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Towards assessing thermal and dynamic reaction scenarios of different permafrost sites in the European Alps: One action within the PermaNET project

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Summary

A large part of permafrost in the European Alps is at or close to melting conditions and is therefore very sensitive to degradation caused by atmospheric warming. Knowledge regarding permafrost distribution and its climatologically driven dynamics in the entire European Alps is still far from being complete. The project "PermaNET – Permafrost long-term monitoring network" attempts to close some of these major gaps in permafrost knowledge. One action of this project is concerned with the assessment of the thermal and dynamic reaction scenarios of 20 permafrost study sites distributed over the European Alps. Study sites and research strategy are presented here. Some of the study sites are located within national parks and other protected areas.

Keywords

European Alps, permafrost, reaction scenarios, climate change.

Background

High altitude and high latitude regions are generally recognized as being particularly sensitive to the effects of the ongoing climate change. A large part of permafrost in the European Alps for instance is at or close to melting conditions and is therefore very sensitive to degradation caused by atmospheric warming. Knowledge regarding permafrost distribution and its climatologically driven dynamics in the entire European Alps is still far from being complete.

The project PermaNET

The new European Union co-funded project "PermaNET – Permafrost long-term monitoring network" was launched in July 2008 and attempts to close some of the major gaps in permafrost knowledge in the European Alps (for details please visit www.permanet-alpinespace.eu). The main motivation for carrying out PermaNET might be seen from two different points of view:

Scientific view: e.g. consolidation and regional compilation of existing knowledge, standardisation of monitoring, set-up of an alpine wide permafrost monitoring system (comparable to the permafrost monitoring program PERMOS in Switzerland)

View from practice: e.g. How to deal with permafrost related hazards in natural risk assessment and management? What is going on in areas affected by permafrost degradation caused by present global change?

Based on this motivation the following three main objectives have been formulated:

Alpine-wide permafrost monitoring network

Alpine-wide permafrost map and database

Common strategy for dealing with permafrost and related hazards under changing climatic conditions

Assessment of thermal and dynamic reaction scenarios of different permafrost sites

One out of seven work packages of PermaNET focuses on the assessment of the relationship between permafrost and climate change (i.e. WP5). Within WP5, one action is concerned with the assessment of the thermal and dynamic reaction scenarios of different permafrost typologies in the European Alps. Research in this action is carried out in two steps:

Step 1: Establishment of the relationship between measured climate data and observed thermal and geomorphic permafrost reactions (Table 1) using available datasets collected during the last years and decades in many study sites (*cf.* Chapter 4) located within the European Alps. Such datasets include for instance ground temperature measurements (at the surface and in shallow and deep boreholes), rock glacier displacement rates or observations on mass movement events triggered in areas affected by permafrost (e.g. rock falls).

Step 2: The established relationships in the first step of this action in combination with data from predictive climate models will form the basis for simulations and estimations of changes in permafrost distribution (vertically and horizontally), in the active layer thickness or in the rates of rock glacier displacement.

Table 1: Possible thermal and geomorphic permafrost reactions relevant for PermaNET.

Possible thermal permafrost reactions
Increasing ground temperature (in bedrock, fine and coarse sediments) and hence permafrost warming
Thawing of Permafrost with three effects: (1) reduction in the spatial extent of permafrost, (2) active layer thickening, and (3) increasing ground-water circulation and pressure
Changes in the number of freeze/thaw cycles and magnitude (duration and intensity) of freezing and thawing periods
Possible geomorphic permafrost reactions
Changes in the rate of rock glacier displacement (vertically and horizontally)
Changes in displacement mode of rock glaciers (initiation of basal sliding, collapse)
Changes in solifluction rates*
Changes in cryogenic weathering (freeze/thaw cycles, ice segregation)*
Changes in the volume and extend of unstable/unconsolidated materials
Changes in frequency and magnitude of mass movement events (e.g. rock fall, rock slide, debris flow)*

*not strictly related to only permafrost but to periglacial environments in general

Selected study sites

The assessment of thermal and dynamic reaction scenarios of different permafrost sites is carried out at 20 sites within the European Alps. Figures 1 and 2 depict, respectively, the location of the study sites within the European Alps as well as visual impressions of some of the study sites. Table 2 gives an overview for each of these study sites.

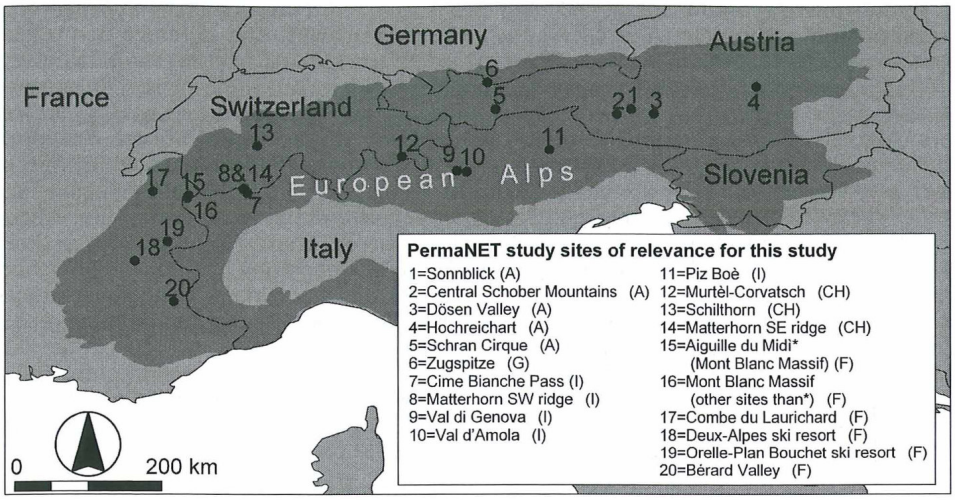

Figure 1: Location of the 20 PermaNET study sites relevant for the assessment of thermal and dynamic reaction scenarios of different permafrost sites in the European Alps.

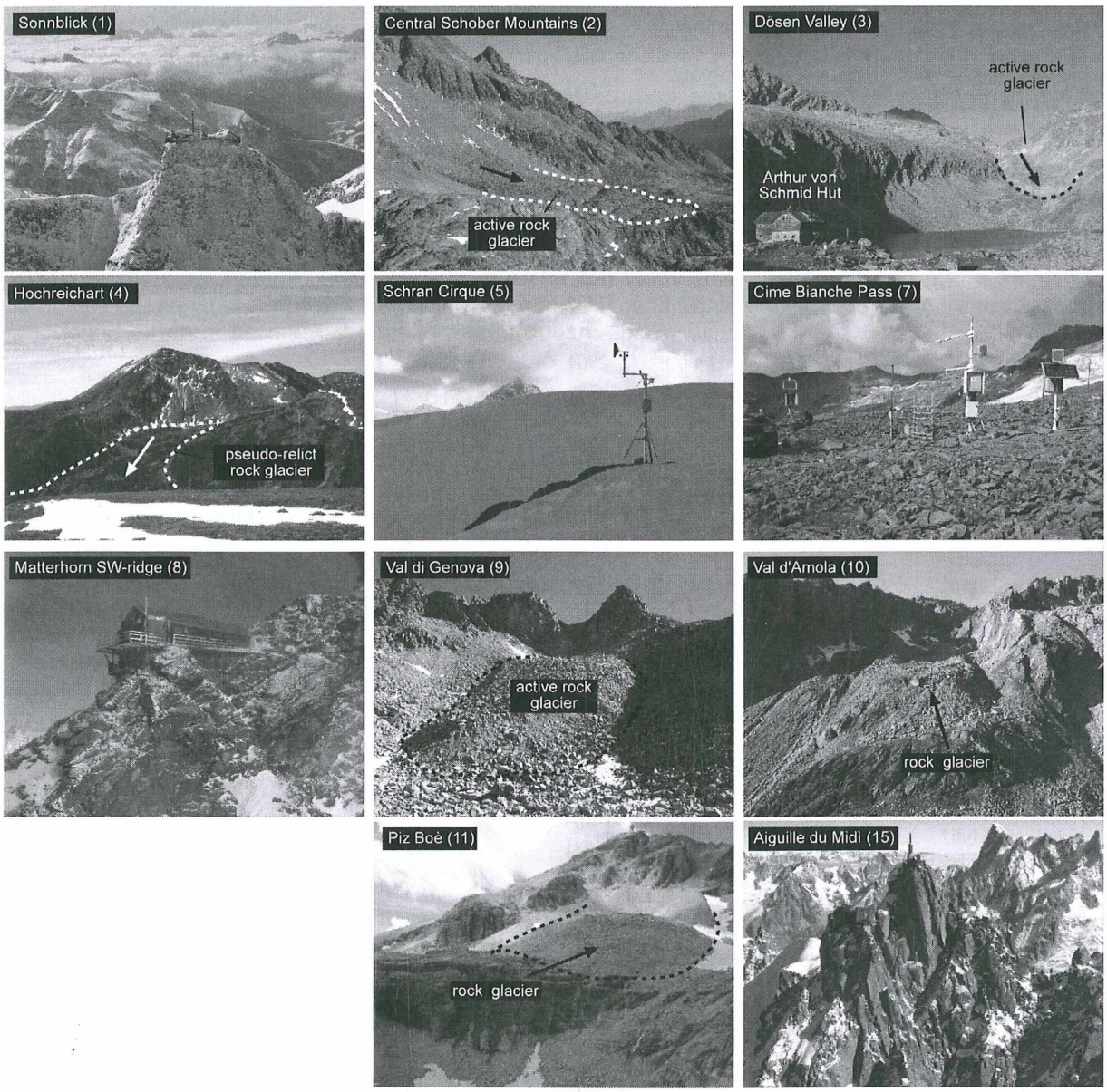

Figure 2: Visual impressions of 11 of the 20 PermaNET study sites relevant for the assessment of thermal and dynamic reaction scenarios. The numbers in brackets refer to the numbers in Fig. 1 and Table 2. The study sites range from just below 2000 m a.s.l. (study site Hochreichart) to about 4000 m a.s.l. (study sites in the Mont Blanc Massif). All photographs provided by the authors of this paper.

Table 2: Overview of the study sites relevant for the assessment of thermal and dynamic reaction scenarios of different permafrost typologies in the European Alps within the project PermaNET. The different permafrost monitoring sites are: **PF-bedrock**=Permafrost in bedrock (from near-vertical rockwalls to flat morphologies); **PF-fine**=Permafrost in fine-grained material (relatively flat morphology); **PF-coarse**=Permafrost in coarse-grained and blocky material; scree slopes, rock glaciers (from slopes to rather flat morphologies); Project partners and collaborators: **LfU**=Bavarian Environment Agency, Department 10: Geological Survey, Economic Geology, Soil Protection, Munich, Germany; **ARPA VdA**=Regional Agency for the Environmental Protection of Valle d'Aosta, Aosta, Italy; **ARPAV**=Environment Protection Regional Agency of Veneto; **GeoVE**=Regione del Veneto, Direzione Geologia e Attività Estrattive, Servizio Geologia, Venezia, Italy; **GST-PAT**=Autonomous Province of Trento, Civil and Territory Protection Department, Geological Survey, Trento, Italy; **UIBK**=Institute of Geography, University of Innsbruck, Innsbruck, Austria; **IGRS**=Institute of Geography and Regional Science, University of Graz, Graz, Austria; **ZAMG**=Central Institute for Meteorology and Geodynamics, Regional Offices for Salzburg and Upper Austria, Salzburg, as well as Vienna, Austria; **IGA-PACTE**=Institut de Géographie Alpine, University of Grenoble, France; **EDYTEM**=EDYTEM Lab, Université de Savoie, CNRS, Le Bourget-du-Lac, France; **Uni Trento**=University of Trento, Department of Civil and Environmental Engineering, Trento, Italy; **Uni Zurich**=Department of Geography, University of Zurich, Zurich, Switzerland; **Uni Pavia**=Earth Science Department, University of Pavia, Pavia, Italy ; **Uni Bonn**=Department of Geography, University of Bonn, Bonn, Germany.

