of age),
- Recreation, sports or the variety of activities on offer (4.5 % of the interviewees, more younger interviewees, under 30 years of age, and families),
- Recreation only (3.5 % of the interviewees, rather younger interviewees, under 30 years of age).

The responses when asked about the acceptance of nature conservation related restrictions or the extension of protective measures, shows that tourists often do not know enough about regulations for protected areas to be able to decide about them. For this reason, these tourist interviews started by mentioning measures of nature conservation and landscape preservation one step before (open question, without multiple-choise answers). More than half of the interviewees, on Hiddensee island even three quarters, could name conservation and preservation measures which they had taken place in the region. However, it became obvious that the perception of nature conservation measures depends upon subjective factors (e.g. personal interests in nature conservation, receptivity), as well as depending upon objective conditions in the region (e.g. ability to perceive them in the countryside, local information).

MODEL OF A PUBLIC TRANSPORTATION SYSTEM WHICH IS BASED ON ASPECTS OF TOURISM

Even though tourist traffic should not be considered in isolation from other types of traffic (e.g. commuters, through traffic), a public transportation system which takes into account aspects of tourism can be regarded as a contribution to solving traffic problems in tourism regions. First approaches for such a model for the nature park and biosphere reserve regions examined here shall be explained by the example of Rügen island.

In respect of the development of the public transport system Rügen island has a favourable

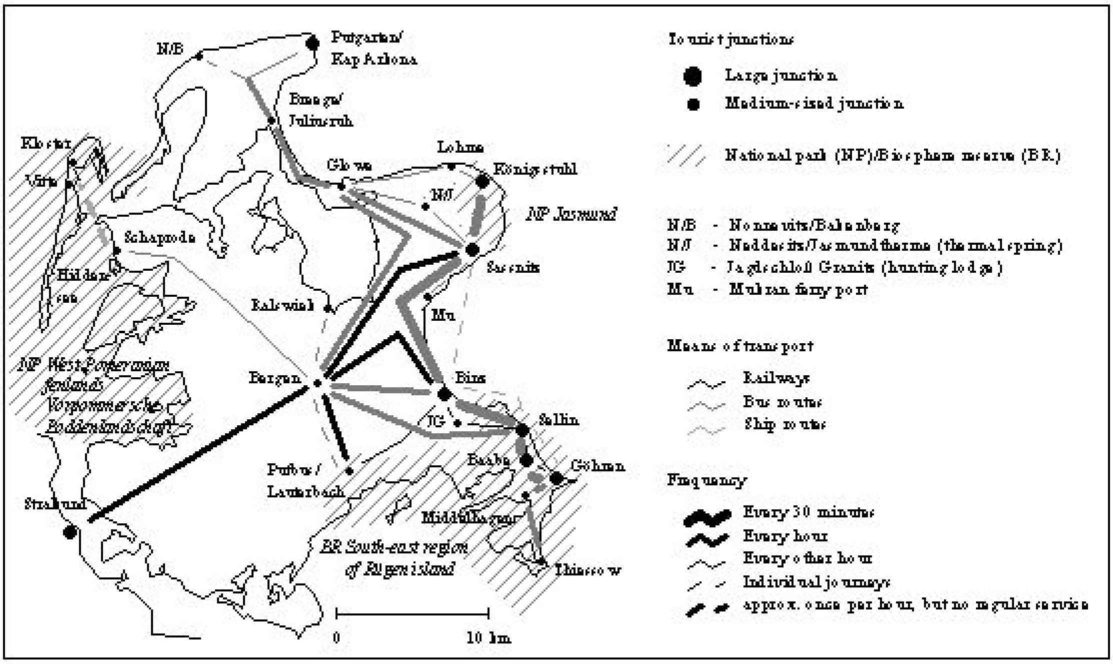

Fig. 3: Public transportation connections between tourist junctions on Rügen island, summer 1999, Mondays through Fridays (source: Rügen Transport timetable, RügenVerkehr, *summer 1999)*

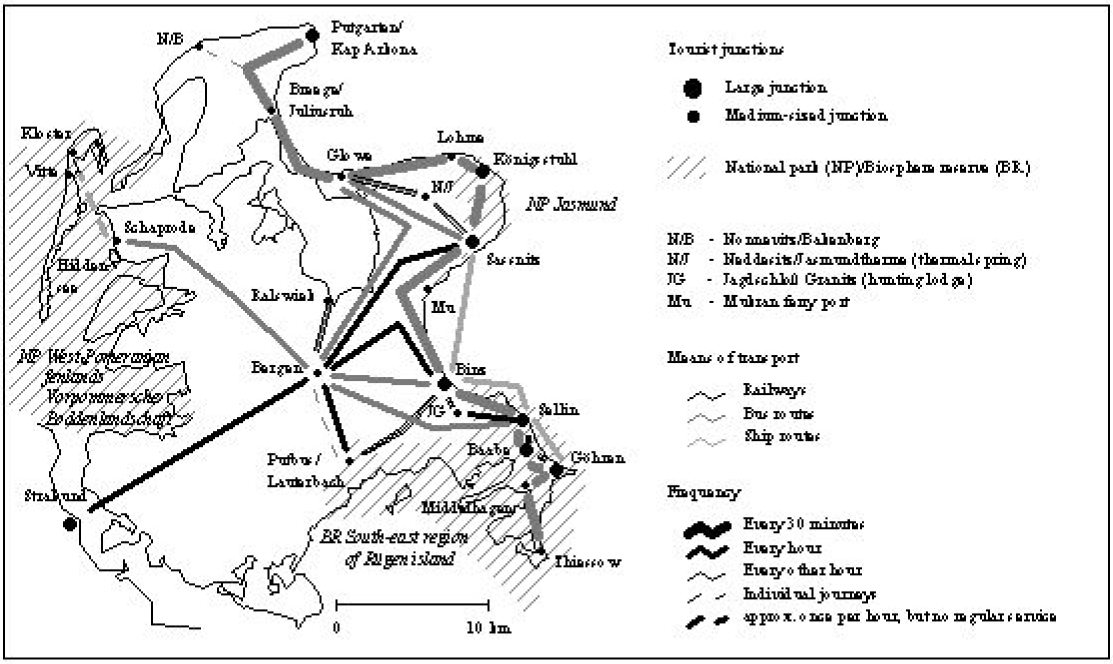

Fig. 4: Model of a tourist-orientated public transport system on Rügen island

touristic structure. Most of the bigger centres of tourism concentrate along the east coast. The Rügen causeway is the only one important access to the island. As the rural district of Rügen is a political and administrative unit, the conditions for organisational measures are also good. However, the previously existing transport agency which combined the various transport carriers has been wound up.

The model shall certainly not cover nor organise the entire public transport on Rügen island, but rather re-structure the tourism-related transport by using an user-specific approach which is based on the directions tourists take. The operationalisation was done by

- determination of big, medium and small touristic junctions by a quantitative and qualitative assessment of all the single tourist destinations,
- determination of the most popular places for outings within the region and
- secondary analysis of discoveries about tourist activities and on the transport corridors they

move along (e.g. evaluation of survey results and studies).

Streams of tourists are supposed to occur only between big and medium touristic junctions. Therefore only these streams have been taken into account for the model, and till now only the high season times have been investigated.

The traffic relations between junctions of tourism and their schedule frequency and the central contents of the model are shown in fig. 3 and 4. Here the main schedule frequency between 9 a.m. and 6 p.m. was used; on weekends the public traffic offers sometimes are clearly reduced. In the case of parallel traffic lines crossovers have been created (e.g. in Sagard - between Sassnitz, Bergen and Glowe), and so the whole structure of the public transport system became even much more complicated.

The model's main contents are (see fig. 4):

- Introduction of a transport frequency of every half hour for the whole route between Thiessow and Putgarten/Cape Arcona: This bus line connects 14 of the 22 large and medium junctions (with about two thirds of the overnight stays in this rural district), with the two most popular tourist destinations on Rügen island, *Königstuhl* hill and Cape Arcona, among them. Rügen's most beautiful beaches (Schaabe, Schmale Heide, Großer Strand), the Hagen car park near the Jasmund national park are linked by this route, and if need be also the Mikran ferry port (possibly a shuttle service). The permanent availability of public transport is an essential condition for its use for outings across the island (see Ziener, 2001). For bathers a through busline is more attractive than a bus shuttle (in the early '90s this was a plan to solve transport problems around Schaabe).
- A through bus line from Binz or Thiessow through Bergen to Schaprode. Regarding outings to Hiddensee island, the private automobile can only be substituted by bus transport if there exist through lines from Sassnitz, Binz, Northern and South-East of Rügen or short transfer times between the lines.
- Regular ship lines between the Baltic Sea spas of Göhren, Sellin, Binz and the city of Sassnitz (so-called pier line), at first every other hour, at later times preferably every hour. Because of the island's geographic situation near the GDR's border line, ship lines between the spas don't enjoy a long tradition. However, they could be an important supplement by sea to the bus transport along the island's east coast which is marked by a strong tourism industry.
- Flexible solutions for Ralswiek and Neddesitz. The remote *Jasmundtherme* is located between the island's main traffic lines. The town of Ralswiek is known by tourists because of the *Störtebeker* festivals which take place on a natural stage; public transport connections should be available especially in the evenings (currently exist only outing offered by bus companies).
- Regular rides during evening hours. Depending on the traffic relation, the busses should go until 8 p.m., 10 p.m. or even later.

The realisation of this model will be implemented primarily in the medium term and only in consideration of the real demand. It requires active marketing efforts. Usually car drivers do not inform themselves about bus transport, so they have to be provided this information.