Name of study site (code see in Fig. 1)	Co	Latitude	Longitude	Elevation range/max. (m a.s.l.)	Main studied landform or process	Re-search initia-tion	Permafrost monitoring site	Involved project partners and collaborators
Hoher Sonnblick (1)	A	47°03'N	12°57'E	3106	bedrock, detritus	2007	PF-bedrock PF-coarse	ZAMG
Central Schober Mountains (2)	A	46°57-59'N	12°47-49'E	2500-2725	rock glacier, rock wall,	1997	PF-bedrock PF-fine PF-coarse	IGRS
Dösen Valley (3)	A	46°59'N	13°17'E	2400-3000	rock glacier, rock wall	1995	PF-bedrock PF-fine PF-coarse	IGRS
Hochreichart (4)	A	47°22'N	14°41'E	1920-2416	rock glacier, rock wall, detritus	2004	PF-bedrock PF-coarse	IGRS
Schran Cirque (5)	A	47°04'N	11°06'E	2400-3496	rock glacier, morainic deposits	2008	PF-fine PF-coarse	UIBK
Zugspitze (6)	G	47°25'N	11°00'E	2964	bedrock		Pf-bedrock	LfU, Uni Bonn
Cime Bianche Pass (7)	I	45°55'N	07°42'E	3100	bedrock, detritus	2006	PF-bedrock PF-coarse	ARPA VdA
Matterhorn SW ridge (8)	I	45°58'N	07°39'E	3750 - 3830	near-vertical rockwalls	2005	PF-bedrock	ARPA VdA
Val di Genova (9)	I	46°13'N	10°34'E	2750-2860	rock glacier	2001	PF-coarse	GST-PAT, Uni Trento, Uni Pavia
Val d'Amola (10)	I	46°12'N	10°42'E	2330-2480	rock glacier	2001	PF-coarse	GST-PAT, Uni Trento, Uni Pavia
Piz Boè (11)	I	46°30'N	11°50'E	2900-2950	rock glacier	2005	PF-coarse PF-bedrock	GeoVE, ARPAV
Murtèl-Corvatsch (12)	CH	46°25'N	09°49'E		rock glacier, bedrock	1980s	PF-coarse	Uni Zurich
Schilthorn (13)	CH	46°33'N	07°51'E	2973	mountain top	1980s	PF-bedrock	Uni Zurich
Matterhorn SE ridge (14)	CH	45°58'N	07°39'E		near-vertical rockwalls		PF-bedrock	Uni Zurich
Aiguille du Midi* (Mont Blanc Massif) (15)	F	45°53'N	06°53'E	3840	near-vertical rockwalls	2005	PF-bedrock	ARPA VdA, EDYTEM, Uni Zurich, Uni Bonn
Mont Blanc Massif (other sites as*) (16)	F	45°50'N	06°52'E	3000-4000	near-vertical rockwalls	2006	PF-bedrock	ARPA VdA, EDYTEM
Combe du Laurichard (17)	F	45°56'N	06°24'E	2450-2630	rock glacier	Ca 1980	PF-coarse	IGA-PACTE
Deux-Alpes ski resort (18)	F	44°59'N	06°09'E	2650-2720	rock glacier	2007	PF-coarse	IGA-PACTE
Orelle-Plan Bouchet ski resort (19)	F	45°15'N	06°36'E	2780-3050	rock glacier	2007	PF-coarse	IGA-PACTE
Bérard Valley (20)	F	44°26'N	06°41'E	2500-2850	fine grained rock glacier	2007	PF-fine	IGA-PACTE

Research strategy

Monitoring of permafrost temperature are performed on four different kind of permafrost sites primarily using miniature temperature dataloggers (MTD), thermistor-chains lodged in boreholes (from very shallow to deep) or calm-grid areas:

Permafrost and active layer in bedrock (from near-vertical rock walls to flat morphologies)

Permafrost and active layer in fine grained material (rather flat morphology)

Permafrost and active layer in coarse grained and blocky material (scree slopes, rock glaciers; from steep slopes to rather flat morphologies)

Thermal state of Little Ice Age moraines above 3000 meters of altitude (ice-cored)

Climate conditions at permafrost sites are monitored by meteorological stations.

Monitoring of dynamic conditions in permafrost environments is carried out by geodetic, photogrammetric, terrestrial laserscanning (LiDAR), DInSAR and DGPS techniques as well as visual observations and calculations. This monitoring focuses on:

Mass movement (e.g. rock fall) frequency and magnitude

Rate of rock glacier displacement (vertically and horizontally)

Rate of solifluction rates

Physical weathering (freeze/thaw cycles)

Numerical models for the estimation of deep temperature or spatial permafrost distribution will be used and calibrated using the field data and will complement the research strategy.

Outlook

This paper gives a brief overview of the planned and partly already initiated research activities within this project part of PermaNET. The project running period of PermaNET is until summer 2011. By then, we hope to understand in most of the study sites presented here more about the complex relationship between climate and climatic conditions and the thermal and dynamic reaction of different permafrost sites in the European Alps.

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Detection of land-use/land-cover change in the Hohe Tauern National Park using an object-oriented classification approach

Katharina Kern, Gerhard K. Lieb, Wofgang Sulzer

Abstract

Land-use/land-cover change reflects environmental as well as social changes. High mountain environments such as the Hohe Tauern Range are very sensitive to these changes. An excellent resource to analyse land-use/land-cover on different spatial and temporal scales is provided by remote sensing data. This study uses Landsat Multispectral Scanner (MSS), Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) images from the 70s to the present, historic orthophotos and GIS data to analyse the spatial pattern and its spatial temporal changes of land-use/land-cover. The aim of the study is to develop a generally applicable method to detect change in high mountain environments. Because of the high spatial diversity in high mountain environments, an object-oriented approach is used to classify the remote sensing data. Object-oriented classification is based not only on spectral but also on spatial information and allows avoiding "*salt-and- pepper*" effects in the classification. After a post-classification application it is foreseen to identify parameters and/or indicators to evaluate ongoing land-use/land-cover changes and their variability in space and time.

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Terrestrial habitat-mapping within the Hohe Tauern National Park - methods and results

Christian Keusch, Hanns Kirchmeir, Michael Jungmeier

Summary

In the course of a large scale biotope mapping which took place between 2006 to 2008 within 9 Pinzgau municipalities, also a large part of the Hohe Tauern national park was mapped. Based on the mapping manual of the federal state government of Salzburg (NOWOTNY et al. 1994), more than 12.000 biotopes and 200.000 vegetation data within the national park was collected. 146 different biotope types and 876 plant species were found in the national park, including several endangered species. It was the very first time a biotope mapping of this scale was carried out in Austria, with 39 mappers and a digital method to collect data of the area.

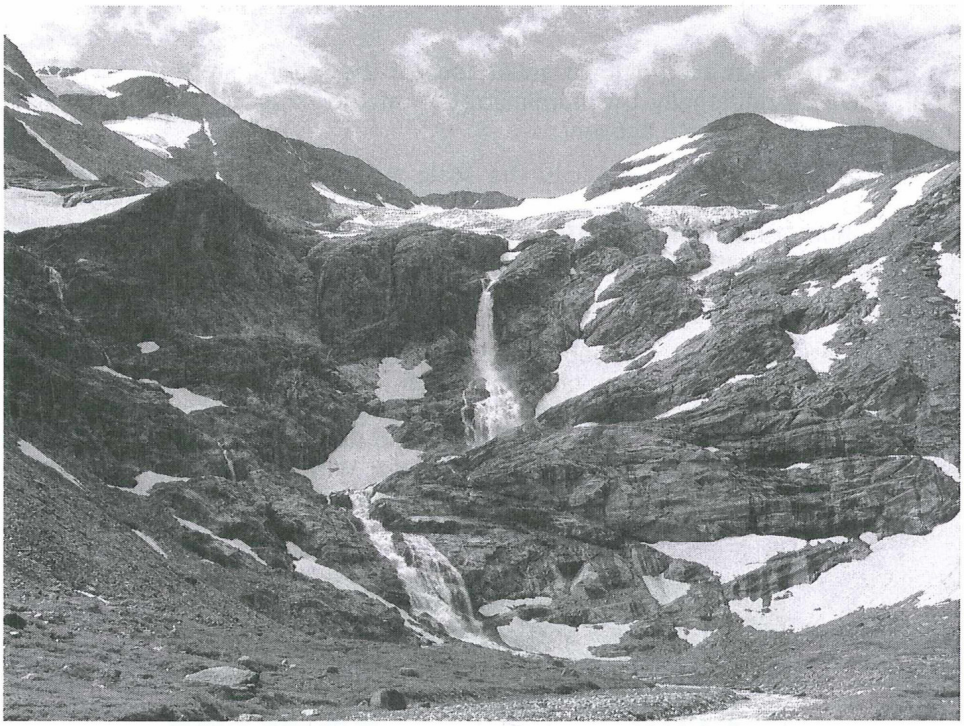

Figure 1: Head of the Kaprun valley (Author: D. Bock)

Keywords

terrestrial habitat-mapping, biotope mapping, vegetation ecology, digital mapping

Aims

The aim of the survey was to carry out a complete spatial collection and description of all relevant biotope types in regard to nature conservation, according to the Salzburg biotope mapping manual. This also included all current complements of the Natura 2000-habitat types. The spatial borders were defined according to the results of the air photo interpretation of the Hohe Tauern national park -Habitalp (BAUCH et al. 2006). The field survey was carried out in 2006 and 2007. The results were presented in 2008 to the municipalities.

Altogether the biotope mapping took place in 9 municipalities of Pinzgau and covered an area of more than 1114 km², of which about 526 km² concerned the Hohe Tauern national park. The present evaluation will only focus on the areas within the national park.

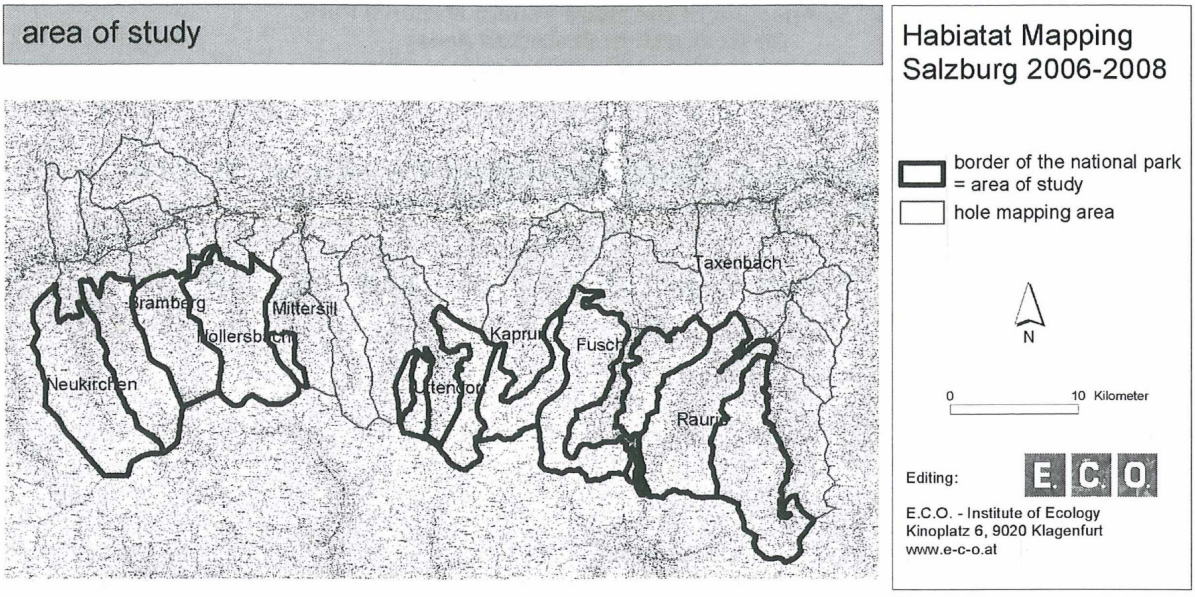

Figure 2: Area of study

Methods

The mapping was carried out according to guide lines of the federal state government of Salzburg (NOWOTNY et al. 1994). Additionally the administration of the national park had special guidelines which also needed to be taken into account.

Terrestrially the mapping was carried out in the scale of 1:5000. Basis for the mapping provided results of the aerial photographic interpretation (Habitalp), the moor mapping (WITTMANN et al. 2007) and aerial photographs taken in 1993 and 2003. The data of the moor mapping was not available in 2006 and could therefore not be taken into account until 2007.

A total of 39 mappers were assigned during the 2 years of field work.

For the first time in Austria a biotope mapping of this scale was carried out using a digital method of collecting data. Each mapper was equipped with a hand-held computer (Personal Digital Assistant – PDA) to input delineated data. Input of data was carried out on a specially programmed input screen. With this method it is possible to make the first controls and most notably to verify the completeness of the data already at the field survey. With a complete and correct input, the time consuming and error-prone input of the analogue mapping sheets after field seasons, could be avoided.

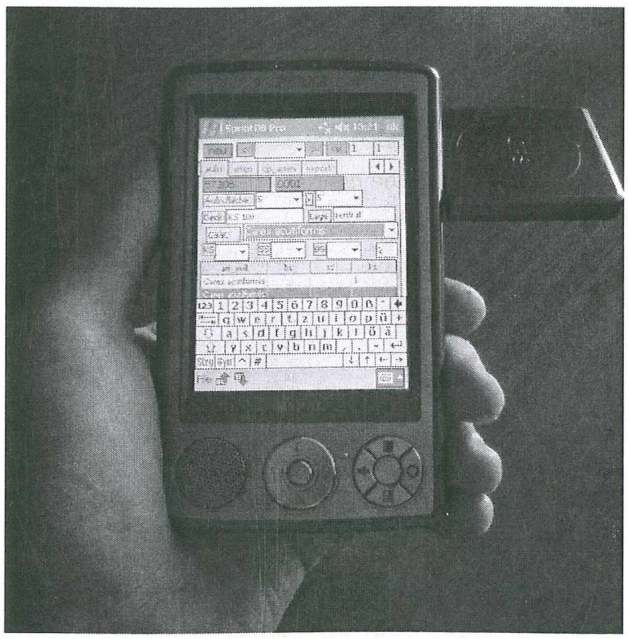

Figure 3: PDA with input screen of the vegetation survey

Additionally all PDAs were equipped with aerial photographs, mapping area borders and existing protected areas and Habitalp-borders. With help of these data as well as an integrated GPS the PDA could be used for orientation in field.

Following parameters were collected in field:

Cadastral municipality
Biotope type
Identification /Description
Name of editor
Date
Slope
Relief
Exposition
Geology
Description
Official protection, targeted
Obligated protection, actual
Obligated protection, targeted
Surrounding biotopes
Natural threat
Anthropogenic threat
Measures, actual
Measures, targeted
Function
Evaluation
Comments
Biotope structure parameter
Subsumed biotope types
Vegetation coverage
Location of mapped vegetation
Plant species list/mapped vegetation
List of animal species

Following parameters were addtionally supplemented via the Geographical Information Systems (GIS):

Municipality number
Object pointer
Surface
Altitude from to
Parcel numbers
Obligated protection, actual
Date of protection

The demarcation of the biotope borders in the field was made on analogue maps in A4-format. In connection to the field work these location data were transmitted to GIS. The external borders of the mapping area were additionally compared with existing biotope mapping data. After a detailed control of the data these were handed over to the Salzburg federal state government in the format of ESRI-shape files and ESRI coverage-files.

Figure 4: Example of a route map for the field work with preprinted Habitalp-polygons

Results

Presentations for the municipalities together with corresponding open house days of all mapping areas took place in 2008, and the official part of the project was successfully completed. The result was an extensive/selective mapping from valley to the summit regions.