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APPENDIX

ad Figures 3 and 4

National park (NP)/Biosphere reserve (BR)
NP Jasmund
NP West Pomeranian fenlands *Vorpommersche Boddenlandschaft*
BR South-east region of Rügen island

Tourist junctions
Large junction
Medium-sized junction

Means of transport
Railways
Bus routes
Ship routes

Frequency
Every 30 minutes
Every hour
Every other hour
Individual journeys
approx. once per hour, but no regular service

N/B - Nonnevitz/Bakenberg
N/J - Neddesitz/Jasmundtherme (thermal spring)
JG - Jagdschloss Granitz (hunting lodge)
FM - Mukran ferry port

0 10 km

Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Observing visitors behaviour as a methodical alternative to questionnaires – a proposal

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Abstract: Basing on case studies in South-West- and North-East-Germany techniques of hidden observation such as observing visitors behaviour with binoculars from far distance are discussed. Their origin in ethological field studies is reflected, ethical aspects are mentioned and the conditions to produce valid data are qualified. Especially in case of analysing non-legal behaviours direct questionnaires are often not be able to clear whether serious damages in the protection areas are resulting or not. Also the intentions of “breaking the rules” cannot be reflected totally by socio-empiric methods. On the other hand behaviour observations require a lot of time and energy and should be limited on serious indications because of ethical aspects. So it is necessary to describe conditions and cases, where observing techniques can be implemented successfully.

INTRODUCTION

The discussion about visitors influences on protection areas is dealing with two not solved questions:

1) How can be “measured” a direct relation between visitors will, visitors activity, and biotope damages or disturbances ?
2) Do we have valid definitions on what we call “biotope damaging or disturbance by visitors” ?

The following contribution deals mainly with the first question. Its intention is to describe practical methods of getting data on visitors behaviour and activity. But nevertheless it is necessary to solve the second question too, because the ideas of what should be evaluated as damage or negative influence are changing. In one of our test areas for example the light erosion processes initiated by visitors foot steps can be declared as constructive elements in revitalizing traditional biotopes. Furthermore new results in disturbance ecology should be mentioned in this case (ANL 2001). Generally the evaluation of several disturbance sources is changing a lot.

To mention these problems without page-consuming explications, the neutral term “influence” is used instead of “damage” or “disturbance”.

The main idea of the proposed methods is that there might be no fundamental difference between observing behaviour and activity of animals or man. A lot of observing methods are common in animal ecology. Habitat suitability and usage of almost any bird or mammal species are investigated with a bright acceptance – so why not to use these techniques with man as objects ?

Of course some ethical aspects should be mentioned in this context: Are any legal or ethical rules be endangered by observing techniques ?

BASING STUDIES AND STUDY AREAS

Between 1993 and 2000 we proved the proposed methodical equipment in four studies:

1) A study on negative influences of very intensive visitors appearance in large grassland areas (Kaiserstuhl, SW-Germany, Coch & Hirnschal 1998)
2) A diploma work on visitors behaviour in a coastal forest (Rügen, NE-Germany, Thomas 1995)
3) A diploma work on visitors behaviour in an alluvial forest (Taubergiessen, SW-Germany, Schenck 1996)
4) A study on nature reception in an extended beach forest area near Zurich, Switzerland (Coch et al., in prep.)

The complete set (see table 1) has not been proved in one area since yet, so we call it a proposal and are very hopefully looking forward to initiate further discussions.

CONVENIENT SAMPLING METHODS

Coch & Hirnschal (1998) are giving an overview to convenient sampling methods in case of observing visitors behaviour and activity.

To describe the intensity of visitation normally a “census” is used: From hidden or open counting points the number of visitors is sampled. Often technical solutions decrease the personal stuff, e.g. by using infra-red photoelectric barriers and counting machines. As result the total number of visitors and the daily or seasonal frequency of visitation can be used as indicators.

By counting the visitors it is not possible to get data about the intentions of the visit. From several studies (compare e.g. Ammer & Pröbstl 1991) it is well-known that different intentions are creating different behaviour patterns. In the Kaiserstuhl area for instance the special intention of finding rare plant species creates a certain movement in the area (Institut für Landespflege 1993). Other foot paths are used, the speed of moving is very slow. In the case of developing behaviour rules for the visit of protected areas the importance to have data about the visitors intentions should be underlined. Convenient data sources are questionnaires. This can be done directly by asking the visitors or indirectly by distribution of form-sheets, which can be filled in and sent back by the visitor (e.g. Ott 1994). Practical problems with questionnaires can be summarized as following:

- The possibilities to get representative data are limited. In typical cases only five percent or less of the visitors are asked.
- The returning rate of form sheets is low (between 20 and 40 %) without any gratifications. It can be increased with several facilities (Ott 1994)
- The possibilities to get a differentiated impression about the specific influences are limited, because "hidden" or "illegal" activities are concealed.