12014 biotopes were collected inside the national park area. The biotopes are situated on an altitude range from 953 to 3640 m sea level. With a total area of 455,34 km² the mapped biotope area equals about 86 % of the total examined national park area. Whereas the core zone of the national park with 93% biotope area offers a higher amount than the buffer zone with 73%. According to the biotope catalogue of the mapping guide lines of the Salzburg federal state government 146 different biotope types were found in the project area.

Within the mapping there are 876 different vascular plant species, with 112 of these on the red list of Salzburg for endangered ferns and flowering plats (WITTMANN et al. 1996). Many of these 112 species are critically endangered. Some of these are even threatened with extinction.

Figure 5 shows the agreement and disagreement between terrestrial biotope mapping and the interpretation of infrared aerial images carried out in the Interreg IIIB Project HABITALP. About 98,5% of the biotope borders (outlines) could be taken from the HABITALP-Data. In most cases, several polygons of the HABITAL-Dataset were merged into one biotope-polygon. It should be noted that capacious studies about the qualitative agreements are still missing.

Figure 5: Comparison of the air photo interpretation and the terrestrial biotope mapping (black HABITALP, grey: Biotop border coincident with HABITAL, white: new biotope boarders)

Discussion

The result of the biotope mapping indicates the high level of nature in the national park. The total area of the 12014 biotopes mapped in the national park cover almost 86 % of the national park surface. Even though mapped areas of the national parks are on higher levels, a total of 146 different biotope types were collected. Therefor more than half of all biotope types surveyed in Salzburg (255) were found. Including almost all watercourse – , wetland habitats, alpine grass communities and biotope types of the high alpine/nival zone and numerous dwarf – shrub moores and forest types. The large diversity of biotope types and the high diversity of species gives the area a unique scenic nature. With 261 moor areas this national park houses several of the endangered and valuable habitats.

In recent times biotope mapping is enforced by the nature protection work (KICHMEIR et al. 2008, KIRCHMEIR et al. 2009). Especially in the case of protected areas, which are interested in carrying out a complete spatial collection and description of all relevant biotope types. Special attention relies on the modern spatial information systems because of there influence on natural resources management. Knowledge about the existing biotope creates a basis for decision- making actions and implementations.

Particularly for large national parks like the national park Hohe Tauern it is essential to organize such large scaled high quality mapping within a manageable time span. For this reason digital mapping has been used to assure a constant quality on high level throughout the project. The first examinations of the datawas done during the collection face outdoors. Due to the constant availability, data can be examined and collected at any time. Therefor the time consumption of inputting data in the field increases a bit, however it highly paid off during no post processing (like submitting data, corrections, etc.) is needed.

This aspect has already been deeply analysed by a project by E.C.O. in cooperation with the Technical University of Graz – department of geoinformation and the Joanneum Research (LIEB et al. 2008).

The project showed that the overall time consumption of this digital method outperforms previous methods. Nevertheless the new digital examination process also brings some slight disadvantages. Therefore staff training and specific instructions are necessary, since limiting factors such as battery life or entering of long texts become evident.

According to actual technical knowledge digitizing the borders within a biotope mapping is not yet possible. (LIEB et al. 2008). But this will be the long-term solution for biotope mapping.

Another important point is the compatibility of the requirement due to NATURA 2000 and the results of the biotope mapping. Due to some post-processing in the results of the biotope mapping, it can play a noteworthy contribution.

The project HABITALP (BAUCH et al. 2006) has shown that the spatial borders of the air photo interpretation can be used, in large parts, for the terrestrial biotope mapping, which is more precise in some aspects. Additional studies could also give a qualitative comparison of the two data sets. The results could give rise to more precise combinations and cooperation of similar projects like terrestrial biotope mapping and air photo interpretation.

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The lab above the clouds
Particle Number Concentrations at the Sonnblick Observatory

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Keywords

Aerosols, particulate matter, condensation particle concentrations, Sonnblick Observatory

Introduction

Atmospheric aerosols (particulate matter) are a complex mixture of particles of different size, shape and chemical composition. Consequently various methods for the characterization of atmospheric aerosols exist and have to be used to tackle different problems.

Since daily average mass concentrations are given as limit values in air, quality standards set for particulate matter (PM10; particulate matter smaller than 10 µm a.d.) measurements in monitoring networks often are based on the gravimetric determination of aerosol mass. A further advantage of this method is the possibility to do chemical analysis subsequent to the actual sampling process on filters. If higher time resolution is needed, other procedures yielding data representative for mass concentrations (e.g. TEOM, β-gauge) are used.

The size of particles ranges across several orders of magnitude starting from several nanometers up to several tenth of micrometers. Obviously single large particles contribute more significantly to aerosol mass than small particles. Consequently even a strong increase of small particles might not influence aerosol mass severely. Thus the determination of aerosol mass does not necessarily reflect changes in particle number concentrations. The number concentration of aerosol particles can be determined as an overall number or segregated in different sizes classes, in an ideal case in terms of size distributions.

Small particles are generated during combustion events and thus can be used as a tracer for freshly contaminated air masses. Thus the CP-count has already been used to classify the 'air status' for other measurements more than twenty years ago (GALASYN et al. 1987). Furthermore elevated concentrations of small particles can also be found during nucleation events in background environments induced by photochemistry.

Here we describe the data set of particle number concentrations measurements conducted at the Sonnblick Observatory and show selected results to demonstrate how these measurements can be used for further investigations.

Methods

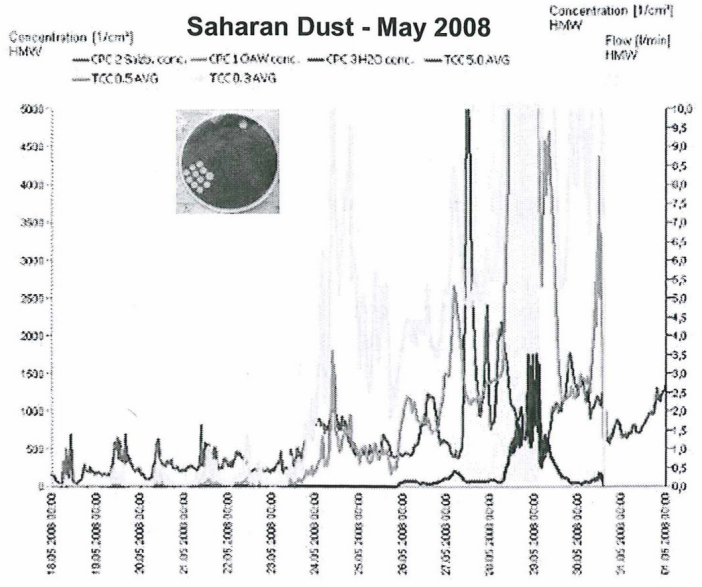
Monitoring of particle number concentrations at the Sonnblick Observatory started in 2004 and is performed with a condensation particle counter (CPC; TSI 3022A) using 1-butanol as a condensation liquid. The instrument has a lower cut-off point of 10 nm. In January 2008 another counter (TSI 3781) using water as condensation liquid was operated in parallel. In addtion to the CPCs an optical particle counter (Klotz TCC-PSS air) was installed in 2007 to determine particle number concentrations in three size classes.

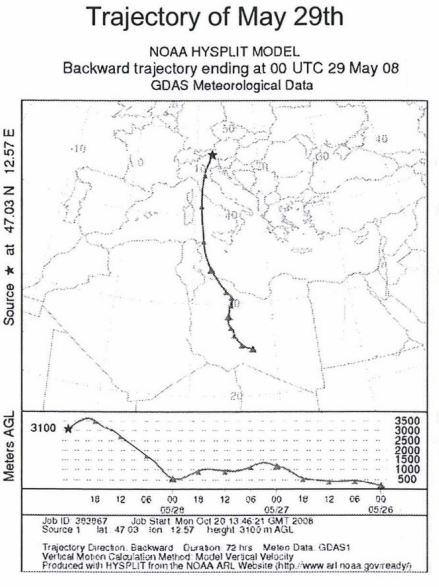
Results

Condensation particle counts determined at the Sonnblick Observatory cover a wide range but generally remain below or close to 1000 cm^{-3}. In accordance with mass concentations of major air constituents average concentrations are higher in summer than in winter. Thus monthly values of condensation particle counts average at 811 cm^{-3} in June 2005 and 440 cm^{-3} in December 2005. These values are characteristic for background air. A first comparison with data given for other alpine stations the sites Jungfraujoch (NYEKI et al. 1998) and Zugspitze (BRIMILI et al. 2009) show that concentrations at Sonnblick are close to data reported for these sites.

It has already been shown that mountain sites can be used as plattforms to monitor free tropospheric air masses (e.g. GALASYN et al. 1987, KASPER & PUXBAUM 1998, NYEKI et al. 1998). However these clean conditions do not prevail for the whole time and especially during the spring and summer season boundary layer air masses can be transported up to the site. Measurements of the condensation particle count allow to identify ‚polluted' and free tropospheric air masses. In the poster we show the possibilities and limitations of this approach for the Sonnblick Observatory.

Regarding single events a period of long range transport of Saharan dust to Salzburg occured in early summer 2008. The increase in aerosol mass as well as particle number concentrations, and the differences observed for the various size classes, could be observed at the Sonnblick Observatory as well and is presented in the poster.





Acknowledgements

Thanks go to the Austrian Academy of Science, Clean Air Comission and the Local Authority of Salzburg, Referat 16-02 Immissionsschutz, for providing the CPCs. M.K. wants to thank the Sonnblickverein for financing part of the evaluations by a grant. Furthermore thanks go to the collegues working at the Sonnblick Observatory for maintenance of the instruments and support.

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Eastern Alpine endemic arachnids (Arachnida: Araneae, Opiliones)

Christian Komposch

Summary

A comprehensive overview of plant, fungus and animal species of Austria has been published. Altogether 748 endemic and subendemic species have been identified, including 10 pseudoscorpion-, 11 harvestman- and 46 spider-species. Hot-spots of endemisms in the Eastern Alps are the north-eastern and southern Calcareous Alps and the central Alps. The conservation status of these highly endangered taxa is poor.

Keywords

endemic, subendemic, Alps, Austria, spiders, harvestmen, conservation

Area of study and aims of the project

The so-called Eastern Alps belong to the 30-35 million year old European Alp system, and are largely contained within the national borders of Austria. Despite to the intensive research efforts of several Austrian zoologists in the past, like Karl Holdhaus, Herbert Franz and Heinz Janetschek as well as more recently renowned „Alpine-arachnologists" like Konrad Thaler and Jürgen Gruber a comprehensive faunal catalogue of the region is lacking. The present study, coordinated by the Austrian Environmental Agency (Umweltbundesamt) aims at filling this deficit. The geographical localisation, digitalisation and management of all available data facilitates the drawing of distribution maps and – for the first time – the clear identification of centres and hot-spots of faunal and floral endemism of the Eastern Alps. Included in this effort are taxa that are truly endemic to the Austrian Republic as well as those whose distribution area lies primarily within national borders (i.e. subendemic).

The geographical localisation and digitalisation of all available data facilitates the drawing of distribution maps and – for the first time – the clear identification of centres and hot-spots of faunal and floral endemism of the Eastern Alps. Included in this effort are taxa that are truly endemic to the Austrian Republic as well as those whose distribution area lies primarily within national borders (i.e. subendemic).

Results and discussion

Altogether 748 (sub)endemic animal and plant species have been identified within the political borders of Austria (RABITSCH & ESSL 2009). Within the 548 animal species 10 pseudoscorpion-, 11 harvestman- and 46 spider-species can be found. The orders scorpions and palpigrades include no real (sub)endemic species of Austria, whereas 10 oribatid mites are classified as endemic and subendemic, many more oribatids as pseudoendemics.

The number of (sub)endemic arachnid species differs widely in the nine Austrian federal provinces. Rich in endemic spiders and harvestmen are the mountainous countries Styria, Carinthia, Tyrol and Salzburg. The recent climate history with large-scale expansion of the last ice-shields is of importance to understand today´s distribution ranges.

Highest arachnid species numbers are reached in the central Alps (e.g. Hohe Tauern NP), the north-eastern Calcareous Alps (Ennstaler Alps) and in particular in the southern Alps (Karawanken) with their massifs de refuge, marking the margin of the Würm-ice-shields. Regions outside the Alps are poor in endemics. For animals, a maximum of 46 endemic taxa was found in a grid cell in the Gesäuse NP, and the Hochobir in the Karawanken came second with 41 endemic taxa.

As expected, most of the endemic arachnid species occur from the nival down to the montane zone. The most important habitats are rocky areas, caves and woodlands. High absolute numbers and percentages of endemics can be found within the soil-inhabiting harvestman-families Cladonychiidae, Ischyropsalididae and Nemastomatidae and the spider-family Linyphiidae (*Lepthyphantes* spp. s. l. and *Troglohyphantes* spp.).

The threat status of endemic spider- and harvestman-species in Austria is in general high. Despite to the big threats caused by forestry, hydraulic engineering, agriculture, tourism and climate change up to now no endemic arachnids and insects are protected by law. The coverage of the distribution of endemics by nature reserves is rather poor. Conservation efforts must focus on these unique tesserae of our Alpine fauna.

Resumé

The presented results should provide a valuable basis for both zoogeographical inferences involving glacial refugia and postglacial recolonization of the fauna and flora of the Alps as well as conservation planning in Austria.