Nevertheless in most cases questionnaires are used to work out guidance models of visitors flow in protected areas.

THE VIEW BEYOND THE END OF ONE´S OWN NOSE: COMPATIBLE ETHOLOGIGAL METHODS

In ecological sciences a impressive variety of sampling methods can be found (bride overview in Eibl-Eibesfeldt 1999). Because of the comprehensible relations between visitors behaviour and effects on the biotopes and their plants or animals. Especially the sampling methods using fixed sampling rates or defined sampling techniques to assess habitat use and quality (such as Hildén 1965 describes) might be interesting to discuss in context of developing methods to produce data for a qualified visitors flow management.

Collecting valid data on mans or animals behaviour causes the following conditions (following Lorenz 1957):

- The observer does not influence the behaviour of the observed objects. This can be guaranteed in three different ways: There is a fitting fractal distance between observer and object (common especially in studies about bird behaviour, e.g. Jenni 1983). Instead of the fractal distance a "mental nearness" can take place (e.g. the well-known chimpanzee-studies by Jane Goodall (1986) or Konrad Lorenz itself with his geese. The third approach bases on disguising or hiding the observing intentions and can be compared with the strategy of hunters.
- The way of observation must be methodically fixed. This is an indispensable condition for an objective evaluation of the results. In practise this requirement is very hard to solve, because the variety of visitors behaviour is high. Examples of stratifying visitors behaviour or action are given in table 1.

Behaviour/action	**Observed as:**
Lying in the grass and smoking a cigarette	Comfort behaviour, position is to be assessed (e.g. with GPS-coordinates)
Jogging on a foot-path	Moving behaviour, direction is to be assessed
Digging out a rare orchid	Special activity (taken from an extended list), position is to be assessed (e.g. with GPS-coordinates)

Table 1: Examples of stratifying visitors behaviour in an observation campaign .

- The conditions of variables, which seem to influence the result of observation, should be assessed. In case of observing visitors this can be realized with assessing e.g. the actual weather, the weather forecast of the evening before, the actual TV-programme, the blooming flower species…
- Certain hypotheses should be elaborated to give the directives in analysing and evaluating the collected data. In case of working out rules for the visitors flow these hypotheses should refer on the main objectives of critical relations between visitors behaviour and possible damages or disturbances (negative influences), e.g.: Hypothesis a: "Open grassland invites to walk outside of the foot-paths" against Hypothesis b: "The frequency of walking outside the foot-paths does not correlate with the vegetation structure".

In the next chapter several techniques in collecting data to evaluate visitors behaviour are discussed basing on the field experience of case studies mentioned above.

OBSERVATION STRATEGIES TO COLLECT DATA ON VISITORS BEHAVIOUR

In our case studies we proofed three different strategies dealing with two different conditions of protection areas: size and vegetation structure. In large areas it is not possible to have a permanent overview on moving visitors from one observation point. Areas covered with mixed vegetation types (grassland, forest) do not allow observation from outside viewing points. Table 2 offers the three solutions we found.

area	Proposed observing strategy
Open land, <100 ha	"One point outside" - strategy: behaviour observation with binoculars from one viewing point in near distance (< 1000m)
Open land, 100-500 ha	"Several points outside" – strategy: behaviour observation from middle-far distances with highly magnifying lenses (> 20times) and several observation localities
Mixed land, without size limitation	"Several points inside" – strategy: behaviour observation within the area, from hidden viewing points or disguised as visitor

Table 2: Overview: Proposed methods to observe visitors behaviour and activity.

"One point outside" - Strategy

The observer takes position on a viewing point outside the observed area, on which it is possible to overview more than 75 % of the object. It can be advantageous to hide the viewing point, especially, when the observation should last some time. Before starting a time system should have been worked out with fixed observation times and days spread in a representative way over the observing period. Useful background information can be the estimated frequency of visitors flow. It is necessary to observe on days with minimum frequency too, because there might be a relation between typical behaviour patterns and frequency (e.g. "digging out orchids" does not take place on periods with high frequency). Convenient working tools are binoculars (ten to twelve times magnifying) and writing utensils. Alternatively a Dictaphone can be used. Best working position is in about 500m distance from the observed area, but using binoculars with high magnification it is possible even to work up to 1200m distance. Depending to the magnification the viewing field should not exceed 150 meters. Behaviour patterns or activities should be mentioned in a stratified way as the examples given in table 1.

"Several points outside" – Strategy

In case of large protection areas to be observed it is not useful to work only with one viewing point. By using several viewing points the planning of the monitoring campaign should mention a representative spreading of viewing times over all viewing points. It is very helpful to work with as many observers as viewing points are, so that observing can be planned in an simultaneous way. Possible distances may rise to 3000 meters by using monocular glasses with high magnification (30 to 60 times). The working procedure is not differing from the "one point outside" – strategy.