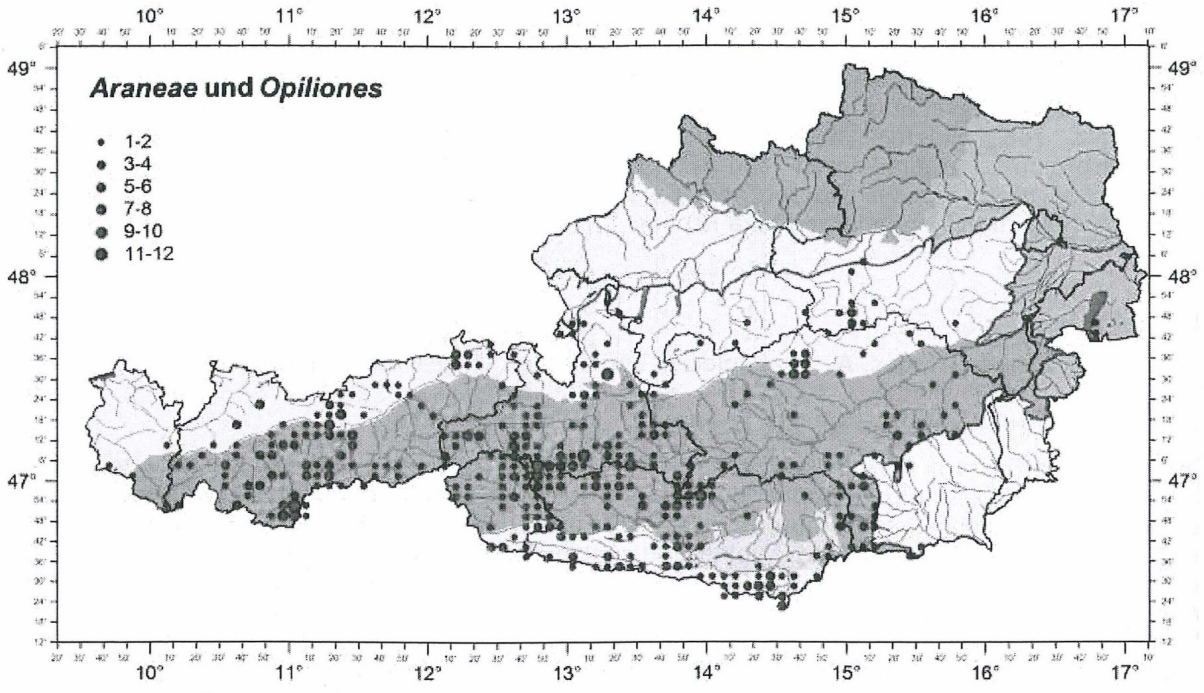

Figure 1: Cumulative distribution map showing all (sub)endemic spiders and harvestmen in Austria.

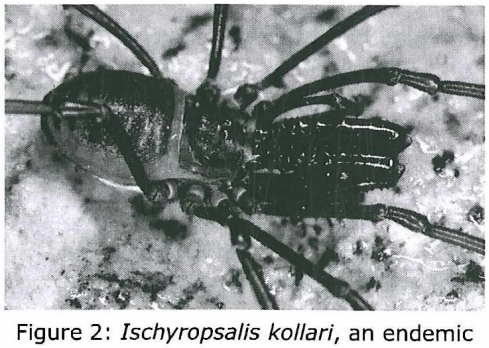

Figure 2: *Ischyropsalis kollari*, an endemic harvestman species to the Eastern Alps.

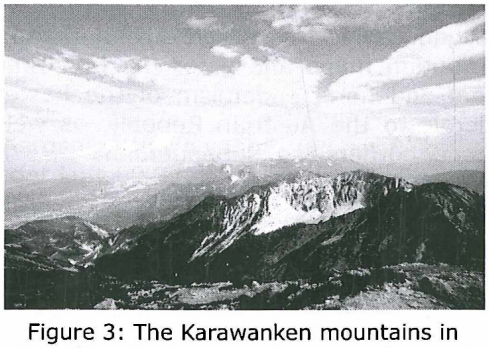

Figure 3: The Karawanken mountains in Carinthia, Southern Austria, are a hot-spot of endemic species.

Acknowledgments

Financial support came from the Umweltbundesamt, Vienna, technical support from Wolfgang Rabitsch and arachnological help from Konrad Thaler (t), Jürgen Gruber and Albert Ausobsky.

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A Transnational History of Alpine National Parks: Introductory Remarks

Patrick Kupper

During the 20th century fourteen national parks were created in the Alps: one in Switzerland (Swiss National Park, established in 1914), four in Italy (Gran Paradiso, 1922; Stelvio, 1935; Dolomiti Bellunesi, 1991; Val Grande, 1992), one in Slovenia (Triglav, 1961), three in France (Vanoise, 1963; Ecrins, 1973; Mercantour, 1979), one in Germany (Berchtesgaden, 1978), and four in Austria (Hohe Tauern, 1981; Nockberge, 1987; Kalkalpen, 1991; Gesäuse, 2002).[14] As can be deducted from this list the dates of establishment vary widely from country to country as well as within some of the countries, especially Italy. In her historiography of South Africa's Kruger National Park Jane Carruthers emphasizes the significance of time and space: "The creation of national parks – anywhere in the world – can only be understood in the context of the time and place in which this occurred."[15] Place, however, is not an absolute but a relative category. One and the same place is part of various layers of space. In our case each Alpine national park is part of the transnational space of the Alps as well as of a national space. Furthermore, each park is embedded into a regional and local Alpine space.

Our approach is located on the national level. Ronald Würflinger investigates the idea of German-Austrian Alpine National Parks until 1945. Patrick Kupper explores the creation and propagation of the Swiss National Park as both a national and international endeavor. Wilko Graf von Hardenberg traces the history of Italian National Parks between preservation and fascist propaganda. Finally, Isabelle Mauz inspects the role of scientists in the creation and management of national parks in France since the 1960s.[16] The contributions show that the national parks in the Alps served many purposes. They were sites for the preservation of scenic landscapes and wilderness, sanctuaries for threatened species, venues for scientific research, destinations for outdoor recreation and tourism, as well as locations of national imagery and nationalistic campaigns. While park politics were closely linked to the different national settings, the Alps have always provided a transnational space, allowing for the transfer of ideas, humans and also natural features across the national borders. Conflicts with local residents regarding access and use of the park areas were manifest in all countries, and so were struggles against large infrastructure projects like dams.

More research is needed to assess the impact of both the transnational connections and the national and local contexts of adoption and transformation on the development of the national parks throughout the Alps. In this respect, I like to suggest two topics for further investigations: First, it could be revealing to explore how the national significance of the Alps within each country's nation state building process affected the creation of national parks in the Alps. Second, it would be interesting to analyze in a comparative way how present differences between the national parks can be related to the dates of park establishments.

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[14] Sometimes different dates of establishment are mentioned in the literature. The dates in the text are taken from the self-declarations of the parks.

[15] Jane Carruthers, *The Kruger National Park: A Social and Political History* (Pietermaritzburg: University of Natal Press, 1995), 47-8.

[16] See the contributions in this volume. Of the Alpine countries Slovenia is missing. For a history of Triglav National Park see Carolin Firouzeh Roeder, Protecting Nature, Preserving the Nation? The Triglav National Park and Slovene National Identity, in: Gissibl, Bernhard, Sabine Höhler, Patrick Kupper (ed.), *Civilizing Nature: Towards a Global History of National Parks*, (forthcoming).

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A Commonwealth of Alpine Nature: The Swiss National Park

Patrick Kupper

In an article published in 1923 in the renowned British journal *Nature* Carl Schröter portrayed the Swiss National Park as "a commonwealth in which alpine Nature can recover and develop undisturbed: a refuge, a sanctuary for plant and animal life. It is an island of primeval Nature, unaffected by the devastating waves of human civilization which break about its shores."[17] Schröter, who was a professor of special botany at the ETH Zurich (the Swiss Federal Institute for Technology), co-founder of the Swiss National Park and head of its Scientific Park Committee, had several reasons to call the park a commonwealth. First, he considered the park a "unique laboratory", where "the naturalists of Switzerland will find themselves united in a common work." Schröter himself had been pivotal in designing the long-term research program for the park, whose cornerstones read as follows: "The initial task is the preparation of complete lists of species inhabiting the reserve. Further, by means of exact surveys of selected areas, repeated from time to time, it is hoped to study – as the previous influence of man and his domestic animals becomes more remote – the gradual restoration of the original flora and fauna, the re-conquest of pasture by forest, and so on. By the work of successive generations of investigators, it will be possible to follow the truly natural successions and changes occurring within the area, and to study in detail the natural relations between soil, climate, and organisms." Second, the costs of park management (e.g. the wages of the park wardens and the maintenance of roads and huts) as well as the costs of the scientific investigations were provided by a non-governmental organization, the *Swiss League for Nature Protection*, which had been founded in 1909 to back the establishment of the park both financially and politically. At the time of Schröter's writing the League's more than 30,000 members were a telling evidence of the popularity of nature protection. Third, in 1914, the Swiss parliament had authorized the federal state to take charge of the park and to use public money to grant compensations to the local owners of parkland. This gave Schröter the content "feeling of patriotic pride that a whole nation is pledged to preserve this fragment of primitive Helvetia, unexploited for purposes of material gain, as a heritage for generations yet unborn." Finally, the biogeographical location of the park in the Lower Engadine turned it into a kind of commonwealth of Alpine nature as the „dividing line between the floras of the western and eastern alps passes through the region", providing for "a mingling of eastern and western forms". Furthermore, forests and animal life were described as extensive and abundant.

The area of approximately 140 square kilometers in the Ofenpass district, which was set apart by a commission of the *Swiss Society of Natural Sciences* as a national park between 1909 and 1914, Schröter declared as "peculiarly suitable": "In wildness and naturalness, as in loneliness and seclusion, it is scarcely surpassed anywhere in Switzerland". Unlike the existing American National Parks, whose regulations were qualified by the mentioned commission as being insufficiently protective, the Swiss national park was meant to be a "Complete Nature Reserve": "Human interference is absolutely excluded from the whole region. Hunting, fishing, manuring, grazing, mowing and wood-cutting are entirely prohibited. No flower or twig may be plucked, no animal killed and no stone removed; even the fallen trees must remain untouched. In this way absolute protection is secured for scenery, plants, and animals; Nature alone is dominant". The motivation for these strict rules was partly moral, but mainly scientific. The national park should serve as a large outdoor laboratory where natural processes could be observed undisturbed by human interference. Schröter and his colleagues spoke of "a grandiose experiment to create a wilderness". In the park they hoped to witness a process of "retrograde succession" leading gradually to the reestablishment of "the old primitive biocenose", as it existed before civilized man set foot in the Alps and disrupted the natural equilibrium.[18] Spectacular sights and exceptional phenomena were of

[17] Carl Schröter, The Swiss National Park, in: *Nature*, 112 (29 September 1923), 478-481. All quotes from this article if not referenced separately. I like to thank Sabine Höhler for her comments and suggestions.

[18] These goals were first publicly stated by the *Commission for Nature Protection* in its annual report 1908/09, 52-57.

less importance. Unlike in the US, Switzerland's national parks were not meant to attract large-scale tourism. On the contrary, tourism was to be highly restricted in the parks. Indeed, the need for large Alpine nature reserves was accentuated by the rapid development of the Alpine regions by ass tourism and the opening up of more and more mountain tops by cog railways.[19] In addition, the remoteness of the area entailed another practical advantage: "It [the Ofenpass district] is very sparsely populated, so that the prohibition of forestry and grazing operations involve but little hardship for its human inhabitants." In other words, the land leased for the park was to a large extent economically worthless. Hence the compensations paid to the land owning local communes were relatively low. Suitability and practicability went hand in hand.[20]

The Swiss National Park was simultaneously promoted as a national and an international endeavor. Its safeguarding meant to preserve a piece of both "primitive Helvetia" and the "European Alps". Furthermore, it was seen as a contribution to the worldwide protection of nature. While lobbying for the creation of a Swiss national park, the leader of the Swiss nature protection movement, Paul Sarasin, campaigned for the establishment of a "Weltnaturschutz" on the international level. The Swiss park was his model for what should be achieved in every nation and lead to a world-wide web of nature reserves. A network of contacts with German conservationists was built up and, in 1909, Sarasin became a founding member of the German "Verein Naturschutzpark". Of the other neighboring countries Italy was closest. The creation of the Italian *Lega Nazionale per la Protezione dei monumenti naturali* in 1913 was inspired by the corresponding Swiss League. Moreover, it was hoped in Switzerland that Italy would assign a protected area to the Italian valleys adjoining the Swiss National Park and thus prevent poachers to enter the park via the national boarder. However, the outbreak of World War I in the summer of 1914 set an end to these plans as well as to Sarasin's vision of "Weltnaturschutz". The Parco Nazionale dello Stelvio was not established until 1935, and World War II had to pass before Sarasin's legacy was resumed by the creation of IUCN in 1948. Four years later an additional framework for the collaboration among the Alpine countries was created, the *Commission Internationale pour la Protection des Alpes* (CIPRA). Scientific research was the hallmark of the Swiss National Park and made it an important model for the establishment of protected areas elsewhere. It provided an alternative prototype to the dominant American national park concept, one that allowed putting emphasis on the scientific rather than on the recreational dimension of parks.[21]

However, not only humans and ideas but also nature travelled through the Alps. When the Swiss National Park was created the region was only sparsely populated by ungulates. Solely the chamois was present in significant number. The red deer had just started to re-immigrate from the east after having been eradicated from the region in the 19th century. The Alpine ibex, the heraldic animal of the canton Grison, was extinct since the 16th century. It was reintroduced into the park in several releases from 1920 onwards. The animals were delivered by two Swiss zoos which had succeeded in raising ibex in captivity. The zoo animals stemmed from the Italian royal hunting estate of Gran Paradiso, the last resort of the Alpine ibex, and were, after the refusal of Italian king Victor Emmanuel III to sell some species to Switzerland, obtained from poachers.[22] The reintroduction of the ibex was somewhat at odds with the park philosophy of non-intervention. However, the issue had already been raised along with the national park idea and was legitimized by the former existence of the species in the region. Old documents and later on also a skull found in the park substantiated this claim.[23] The reintroduction of the ibex was not only celebrated as an achievement in species conservation but also as a highly popular public event. Bear, wolf and lynx, who had also formerly lived in the area (a last bear was shot near the future park in 1904), could not count on a similar social prestige. While the park advocates rejected the common contemporary partition in useful and harmful animals and, at least in theory, appreciated the free

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[19] Patrick Kupper. Science and the National Parks: A Transatlantic Perspective on the Interwar Years, in: *Environmental History*, 14 (1/2009), 58-81.

[20] "Worthless land" was an important factor in national park creation worldwide. Cf. Alfred Runte, *National Parks: The American Experience* (Lincoln: University of Nebraska Press, 1987); Warwick Frost and Colin Michael Hall (ed.), *Tourism and National Parks: International Perspectives on Development, Histories, and Change* (New York: Routledge, 2009).

[21] Cf. Bernhard Gissibl; Sabine Höhler and Patrick Kupper (ed.), *Civilizing Nature: Towards a Global History of National Parks* (Oxford: Berghahn, 2010).

[22] See Marco Giacometti (ed.), *Von Königen und Wilderern: Die Rettung und Wiederansiedlung des Alpensteinbocks* (Wohlen/Bern: Salm, 2006).

[23] Ferdinand Rudio and Carl Schröter. "Naturschutz" in der Schweiz, Notizen zur schweizerischen Kulturgeschichte, 19, in: *Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich*, Jg. 54 (1906), 502-508, 505. Carl Schröter. Hooker lecture: The Swiss National Park, in: *Journal of the Linnean Society of London, Botany*, 47 (318/1927), 637-643, 640.

roaming of predators in the park, they were not so bold to repopulate the park with these species. In the 1960s, the park board considered to reintroduce the bear to control the soaring population of red deer in a "natural" way, but eventually dismissed this thought. Thus, the bearded vulture was the second animal to be actively reintroduced into the park in the 1990s, whereas the bears and lynxes which were sporadically observed in the park in the last years appeared without human assistance.

This review of wildlife management shows that the practice in the park never fully complied with the scientifically underpinned philosophy of non-intervention and was open to social influences. The national park never became Schröter's "island of primeval Nature" unaffected by human civilization. This is less surprising if one takes into account that the park was itself a social product and as such kept being molded by social aims, wishes, and fears. The Alps provided a transnational space for the transfer of both human and natural elements. Some of these movements were encouraged by human actors, others just happened.

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Transboundary Cooperation in Protected Area´s Management – Factors Influencing Success or Failure

Sigrun Lange

Summary

Little disagreement exists about the need of conservation measures at the ecosystem level. As mountain ranges or water bodies do not end at administrative borders, ideally neighbouring countries have to coordinate their activities. Many international organisations strongly recommend the establishment of transboundary protected areas. However, cross-border cooperation adds another layer of complexity to the already difficult task of managing a protected area. "Still protected areas are being established near borders without any thought of coordinating measures with the neighbouring country to ensure an effective protection" (BRUNNER 2006). Recommendations of concerned stakeholders and the application of principles of change management may help to find new approaches for a successful and sustainable cooperation.

Keywords

Transboundary cooperation in protected areas management

Aims

The study examines the factors for success or failure of transboundary cooperation as perceived by stakeholders in three case study sites with different levels of cooperation. Further, it analyses, if basic principles of change management in organisational development can be applied in order to facilitate decisions on whether to establish and how to handle transboundary protected areas. The results are meant to add to the international discussions and facilitate transboundary cooperation in protected area´s management.

Duration of project

From January until August 2009

Areas of study

Three adjoining proteced area complexes in Europe have been selected as case study sites (cp. Figure 1):

Interstate Nature Park Maas-Schwalm-Nette between Germany and The Netherlands with one management unit responsible for both sides of the frontier (high cooperation level),

National Park Triglav in Slovenia and (almost) adjoining Regional Nature Park Prealpi Giulie in Italy (medium cooperation level) and

the mountain range „Karwendel" between Tyrol (Alpenpark Karwendel which currently is transformed into a Nature Park) and Bavaria (nature conservation site), where since 20 years stakeholders make an effort towards an institutionalised cooperation, however so far without success (low cooperation level).

Methods

The guidelines of IUCN (SANDWITH et al. 2001), UNESCO (2000) and EUROPARC (2000) and some previous studies (ZBICZ 2003, LANFER et al. 2003 and UNESCO 2003) have been compared in order to identify the most important and commonly agreed criteria for a successful cooperation in transboundary protected areas.

Figure 1: Location of the selected case study sites in Europe (Graphic: Lange).

In a second step, representatives of relevant interest groups (conservationists, mayors, tourism experts, land users etc.) have been chosen in the case study sites on both sides of the border and questioned about their experiences with transboundary cooperation. In total, 30 guided (phone or face-to-face) interviews have been carried out.

In a third step some basic principles of change management have been applied to analyse the cooperation processes in the case study sites. It has been evaluated if they may help to find new approaches of how to establish or handle transboundary protected areas.

Results

What do international organisations and previous surveys recommend?

International organisations and previous studies agree on some basic recommendations like specifying common visions or (written) agreements, establishing coordinative structures, encouraging personal meetings between all levels of staff members, finding a way of how to deal with language barriers, harmonising regulations and management practices, developing common external communication, realising joint projects and finally guaranteeing a particular budget for transboundary activities (cp. summary in Figure 2).

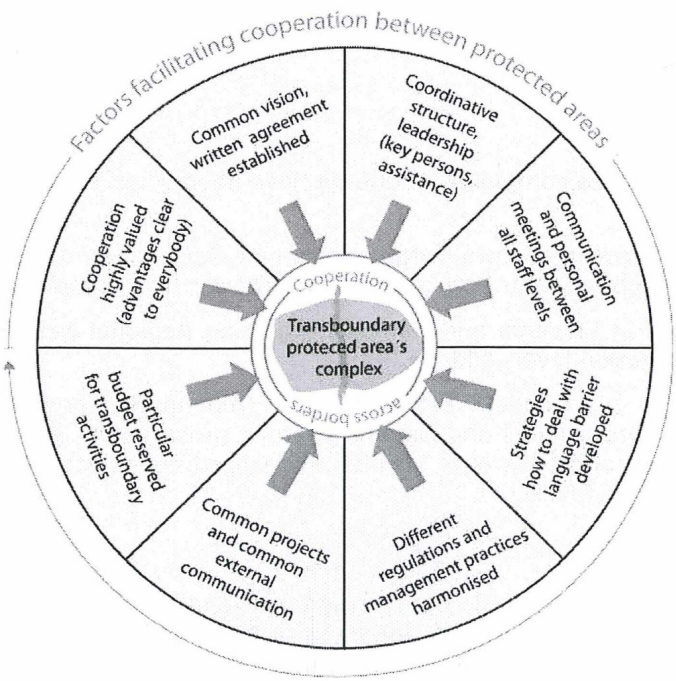

Figure 2: Factors facilitating transboundary cooperation in protected area´s management (Graphic: S. Lange, based on recommendations of international organisations and results from former studies).

What do stakeholders recommend?

According to the surveyed stakeholders cooperation brings some benefit not only for nature conservation, but rather for increasing the popularity of the area and strengthening tourism activities. Motives behind the cooperation are (amongst others) gaining more income, maintaining historic relations and creating a European feeling. Personal contacts are considered a key factor for the success of cooperation. However, these contacts should not only occur on staff but also on local level (exchange of farmers, children, tourism associations etc.). Further the importance of informal events (like cultural events, competitions, having a beer together) was stressed to allow for building trust and friendship. Differences between neighbouring countries will always occur. However they rarely have been perceived as being an obstacle but rather an enriching source for new learning experiences. Shall joint projects be implemented successfully, there only has to be a key person who is familiar with these different structures, regulations and attitudes on both sides of the border in order to guarantee a smooth flow of the project.

Can principles of change management be applied?

Even if already some important aspects of how to organise transboundary cooperation have been identified, they still do not answer the question under which circumstances transboundary cooperation is worth trying. Change management principles deal with the question of how people can be motivated to give up familiar habits and accept changes. One of these principles is summed up in the following change equitation:

D[issatisfaction] x V[ision] x F[irst step] > R[esistance] to Change

It reveals that dissatisfaction with the current situation is a key driver for changes. Developing a common vision is important to agree on what shall be achieved in the future. Concrete first steps have to be taken in order to demonstrate the progress towards the vision. The change formula is multiplicative, which means that if any factor is missing or poorly developed, resistance will be greater and positive change will not take place (Beckhard & Harris 1987).

Can this be applied to transboundary protected areas? Does it explain why the cooperation in the Karwendel mountain range still has not worked out yet? Yes, it does.

The cooperation between Tyrol and Bavaria should be easy as there is no language barrier and the last armed conflict happened 200 years ago (cp. Figure 3). Currently, the main resistance comes from the Bavarian stakeholders (representing the smaller part of the Karwendel). They fear that their interests may be ignored by the Tyrolese majority. Additionally the driving forces for cooperation are not well developed. Some benefits are expected from the cooperation, but the majority is not at all dissatisfied with the current situation. They don´t share a common vision of how to develop the region and the first steps taken in form of a joint INTERREG project have been realised mainly on the upper management and expert level with the consequence that no contacts on the local stakeholder level have been triggered. The establishment of a transboundary protected area is therefore at present not imaginable.

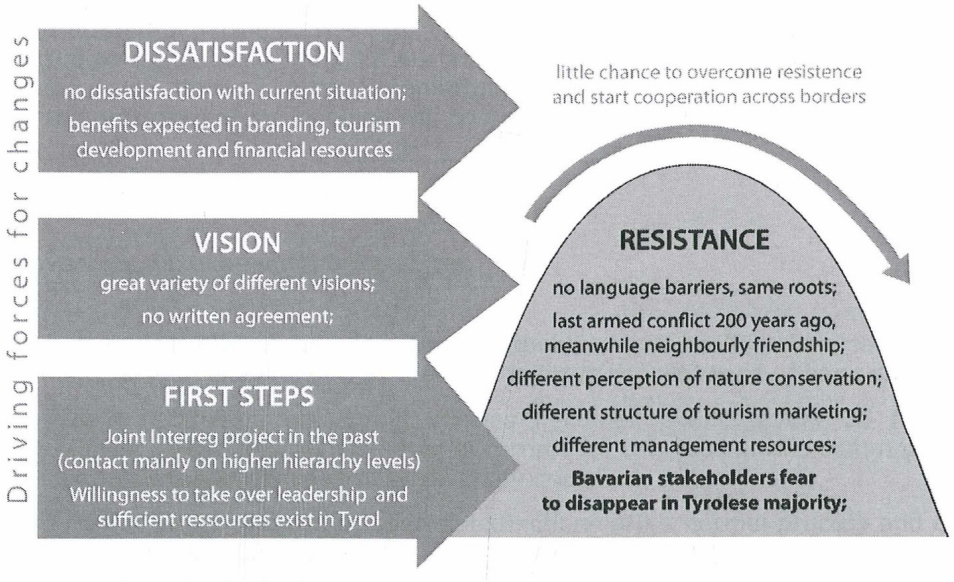

Figure 3: The basic principles of change management, applied to the transboundary cooperation process in the Karwendel mountain range (Graphic: S. Lange).

Discussion

The recommendations given by international organisations encourage transboundary cooperation. However, they lack the aspect of how to build trust and friendship amongst the neighbours which seems crucial to allow for a sustainable cooperation outlasting the ending of an INTERREG funding period. Combing the recommendations of concerned stakeholders with principles of change management may stimulate new approaches of how to deal with transboundary protected areas. In case of the Karwendel mountain range, informal events on the local level would be advisable to overcome the distrust of the Bavarian stakeholder. Once more confidence is provided, the attention could be turned to the benefits of transboundary cooperation, establishing a common vision and implementing first concrete steps.

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A new All Taxa Biodiversity Inventory and Monitoring (ATBI+M) approach for improving biodiversity knowledge and data management for protected areas

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Abstract

As many protected areas lack comprehensive and accurate data about much of their biodiversity, the Mercantour National Park (PNM), France, and the Alpi Marittime Natural Park (PNAM), Italy, through collaboration with the National Museum of Natural History in Paris, joined a partnership with the European Distributed Institute of Taxonomy (EDIT). EDIT is a consortium of 28 leading scientific institutions supported by the European Commission (FP6), with the aim of integrating the taxonomic community through institutional collaboration and joint programme of activities. As part of these activities, EDIT Work Package 7 established the first European "All Taxa Biodiversity Inventory+Monitoring" (ATBI+M) pilot site at PNM/PNAM in 2007, also as a joint contribution towards the "Countdown 2010" activities for biodiversity protection.

During the first two years of collaboration, more than 80 researchers from EDIT visited the two Parks to record, collect, and inventory different taxa in the two parks. More than 3000 species were already recorded, and more than 8000 individual geo-referenced records have been generated. The second EDIT ATBI site was launched in 2008 in the Gemer area on the Western Carpathian Mountains, Slovakia. This ATBI+M site covers three national parks of carstic character, which represent a well preserved, typical environment of the Carpathian Mountains. Research activities at ATBI+M sites are accompanied by the EDIT summer school of taxonomy, where graduate students from different European countries are taught fields methods for taxonomy by experts from EDIT institutions and academic partners. The EDIT ATBI+M activities will continue for three more years, and are expected to significantly enhance our knowledge on European biodiversity and contribute to its protection, also through future monitoring activities. Depending on additional funding opportunities, the protected areas involved will continue their ATBI+M activities after EDIT

Keywords

biodiversity, inventory, taxonomy, protected area.

The impact of human activities on all ecosystems probably shows itself in the clearest way through a global drastic decrease in biodiversity, as direct or indirect consequence of habitat loss.

According to recent estimates, one living species becomes extinct every 20 minutes, which represents the highest rate in species loss ever occurred: for this reason it is commonly referred to the Sixth Mass Extinction, also called the "biodiversity crisis".

However, it should not be forgotten that species extinctions are a normal process and always have happened, while what is surprising about the actual situation is the impressive speed at which it is evolving.

According to the IUCN Red List, 12 to 52% of most common species are endangered; however we must consider that only 10% of all known species have been subject to conservation status verifications (Hassan & Scholes, 2005).