"Several points inside" - Strategy

The evidence of visitors flow management is usually increasing with the size of the protected area. Especially in the National Parks flow management is well implemented, but there might be cases to proof the success. Using ethological methods this task can be solved with the "Several points inside – Strategy". Instead of fixed viewing points outside the area the observers are using hidden or disguised positions inside. The observing technique must be adapted to the way of hiding or disguising: Using raised hides the procedure can be same as in "Point outside – Strategies". Being disguised as "innocent visitor" the observing method can lean on transect or line sampling with planned sampling routes. In this case the usage of a Dictaphone with an extern microphone is recommended. The conditions depending on a representative way of spreading the observing periods should be mentioned.

ATTIBUTES TO ASSESS WITH ETHOLOGICAL METHODS

Comparing questionnaires with ethological field methods significant differences in the assessed attributes can be identified:

- The personal background of a visitor can be assessed very precisely with direct or indirect questions. "The art of questioning" produces qualified information even to aspects visitors think better to hide. With observation strategies only physiological attributes (sex, age) are assessable.
- The real activity is not assessable with questionnaire. Even in combination with some assessed behaviour aspects (e.g. the main activity just before beginning the questionnaire) the special situation of questioning and answering, which can be identified by the visitors rather early, will modify the behaviour patterns. Naturally the emphasize of ethological assessment is set on a precise reporting of behaviour patterns.
- Questionnaires often are interested in future actions. The interviewer tries to find out, what visitors will do depending to different conditions (e.g. "Will you visit this nice forest when you have to pay one Euro next time ?"). Observing can not produce data with relation to future.

Table 3 shows possible attributes to be assessed with ethological field methods in case of deriving a visitors flow management. The "ideas of interpretation" should be understood only as proposal.

Attribute	idea of interpretation
Actual activity, stratified assessed	Variety of activities on different locations, preference on special activities depending to location, weather, physical conditions, potential negative influences
Speed and direction of moving	Preferences on main routes, indicator of possible disturbance (real frequency in parts of the area)
Continuity of moving	Special interests or needs, potential negative influences
With-carried tools	Special interests, potential negative influences
Social behaviour	Social needs of the visit, relations between activities and social aspects
Sex and classified age	Age or sex-depending needs or preferences

Table 3: Some proposed attributes of an ethological field assessment and ideas of interpretation in case of deriving a visitors flow management.

ETHICAL ASPECTS

Ethological field data to elaborate a visitors flow management are affecting personal rights of the visitors. Especially hidden observation can not be tolerated without the following rules on data security and bewaring of personal rights:

- All data is assessed without personal interest on the identity of the visitors.
- All data is handled anonymously.
- All data is stored without any possibility to identify the observed persons later on. This means that – in opposite to the practice in ethological sciences – no photographic techniques or movies should be allowed.
- Situations which require observing strategies are given. There is no “lack of methodology” in cases requiring only data on the quantity of visitors flow (e.g. in case of constructing adapted parking or resting places in an protection area).

CONCLUSIONS AND NOTES OF THANK

In several cases the elaboration of visitors flow management plans requires data to visitors real intentions, activities and behaviour. The methodical input of ethological field studies allows to collect those data objectively. First experience is made in different areas. It would be very exciting to proof this methods in very large areas (National Parks) in future. Of course traditional questionnaires should not be substituted but supplemented with ethological methods.

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Monitoring and Management of Visitor Flows in Recreational and Protected Areas
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Simulation of Recreational Use in Backcountry Settings: an Aid to Management Planning

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Abstract: Simulation models of recreation use patterns can be a valuable tool to managers of backcountry areas, such as wilderness areas and national parks. They can help fine-tune existing management programs, particularly in places that ration recreation use or that require the use of designated campsites. They can assist managers in evaluating the likely effects of increasing recreation use and the implementation of new management programs. They also can be used as a monitoring tool, being particularly helpful in predicting encounter levels in the interior as a function of easily measured counts of recreationists entering the area. The first backcountry travel simulation models were developed in the 1970s. They were never widely used, however, primarily because simulation runs were costly and difficult. Recent improvements in computer technology have ushered in a new era of travel simulation modeling.

INTRODUCTION

Although most outdoor recreation occurs at developed sites, growth in dispersed recreation has been rapid, particularly in backcountry areas, such as in wilderness areas and national parks. Management of such places presents some unique challenges. Because backcountry areas are typically large and remote, contacting and counting visitors is difficult, as is monitoring and controlling the distribution and behavior of visitors. Moreover, management objectives for backcountry areas typically stress the importance of minimizing both contact between visitor groups and regimentation of behavior.

Where growth in recreation use of backcountry has been substantial, managers have often responded by attempting to control amount of use and influence the distribution of use. In many areas, standards for acceptable numbers of encounters between visitor groups have been developed within management plans. Managers seek to monitor encounter levels and implement actions needed to keep conditions in compliance with standards. In many areas, visitors want to camp away from other groups but are required to camp only in designated campsites. If too many groups plan to camp in the same general area on the same night, this can be problematic. Groups are either forced to share a single campsite or one group must move on to the next available campsite or create a new campsite nearby.

All of these management actions depend on having an understanding of the spatial distribution of use within a backcountry area. In a number of backcountry areas, overnight visitors are required to provide a fixed itinerary for their visit and to stick to that itinerary. In these places, the spatial distribution of overnight use can be estimated. However, even in such places, many visitors do not stick to their itinerary (Stewart, 1989) and day visitors are not included. Moreover, requiring visitors to stick to a fixed itinerary reduces opportunities for exploration and spontaneity, important elements of the recreation experience. Consequently, fixed itinerary requirements are often among the most undesirable management approaches for many visitors. Where fixed itineraries are not required, information about the spatial distribution of use is typically anecdotal at best.

This suggests the value of models capable of predicting the spatial distribution of use within a backcountry area and how this distribution might respond to various management scenarios. This value has been recognized and explored since the 1970s. Romesburg (1974) proposed the use of mathematical decision modeling to develop management scenarios that minimize encounters among users, given a constant level of recreation use. Peterson at al. (1977) used a Markov-based linear programming model to predict interior use levels within the Boundary Waters Canoe Area Wilderness, Minnesota, USA, as a function of the number of groups entering various peripheral trailheads. This model was subsequently used to establish quotas for trailheads, designed to keep interior encounter levels within acceptable limits. In more recent work, scientists at Mount Rainier National Park, Washington, USA, are using regression modeling to predict the number of hikers at one time on interior trails as a function of vehicle counts at entrance gates.

Most attention, however, has been devoted to simulation modeling. In this paper I, first, describe some of the important potential uses of simulation modeling of backcountry recreation use and, second, provide a brief historical overview of efforts to date.

USES FOR TRAVEL SIMULATION

There are at least three ways in which simulation modeling of recreation use can contribute to improved management. First, it can help fine-tune existing management programs. Where amount of recreation use is rationed, simulation models can help backcountry managers develop rationing programs that optimize the tradeoff between amount of use and crowding within the backcountry and minimize loss of freedom and spontaneity. In contrast to rationing programs that utilize fixed itineraries, programs that utilize trailhead quotas minimize loss of freedom and spontaneity, because recreationists are free to travel wherever and whenever they want once they gain access to the area. With trailhead quotas, the challenge to the manager is to set quotas such that total use is maximized without causing unacceptable levels of congestion at specific locations within the backcountry area. This is difficult to do given the complexity of travel patterns and the minimal information available about travel patterns. Simulation models allow the manager to "experiment" with different trailhead quota schemes to identify a program of trailhead quotas that optimizes the tradeoff between amount of use and congestion.

Simulation models can also help fine-tune management programs in which camping is only allowed at a limited number of designated campsites. The challenge with designated sites is to control use levels and distribution such that (1) the total number of designated sites needed to accommodate a given amount of use is minimized and (2) unoccupied sites are available to all groups, so that few groups need to either camp with another group on a designated site or make a new campsite. Most backcountry areas with designated sites require recreationists to create and adhere to a fixed itinerary of designated campsites. This approach accomplishes the objectives just described, but it severely constrains freedom and spontaneity and, perhaps in response, many recreationists deviate from their itinerary (Stewart, 1989). Simulation modeling can help managers achieve these same objectives without having to resort to fixed itineraries. Simulations can be used to predict the number of groups per night within different interior camping locations as a function of number of groups entering different trailheads. This understanding can be used to either alter the number of designated campsites in different interior locations or to adjust trailhead quotas on the basis of the current number and distribution of designated campsites.

A second use of simulation modeling is to evaluate alternative future scenarios. Simulation could be used to estimate how travel patterns and the number of encounters between groups might change with increased use in the future. It could also be used to assess the effects of an action taken to reduce use through a rationing program. It can help evaluate actions that might influence the spatial and temporal distribution of use, such as changing trailhead quotas, building or closing trails, or scheduling the timing of trips. Trial and error could also be used to evaluate any of these actions but simulation avoids many of the problems inherent to trial and error.

Finally, simulation models can be an important part of a monitoring program. In particular, many areas have developed management plans that include standards for a maximum acceptable number of encounters per day on interior trails and campsites. This indicator has proven to be extremely difficult to monitor effectively. Simulation makes it possible to use easily measured indicators (e.g., the number of groups entering at different trailheads) to monitor hard-to-measure parameters (e.g., number of encounters in the interior).