Since this has to be considered a global issue, it is necessary that all measures and commitments are to be undertaken at an international level. One of the first responses has been the Convention on Biological Diversity in 1992, which "aims to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth" (UNEP, 2002). The European Union included the principles and the proposed objectives in all environment protection action programmes, and became a priority for the Sixth Framework Programme (6FP) (2002-2012), and for many other local initiatives, also supported by the "Natura 2000 Network", the world largest connecting system among protected areas.

Thanks to the initiatives promoted by the European Distributed Institute of Taxonomy (EDIT), also supported by the 6FP, a great effort has been made and is still under way to create a network of scientific excellence at European level (and also to interact with non-European parties). The aim is to integrate the taxonomic community through institutional collaboration and joint activity programmes.

With the purpose of involving the scientific community in actual taxonomic and conservation issues, EDIT introduced the European "All Taxa Biodiversity Inventory + Monitoring" (ATBI+M) approach, based on the experience originating from the Great Smoky Mountains, USA.

The aim of this project is to create an exhaustive inventory of all species existing in a given territory through intensive community efforts. These activities allow taxonomists specialized on the study of a particular group of organisms to interact with their colleagues and to create strong connections between scientific institutions.

In particular EDIT intends with this project:

- to increase the knowledge regarding all taxa existing in the study area and the ecosystems in which they live;
- to encourage the spread of taxonomic knowledge and the interest in new field and laboratory work methodologies;
- to share the acquired knowledge among scientific institutions, stakeholders and local administrations;
- to rise awareness among the general public, and especially local populations, about biodiversity and its role and value.

The first ATBI+M was established in 2006, thanks to the collaboration between the Mercantour National Park (PNM), France, the neighbouring Alpi Marittime Natural Park (PNAM), Italy, and the National Natural History Museum of Paris and supported by the French Ministry of Environment, the Foundation Albert II of Monaco, the Government of Monaco. In 2008 a new ATBI+M site was identified in Slovakia, and in particular in the Gemer area which includes three national parks in the Western Carpathian Mountains (National Park Slovenský raj, Muránska Planina National Park and Slovenský kras National Park).

The Mercantour National Park, the Alpi Marittime Natural Park and the Gemer area were chosen as ATBI+M sites because of their large habitat and species diversity, but also due to the relatively easy accessibility to basic infrastructures.

Although the Mercantour-Marittime area has been studied for at least 2 centuries, especially concerning some groups of animals and plants, the knowledge regarding all existing species and habitats is not complete and often not available to park managers, researchers or to the general public. This is why it is crucial to gain more information regarding the biodiversity of these areas and to manage the data obtained in order to make then accessible to a large public.

Moreover, this inventory is not only a mere list of species but it is also a way to increase the awareness of the local authorities and the general public about the existing biodiversity, and about why and how to protect it. At the same time the inventory will bring together major experts and scientific institutions, that need to overcome old impediments and start collaborating with other institutions to share material and expertise. Finally, this inventory will allow to clearly define the actual situation, to compare it with future situations, so as to assess changes in biodiversity in dependence of time.

For both ATBI+M sites all research activities were implemented according to the EDIT action plan and the Parks regulations. The end of the ATBI+M project promoted by EDIT is fixed for middle 2011, but it might be prosecuted if enough funding for all programmed activities will be received.

For the Mercantour-Marittime territory, June 2009 represents the beginning of the third collecting season, while this will be the second year for the Gemer area.

The project activities include:

defining the collecting sites

informing the scientific community and providing useful information

coordinating researchers activities

managing data and updating the website.

In the Mercantour National Park and the Alpi Marittime Natural Park 17 sites were firstly selected according to their habitat characteristics and accessibility also with heavy gear necessary for the fieldwork.

All researchers were asked to collect only in those areas, while from this summer, the whole territory within the two parks can be surveyed so as to gain a better insight into the overall biodiversity.

More than 150 individual specialists are involved in the project activities and almost all of them already visited the Mercantour-Marittime territory from 2007 to 2008, collecting samples, identifying them and sending the results to EDIT, with the support of the two parks' staff. All collecting activities were conducted according to the parks' and EDIT's regulations. Figure 1 shows a Malaise trap placed in Vallone del Gesso della Valletta in the Alpi Marittime Natural Park in August 2007.

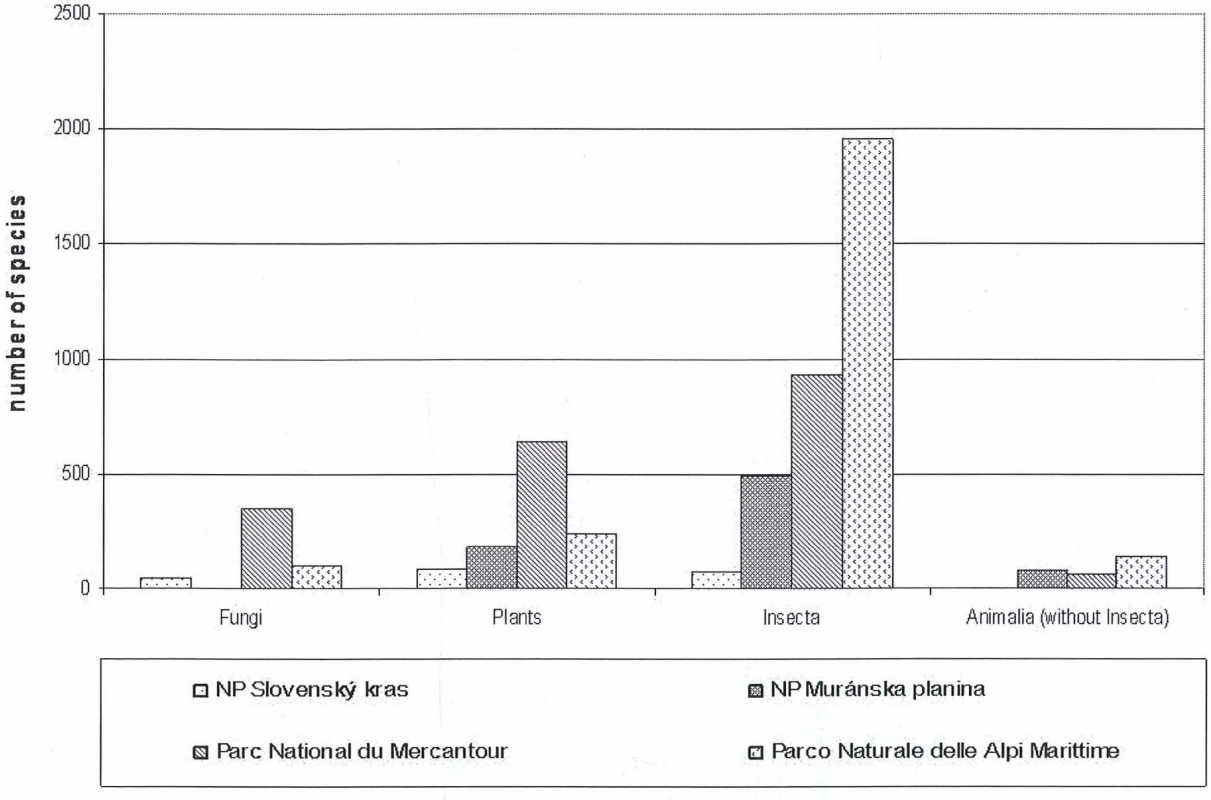

Figure 1: Recorded species at the National Parks during ATBI+M activities in 2007-2008: total number per kingdom (data include digitized records from available literature)

Until now 4444 species have been catalogued, of which 1996 species are from the Mercantour National Park and 2448 from the Alpi Marittime Natural Park. Insects are the most represented group.

The figures coming from the site Gemer are considerably lower than the other ATBI+M sites because of it's recent origin and because research activities in 2008 were concentrated in Muránska Planina and Slovenský Kras.

Figure 2 clearly shows that the group counting the largest number of identified species is the class Insecta, followed by Plantae, and in particular the phyla Bryophyta and Marchantiophyta.

Among the insects, the order that has been mostly investigated is Lepidoptera, with almost 1800 species (Figure 3), while Coleoptera counts almost 500 identified species. The large predominance of data on butterflies and moths might be due to the high participation of experts on these groups together with the high ease in capturing samples compared to other insects.

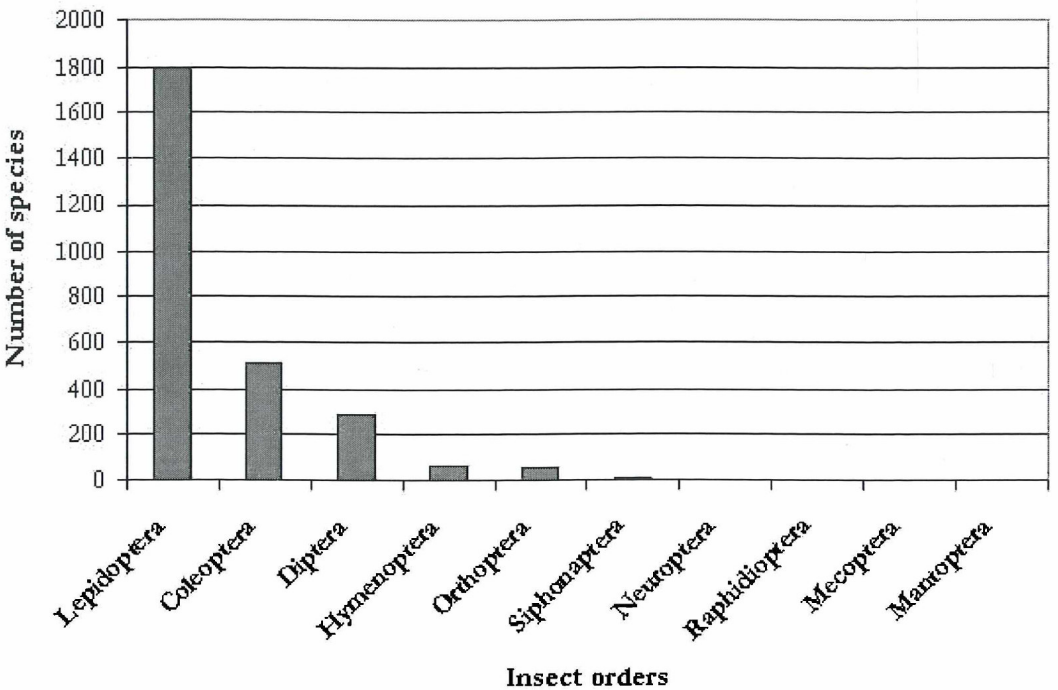

Figure 2: Number of species recorded within different insect orders

During these 4 years of studies (2007-2010) for the Mercantour-Marittime territory we expect to gain more information on known species and on new ones (to the area or to science) especially for insects and other minor groups (e.g. Fungi, Diatomeae, Malacofauna, Micromammals, etc). Concerning big mammals, birds and vascular flora, much is already known, thanks to the monitoring activities carried out by individual specialists and by the parks staff. However, some inventorying activities will be carried out, in order to update the old checklists and to study distributions or other specific topics. Thanks to the suggestions and expertise of a recently formed Scientific Committee these activities will be accurately planned and carried out.

Figure 3: Malaise trap placed in Vallone del Gesso della Valletta (Alpi Marittime Matural Park) (Photo: Daniele Birtele)

The data generated by EDIT's ATBI+Ms are also accessible world-wide through the Global Biodiversity Information Facility (GBIF). The data for Mercantour/Alpi Marittime are available at http://data.gbif.org/datasets/resource/7949/ and for the Gemer region at http://data.gbif.org/datasets/resource/7950/. Another possibility to search for observation and collecting data is the "EDIT Specimen and Observation Explorer for Taxonomists" (http://search.biocase.org/edit; ZIPPEL et al. 2009)."

Figure 4 is an example made for the Mercantour National Park that shows the data (identified species) growth that accompanied the Park from it's institution to the beginning of the systematic inventorying activities.

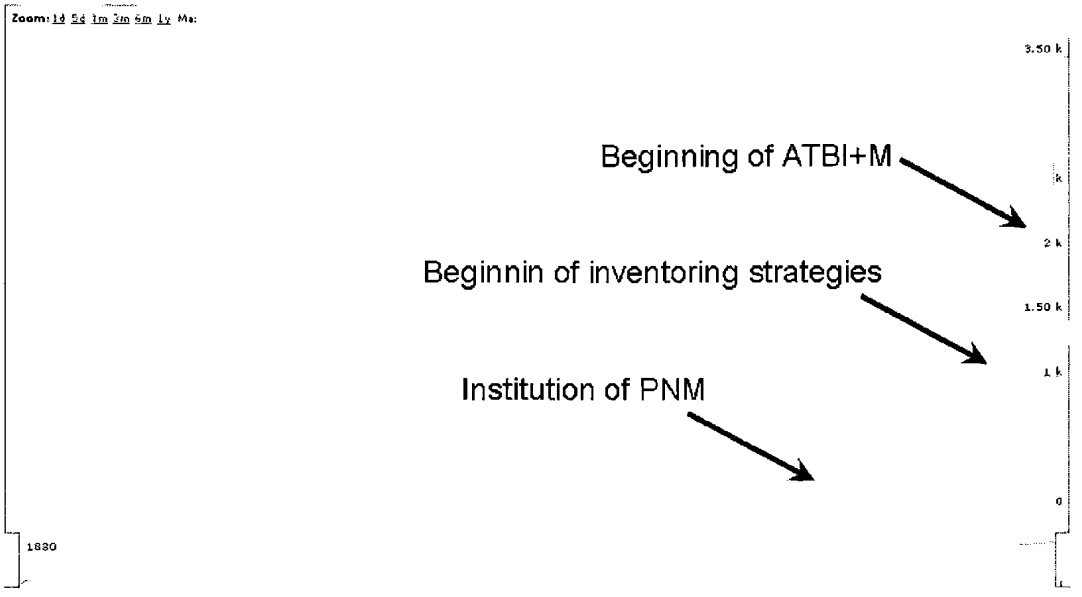

Figure 4: Growth in the number pf species catalogued in the Mercantour National Park from its institution and after the beginning of the ATBI+M activities

With the beginning of 2008, as some results became available, a media event was organised for the ATBI+M Mercantour-Marittime and several articles on national and local newspaper and magazines were published. It is also thanks to this type of communication that now a large part of the scientific community, nationally and internationally is aware of the existence of the ATBI+M sites and is interested in participating. From 2009 different activities with local schools and other public events will take place in both Parks. Moreover we intend to inform and involve the public and especially the local population through the organisation of public events. Specific activities with students will be continued.