EARLY SIMULATION MODELS

In a paper published in 1975, Cesario (1975) describes a simulation modeling approach that utilized GPSS (General Purpose Systems Simulator), a simulation language designed to deal with scheduling problems. At about the same time, International Business Machines (IBM), Resources for the Future, and the Forest Service collaborated in development of a wilderness travel simulation model, also using GPSS language. The model was dynamic, stochastic and discrete, meaning that it represented a system that evolves over time, incorporates random components, and changes in state at discrete points in time (Law & Kelton, 2000). Two generations of the model were developed. The first generation (Smith & Krutilla, 1976) developed the basic model structure and was applied to a limited data set collected in the Spanish Peaks Primitive Area, Montana. The second-generation model involved adaptations to accommodate a wider range of situations and provide additional outputs (Schechter & Lucas, 1978). The need for these changes became clear when the model was applied to a more extensive data set for the Desolation Wilderness, California, an area that is much more heavily used than the Spanish Peaks.

The model included a replica of an area's travel network, its entry points, trails, cross-country routes and campsites. It distinguished between the travel patterns of different kinds of users (different group sizes and modes of travel) and of groups arriving at various times (different weeks, different days of the week and different times of the day). Each simulation involved generating groups of different kinds and different travel patterns arriving at various entry points, where they are assigned a specific travel route (set of trail segments and campsites). They move along this route, overtaking and passing slow groups, encountering groups moving in the opposite direction or camping along the trail and they camp at campsites, where they also may encounter other groups.

The data needed to make the model operational include detailed information on the travel network, visitors, and the travel patterns of different types of visitors. This data was generated through the use of surveys of visitors that included information on their characteristics and their travel patterns. Often a trip diary was used. Typically a number of simulation runs were conducted for different management scenarios. Summary statistics provide information on use patterns and number of encounters by type of encounter, type of group, and by individual trail segment and campsite. A variety of validity tests, based on data from the Desolation Wilderness, contributed a substantial degree of confidence to the model (Schechter & Lucas, 1980).

One unique aspect of the effort to develop the wilderness travel simulation model was the effort expended on working with wilderness managers in model development and testing, in encouraging others to utilize it and in developing user manuals and conducting training. Model developers clearly hoped the model would be widely used by many managers capable of building and running the model themselves. Indeed, the model was adapted and applied to river recreation (McCool et al., 1977) and a long-distance trail (Potter & Manning, 1984). On the Colorado River in Grand Canyon National Park, Arizona, Underhill et al. (1986) used the model to evaluate the effect of upstream dam operations on downriver whitewater boating patterns. In Yosemite National Park, California, and elsewhere in the Sierra Nevada the model was modified to simplify data collection requirements and used to generate trailhead quotas for some of the more popular wilderness areas in the United States (van Wagtendonk & Coho, 1986).

Despite this promising beginning, the wilderness travel simulation model never lived up to its original promise and fell into disuse. Much of this can be blamed on the cost and difficulties of running computer simulations in the 1970s and early1980s. Simulations often had to be run on remote mainframe computers, with individual simulations costing $100. With the advent of the personal computer, all this has changed. By the mid-1980s, Rowell (1986) reported that he had modified the wilderness travel simulation model so that it could be run on a personal computer. He also built in the capability to graphically represent output data in map form, making it spatially explicit. However, there was little effort to encourage use of this model and land managers apparently have never used it.

RECENT INNOVATIONS

Simulation modeling remains a needed tool to help backcountry managers fine-tune existing management programs and test hypothetical alternative management scenarios for managing encounter levels and the quality of the recreation experience. Recently, researchers assisting park and backcountry managers have developed new travel simulation models to assist in improving management programs. Two alternative approaches will be briefly described.

Manning and his associates have built simulation models for use in their "carrying capacity" research for several national parks, using the general-purpose simulation package, Extend (1996). Their models have much in common with the wilderness travel simulation models developed in the 1970s, but can be run on personal computers. In particular, simulated groups are assigned entire travel routes. For example, data collected on carriage roads in Acadia National Park identified 381 unique travel routes, which are randomly assigned to simulated groups on the basis of frequencies reported by survey respondents (Wang & Manning, 1999). The assignment of routes also takes into account variation in travel routes between different travel modes (walking or biking) and different group sizes.

Validity tests suggest the model provides a reasonably accurate representation of the system. Moreover, model output can be related to management planning standards that set maximum levels of congestion on the carriage roads, suggesting the levels of use likely to violate standards. The model has also been used (1) to assess how the scheduling of bus transportation in Yosemite Valley will influence levels of congestion at popular destinations (Budruk et al., 2001), (2) to relate the number of vehicles entering Arches National Park, Utah, to the persons-at-one-time at Delicate Arch, and (3) to adjust entry quotas at arrival points at Isle Royale National Park, Michigan, to minimize the problem of multiple groups having to use individual designated campsites on the same night.

Gimblett, Itami and their associates have taken a different simulation approach in applied research for land management agencies in Australia and the United States. Employing an object-oriented, individual-based simulation approach, they have developed the Recreation Behavior Simulator (RBSim). Instead of assigning groups entire travel routes, autonomous agents make decisions, on the basis of behavioral "rules" derived from visitor surveys, along the way, responding to what is encountered (Gimblett et al., 2000, 2001). Their approach couples the use of multi-agent systems with geographic information systems (GIS) to produce simulation models which are much more flexible and complex than previous models. Interestingly, they have developed models for the Sierra Nevada and the Colorado River (Daniel & Gimblett, 2000) two of the places where the original wilderness travel simulation model was developed.

Data input requirements for RBSim include the same types of data needed to operationalize other simulation models. However, to realize the advantages of more complex decision-making that RBSim allows for, additional information is needed to develop the "rules" that drive the artificial intelligence techniques employed. Typically, rules are initially derived from expert opinion, but are subsequently modified on the basis of observation of patterns of inputs and outputs of the model, under a variety of operating conditions (Gimblett et al., 2000). To the extent that "rules" vary substantially between areas, additional model development and programming will be needed to apply RBSim in a new place.

RBSim can produce the same types of information about travel patterns, encounters, and other measures of congestion that other simulation models can. It also provides spatially explicit visualization capabilities that can be very helpful in gaining insight into the behavior of recreationists, as well as the spatial pattern of use. Perhaps of most importance, RBSim should be more capable of predicting the effect of management scenarios far removed from the present situation. For example, RBSim is capable of assessing the effect of building new trails, something other approaches cannot do.

CONCLUSION

Clearly, backcountry managers could profit from ready access to models capable of simulating travel patterns and recreation behavior. Managers of any backcountry area could utilize the ability to monitor interior conditions by simply measuring visitor use at trailheads. Those with significant concerns about managing recreation use would profit from the ability to explore the conditions likely to result from different choices between management scenarios. Those managers that have implemented rationing systems or that require the use of designated campsites could use simulation to fine-tune their systems. The recent innovations in simulation technology described above suggest the potential to provide managers with ready-access to this tool. When the wilderness travel simulator was developed in the 1970s, considerable effort was expended on developing a generic tool, supported by training manuals and training sessions, to make the tool readily available for use by managers. A similar technology development and transfer effort, based on recent improvements in technology, seems vitally important at this time. Although it will never completely replace the need for ongoing innovation and research-driven improvements to simulation technology, there is a substantial need for a simulation tool that managers can use without having to contract the work to researchers.

To develop such a tool, it seems timely to describe the types of outputs needed from a generic simulation tool. Then, the data input and programming requirements, as well as the output possibilities, of alternative simulation technologies could be compared. Hopefully, one (or a few) technologies would meet the criteria of (1) providing most of the requisite outputs, (2) having data input and programming requirements that can be met by the personnel of land management agencies, and (3) being user-friendly enough to be used by land management personnel. If so, programming work could be done to develop a generic tool with front-end interfaces that make it easy for the nonexpert user to parameterize the model. Training manuals could then be written describing data requirements, how to run the model and how to generate and interpret output. Finally, training courses could be provided and effort expended to encourage the use of the tool.

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Video Monitoring Visitors as a Management Tool: Identifying the Issues

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One consequence of providing for recreational use of parks, forests, and open space is the negative impact of such use on the resource (Watson, Cole, Turner, & Reynolds, 2000). In order to develop strategies to mitigate negative consequences associated with use, managers must be able to quantify the types and amount of use that occur. Typically, managers will begin to estimate use through counts of visitors at developed sites, such as information centers or campgrounds, where staff can make the counts during their normal work routine (Hornback & Eagles, 1999). With experience these managers then identify the limits to this type of data gathering (some visitors will not go to either the campground or the information centers, while others will make several trips to the information center during one visit) and seek more sophisticated means of estimating the number of visitors to an area.

The most common means of non-intrusive measurement are through the utilization of mechanical traffic counters which tally visitors through the use of infrared beams, sensor plates, or loops which trigger a counter. Although these types of counters can be very accurate when properly calibrated, the calibration process can be time consuming and expensive. Even when properly installed, mechanical traffic counters provide no indication as to the approximate age of the participants, the size of the group, or the type of activities in which visitors are engaged.

In an effort to gather more accurate and more detailed information researchers linked mechanical counters to cameras so that an image would be recorded each time the counter was triggered. Due not only to the costs of equipment, but also due to functionality issues which have yet to be resolved, such as limited storage space for images, power supply, camera installation, and data analysis, this type of system is not in widespread use. Alternatively, some researchers have mounted cameras with a dedicated power supply which have been allowed to run continuously to monitor all use on a given segment of trail. In those cases analyzing the vast amount of data recorded can be challenging.

With the dramatic pace of technological development, new solutions to monitoring visitor use are on the horizon. This session will address recent technological advances in video monitoring as well as identify the needs of researchers interested in conducting studies employing this data gathering methodology.

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