The involvement of all these parties, local population, general public and scientific community, is indeed essential to allow for a better protection and management of the biodiversity as well as to help improving land management practices.

Although it is too early to draw final conclusions for the whole inventory, it is important to highlight the good response of the scientific community, both involved in fieldwork activities and in the identification process. It is our intention to improve the efficiency of field work in such a way, that the whole territory can be studied according to standardised methodologies.

This experience is particularly important for protected areas because it shall help the general public understand that it is not only necessary to preserve the existing species within an area, but also to maintain the biological potential that these areas have. The Mercantour-Marittime territory, as well as the Gemer area are partly subjected to land exploitation due to agricultural practices and suffer from loss of habitat and general damages to various ecosystems (water pollution, colonization of invasive species...).

The Inventory represents a unique opportunity for these protected area to draw the attention of the whole scientific community and the public (especially the local population) to the importance of taxonomy and scientific surveys within the framework of environmental protection strategies: preservation of an environment can only be done if park manages are aware the biological diversity and its distribution. This type of knowledge can define the real potential of an area, and allow a real protection, though the integration of local culture and land use.

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Moorland landscapes in Switzerland – the changing significance of near-natural cultural landscapes

Marion Leng, Thomas Hammer

Abstract

Moorland landscapes consist of a large number of natural, near-natural and human-made elements, which in their entirety determine the character of each individual moorland landscape. They are the only constitutionally protected landscape type in Switzerland. The legal definition describes a moorland landscape as "a near-natural landscape that is strongly characterised by moors" and whose moor-free sections are "closely interrelated with the moors in an ecological, visual, cultural or historical sense" (Article 23b §1 Swiss Nature and Cultural Heritage Protection Act). Usually they are valuable in terms of ecology, history and aesthetics: they provide habitats for endangered species and for human beings, they bear witness to traditional, extensive land use forms, and they are perceived as being aesthetically valuable for leisure and recreation. In spite of the widely accepted aim to protect them, they are by no means secure. Conflicting trends such as the intensification of land use and non-cultivation of agricultural land and the growth in outdoor sports mean that the biodiversity, unique character and variety of the remaining moorland landscapes are threatened, in spite of regulations for their protection. They can only be preserved if extensive land use adapted to the special conditions in moorland landscapes, associated maintenance measures continue, and unsuitable land uses and over-use are avoided.

Keywords

Moor, moorland landscape, cultural landscape, land use, landscape protection, landscape preservation

Aims and duration

The problematic situation described above provided the starting point for this research project, which is part of the Swiss involvement in European co-operation in the area of scientific and technological research, the COST Action A27 *Understanding Pre-Industrial Structures in Rural and Mining Landscapes* (LANDMARKS).

The super ordinate aim of the project is to identify and describe the many aspects of the changing human significance of moorland landscapes in order to identify and document associated changes in the landscape.

Overall, the project should make a contribution to the collection and preservation of knowledge about a near-natural cultural landscape that developed over centuries of human use and maintenance. Changes in land use and in the significance of moorland landscapes are described, together with associated conservation and preservation aims as well as spatial and qualitative changes in the landscape. Research is carried out into options for the long-term conservation of moorland landscapes using traditional and new uses in order to preserve their multi-functionality for society. Furthermore, the development of conservation aims is described together with an overview of conservation concepts in Switzerland.

The central research question is: What changes have occurred in the use and significance of moorland landscapes in the course of their development?

It is the aim of this research to understand changes in significance in their historical context and to discover what significances were important during what periods and how material and non-material significances were weighted. The changes in the significance of the moorland landscapes for humans include the emergence and institutionalisation of conservation and preservation measures and their justification.

The project was conducted between 2006 und 2008.

Area of Study

The research project focuses on moorland landscapes in Switzerland and especially on those 89 moorland landscapes which are constitutionally protected as "moorland landscapes of particular beauty and national significance" (Swiss Constitution Art. 78). They are spread over the country but most of them are in the region of the northern pre-Alps.

Methods

The research methodology applied included systematic literature and document searches in data banks, libraries and archives, comparative analysis of historic maps, field observation and photography. The data thus gathered was evaluated through systematic analysis of literature and documents, interpretation of maps, drawings and photographs as well as comparative analysis of maps and photographs. Descriptions, maps, diagrams and photographs are particularly important, with the special aim of securing the documentation thus collected.

Results

About 20 years after the acceptance of the decisive initiative to protect moors and moorland landscapes in Switzerland (Rothenthurm initiative in 1987) and in spite of the manifold efforts, the aims concerning the protection of moors and moorland landscapes were not or at least not entirely achieved.

The ecological quality of many nationally protected moors is degrading and the area of intact bogs is decreasing. A lot of the buildings, ways and roads that have been constructed during the last 20 years do not accord with the aims of protection. Incipient scrub and forest encroachment increase.

Moorland landscapes change slowly but steadily, due to the combined effect of many creeping changes which threaten the specific character of the moorland landscapes.

Discussion

Changing significances of the moorland landscapes for humans, the appreciation of the non-material significances and the identification of new significances reflect the changes that occurred in the human-nature relationship.

Nowadays, moorland landscapes are more and more perceived as ecological, historical and aesthetical valuable near-natural cultural landscapes. This fosters hope for local and regional development.

Especially the new and increasingly important non-material significances (recreation and leisure) have become central arguments for the protection and preservation. They probably have an effect on the local social and economic creation of value, such as new jobs in the local tourism industry.

The challenge now is to avoid the creeping changes in the moorland landscapes and to preserve the manifold material, non-material and geo-ecological significances. To meet these challenges, it is important to foster the general publics' awareness of the values of the moorland landscapes.

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Building an Inventory of Life: The Biodiversity Archives of the Nationalpark Hohe Tauern at the Haus der Natur, Salzburg

Robert Lindner, Patrick Gros, Christine Medicus

Summary

The biodiversity database of the Hohe Tauern National Park is a multi-functional information system which aims to document all available data about the biodiversity of the Hohe Tauern region. The database, maintained at the "Haus der Natur" Museum of Natural History in Salzburg, is designed to integrate distribution data on all groups of animals and plants. All data are stored in one central data repository as to maintain maximum standardisation, yet the specific requirement of certain systematic groups can be accounted for. Unit-level data originate from various sources such as commissioned field studies, museum collections and various published sources, as well as private specimen and data collections. Unit-level data are referenced to comprehensive metadata concerning taxa, sites, collections, literature, and contacts. Possible applications of the biodiversity database are manifold and are of large interest to biologists, teachers, Governmental experts, conservationists, politicians, and all who relate to the region of the Hohe Tauern National Park.

Keywords

Biodiversity, database, digitisation, animal and plant distribution, maps, natural history collections, museum, Salzburg, Carinthia, Tyrol, Austria

Aims

The Hohe Tauern National Park biodiversity database was established with the aim of documenting all available data on the distribution of animals and plants in the Hohe Tauern region in one extensive database. Main data sources for the project are: commissioned projects of the National Park Hohe Tauern and from the state governments, various atlas projects, published scientific literature, natural history collections (specimen), data from amateur-scientists. The database is designed as a multi-functional information system which allows data query relating to specific scientific questions, or spatial extent. Data can be retrieved quickly in any desired structure and format.

The data are collected with the main aim to allow the quick assessment and visualisation of known and potential distribution areas. In compliance with the conservation aims of the National Park Hohe Tauern special attention is given to threatened species as well as species which are defined as conservation targets. The data stored in the database enable us to visualize areas of high and specific biodiversity as well as areas requiring special protection or management actions. The database is meant to be a valuable basis for analysis and publication of biodiversity data. Furthermore, the project can be used to identify those taxonomic groups and those areas within the national park where only insufficient data are available. The database is therefore an integrated and valuable part of the biodiversity conservation strategy of the National Park Hohe Tauern.

Duration

The project started in the year 2000. As nature is constantly reshaped by underlying dynamic processes (natural or non-natural) continual changes in biodiversity are to be expected and the documentation of biodiversity needs to be updated on a regular basis. Hence new data are continuously collected and the duration of this documentation project is infinite.

Area of study

The geographic area covered is the Region of the national park Hohe Tauern, including the core and the buffer zone of the National Park (ca. 1800 km²), as well as the area outside the national park covered by the municipalities in Salzburg, Tyrol and Carinthia that share a part of the National Park Hohe Tauern. Hence the study area covers a natural spatial unit and is not confined to legislative boundaries such as the borders of the national park.

Methods

The Biodiversity database is maintained at the "Haus der Natur" Museum of Natural History in Salzburg. Database management and data entry is carried out by a small team of biologists specialised in the taxonomy and ecology of vertebrates, invertebrates, and plants respectively, and with in-depth knowledge of informatics.

The main software used in the project is "BioOffice" a specialised software package for the documentation of biodiversity data (formerly produced by Biogis Consulting now maintained at the Tiroler Landesmuseum Ferdinandeum). The database program is based on a Microsoft SQL-Server and a client software with integrated GIS functionality (based on ESRI Map Objects). The software allows the adaptation of the database model as well as the user interface to exactly fit the scope and particular needs of each taxonomic group. For each data field content policies and rules for data integrity and consistency have been set up and documented. Accurate and efficient procedures have been developed to guarantee standardised, consistent data.

The database contains comprehensive and standardised taxonomic lists (based on the Fauna Europaea project and from standard botanical references) for all organism groups covered. These include information on higher systematic, nomenclature, name codes, general distribution (in Austria, Europe), national and regional Red Lists, protection status according to European Union Directives.

Unit-level data records (so-called "objects") contain observation data of individuals in their habitat, or information about collected, prepared, and preserved specimens. Sources of unit-level data include published literature, unpublished project reports, distribution mapping projects and expert opinions, private and public collections, and miscellaneous sources of observational data collected in the field and held by many zoologists and botanists (such as traditional paper card indexes, excursion lists and diaries, but also data already digitised in some way). Consequently, the database contains recently sampled data as well as historical data. Before importing data from various sources, the reliability of the information is evaluated and commented by scientists (e. g. with respect to taxonomic identification), assuring a high quality standard.

The record sets documented in the database can easily queried and can then be presented in user-defined reports or in the form of digital maps. Data may also be exported for further analyses in statistical software packages or other GIS software or.

Results and discussion

Currently the database contains ca. 185.000 records (objects) concerning ca. 8.000 species of animals and plants and ca. 9.500 georeferenced sites. The proportional contribution of various organism groups to the overall record set changes from year to year reflecting the fact that each year other organism groups are focused upon. By the end of 2008 birds and butterflies comprise more than 40 % of the data (table 1 and figure 1). On average each record set comprises about 25 data fields (those containing actual information) therefore the total amount of effective information can be estimated as 4.600.000 data. Within the last six years the record set increased tenfold, from 18.810 in 2003 to more 180.000 by the end of 2008. The mean annual data increase was 65 % (figure 1).

The most important data sources which have been integrated in the database so far are: research project reports commissioned by the National Park (e. g. vegetation science, monitoring of eagles, vultures, bats); collections of specimens and data held in the "Haus der Natur" Museum of Natural History; published scientific papers, data collections provided by specialists (of e. g. birds, butterflies and dragonflies); various unpublished research project reports (e. g. private excursions, university projects); various collections of specimens and last but not least research project reports commissioned by the state government (table 2). A significant amount of data originates from private experts who volunteer their time to floristic and faunistic investigations (a big proportion of the specimen collection in the Museum Haus der Natur comes from private collectors).

The spatial distribution of record highlights some areas of special interest. These are regions which are easily accessible (e.g. along the Grossglockner High Alpine Road) and regions that have been researched in more detail (e. g Wildgerlostal or Dorfertal where "Tage der Artenvielfalt" biodiversity days have been organised in 2007 and 2008). On the other hand, the data clearly highlight areas where biodiversity data are scarce and where future research should be focused.

During the last years of database management we clearly experienced the importance of data standardization which becomes even more important as the number of unit level records increases. Hence, the effort needed to administrate the database and to maintain the high data quality grows with the number of integrated data sources.

The biodiversity database now is an integrated tool which helps us to organise the huge amounts of data originally spread over many sources. The database makes those data accessible for further analyses and for the use in day to day conservation work. It serves as a very helpful service for decision makers who have to consider biodiversity in their daily work.

Tables

Table 1: Number of unit level data per organism group recorded in the biodiversity database (as from December 2008).

Organism group	**Unit-level data**
Mammals	4.511
Birds	32.431
Reptiles and amphibians	1.544
Butterflies and moths	46.132
Hymenoptera (mainly bees and bumble bees)	6.405
Grasshoppers	1614
Beetles	8.350
Dragonflies	589
Spiders	191
Other animal groups	434
Flowering plants and ferns	68.086
Lichens	5.230
Mosses	9.082
Mushrooms	184
Algae	2
Total	**184.785**

Table 2: Data sources for the Biodiversity database.

	Unit level data
Commissioned work by the NPHT	97.572
Natural history collections at the Museum Haus der Natur	52.483
Published data sources	24.596
Private data-collections	6.434
Unpublished reports form various projects and excursions	1.934
Other specimen collections (private and public)	1.139
Commissioned work by the state government	417
Other data sources	210
Total	184.785

Figures

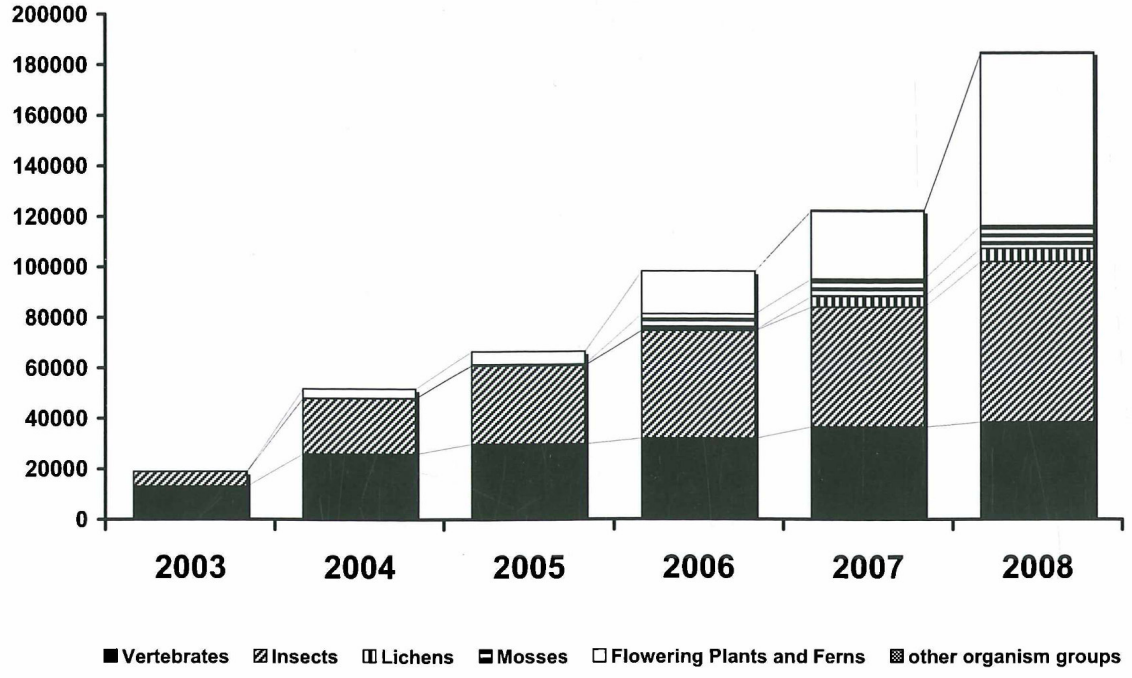

Figure 1: Increase of the number of unit level data recorded in the biodiversity database within the last six years.

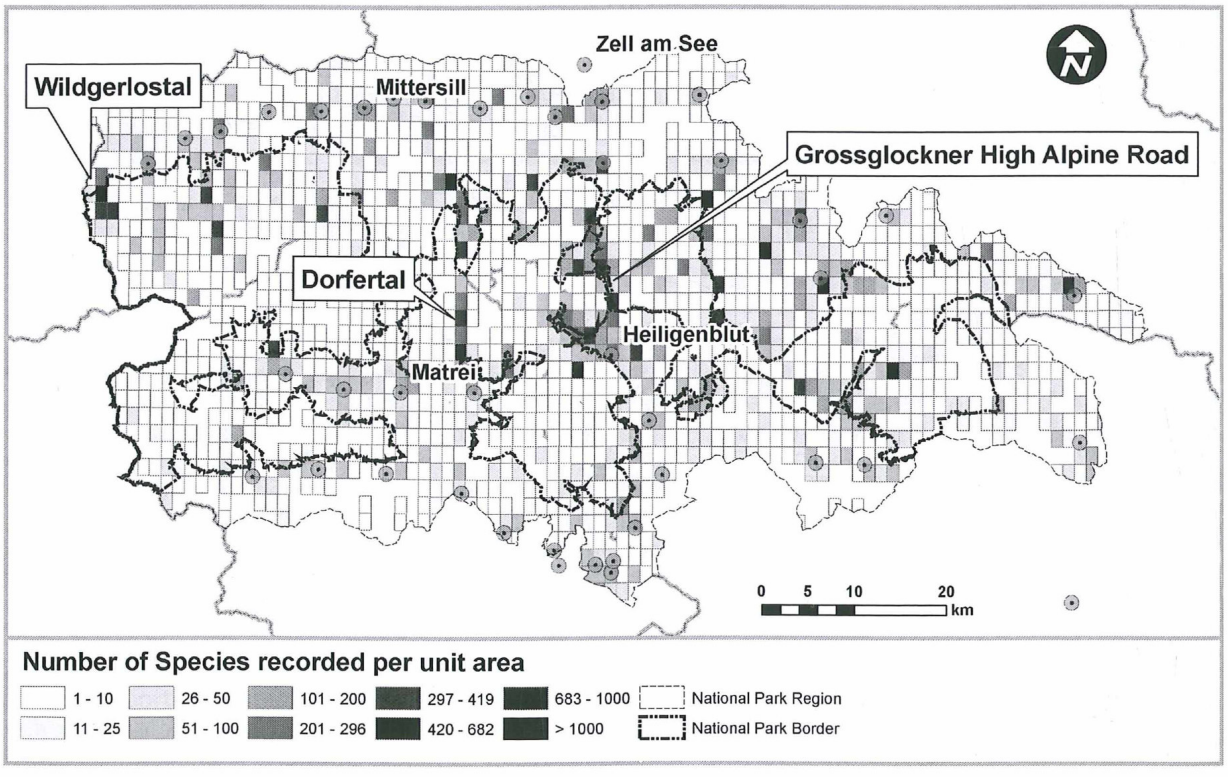

Figure 2: Spatial distribution of animal species records (number of species documented per minute-square) in the region of the National park Hohe Tauern.

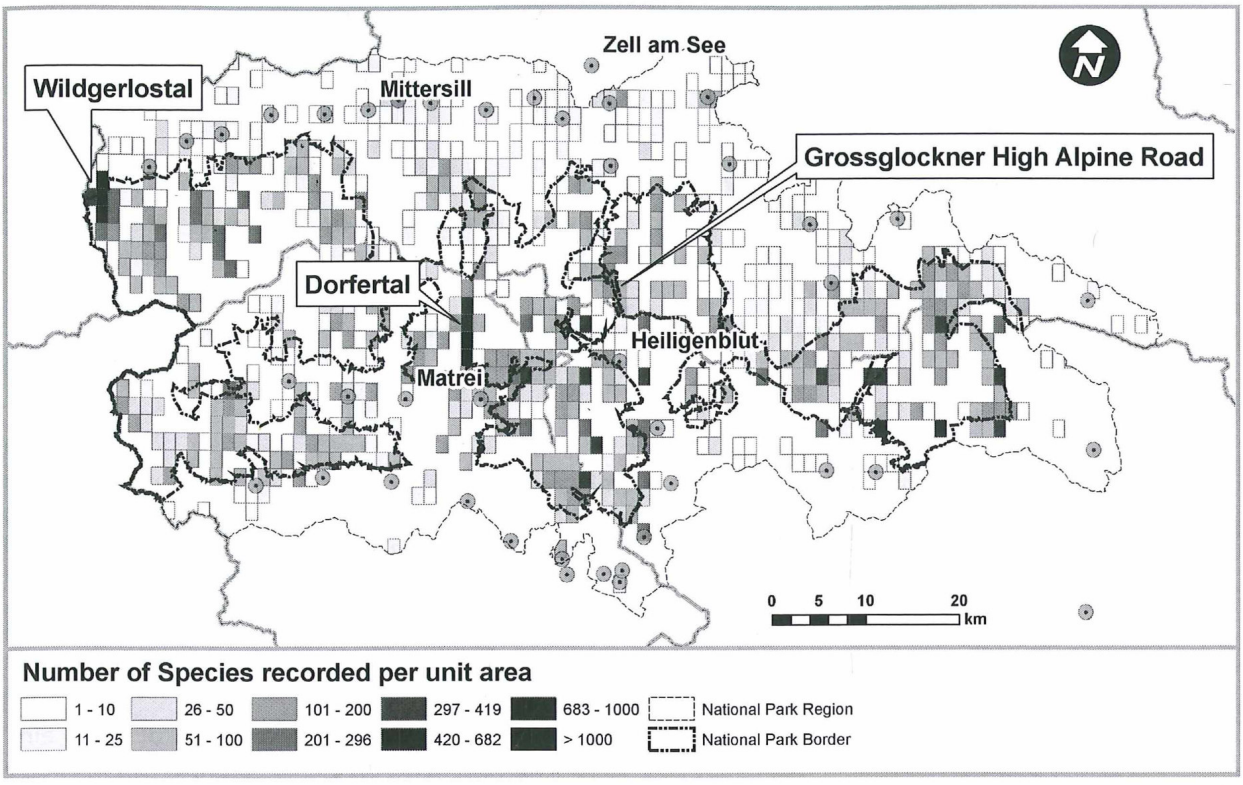

Figure 3: Spatial distribution of plant species records (number of species documented per minute-square) in the region of the National park Hohe Tauern.

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The benefits of the past projects aiming on conservation and the habitats' management in the Iron Gate Natural Park, for 10 years of existence

Gabriela Manea, Elena Matei

Abstract

The Iron Gate Natural Park includes the most important and unique gorge of the Danube Basin, together with the southern slopes of the Banat Mountains (from west to east: Locvei, Almajului, Mehedinti Mountains). The research and the steps to proclaim this area, with remarcable value for Europe, as a natural protected area have started at the end of the seventh decade of the past century, simultaneous with the creation of the big Iron Gate Dam. Science studies, carried out between 1970 and 1997, pointed out quantitative and qualitative changes that the hydro electrical system and others activities in the area have influenced the natural ecosystems and human communities. They also substantiated the setting up in 1998 of the Iron Gate Natural Park.

This paper tries to evaluate the power of these transdisciplinary or interdisciplinary projects for conservation or/and management of the habitats in ten years (1998 – 2008) and the benefits in the amelioration or improvement of the quality for ecosystems with a high degree of naturalness and for human communities as well.

Keywords

Iron Gate Natural Park, ecosystems, local communities, benefits, projects

Aims

The study tries to analyze the progresses of the protection and conservation strategies upon natural and human ecosystems in the Iron Gate Natural Park since 1989 in order to maximize its sustainable development in the context of global changes.

It is an emergent product of a new project, named « The interaction of the climate variability, structural configuration changes, pollution and their impact upon the functional and support capacity in the Lower Danube Sector» which started in 2009 and lasts till 2012 involving all faculties and research centres of the Bucharest University whose results are planned to be used both in researching-teaching process and as a database for the sustainable local community's management of the Danube River resources.

The area of study corresponds to the Iron Gate Natural Park (Modova Noua-Drobeta Turnu Severin Sector) which conserves a unique landscape nucleated on the left bank of Danube Gorge, covering an area of 115 655 ha which represents 9.3% in whole Romania protected area. As the most important gorge of the Danube Basin it gathers over 4000 plants ad 5300 animals species (14 species being endemics) adapted on several diverse biotopes offered by compact rocks limestones, magmatic intrusions, marls in Locvei (735m), Almajului Mountains (1226 m) Mehedinti Mountains and Plateau in alternation with sands, clays in lower depressions (MATEI, 2004), soils, subtropical climate influences, associated to some intense biogeographic processes (migration, speciation, vicariation), (MANEA, 2003).

Objectives

The analysis of the database concerning science activities for conservation and protection awareness of local communities; the identifying through investigations of the success and gaps in the established targets at the beginning of setting up of this protected area and the identification of some opportunities to maximize the natural and cultural values of the park.

Methods

field observations, interviews, GAP analysis.

The interview was semi structured, applied to local communities and authorities, on ten subjects. The GAP method was very useful because it allowed evaluating the efficiency of conservation programs through the comparison of the priorities of biodiversity conservation with proposed and established protected areas. Even though this method was informal used to the initiation of a new protected area it identifies gaps or the degree of fulfilment of the specific objectives for protection. GAP analyse includes 6 direction (sequences) of implementation, but for this study the most important was the third sequence: the protected area is verified in order to determine what is protected and what is not and the degree of coverage. In fact, the study identified gaps of the objectives' fulfilment in their complexity: protection and preserving, economical and social management.

Results and discussions

There were identified benefits for natural ecosystems and human communities in the Iron Gate Natural Park and some unfullfilments or constraints were met in this area as well.

Benefits for habitats and biocenoses are classified in two categories: indirect and direct benefits.

The indirect benefits are hinted by actions focused on protection and preservation launched consequently with the setting of the area as V category (IUCN) such as:

1. The setting up of the managing board composed by specialists, of the advisory council which includes 54 institutions from the two counties and a scientific council made of 13 scientists or academicians;
2. The management plan of the IGNP;
3. The impelling of scientifically research about habitats management (*Life Nature LiFE00/NAT/RO/007171* Iron Gate Natural Park - *CCMESI-University of Bucharest* in order to rise the local communities awareness for endanger species :*Vipera ammodytes ammodytes, Testudo hermanni hermanni, Egretta garzetta, Ciconia nigra, Phalacrocorax pigmaeus, Falco naumanni*; three PhD thesis);
4. Closing of several economical activities with a strong negative impact upon natural ecosystems and human health state (copper and coal mines);
5. Inventory and GIS mapping of stones quarries and banning of new ones to avoid overexploitation and habitats breaking up;
6. Park zoning (strictly preservation- 18 scientific reserves, buffer, recreational and rural development);
7. Creation of a very dynamic centre for captive breeding of Herman tortoise (*Testudo hermanni boettger*) in Eselnita;
8. Environment education: *Tulipa hungarica Celebration on 6-7 April*;
9. Unifying the effort of protection and environmental education on both banks of Danube River- a partnership with Djerdap NP from Serbia;
10. Establishment of five information centres;
11. Consulting and approval of any building or activity by the park managing board.

Direct benefits summarise all countable progresses in natural habitats or biocenoses. As positive feedback of 10 years of protection they were identified next benefits:

1. Reconstruction trends of natural habitats for those animals or plants species spoiled by mining, overgrazing, poaching, speculative and informal commerce of endangered organisms;
2. Minimizing the endemic fauna or plants species extinction belonging of the IGNP bio complexes (fig.1) or those threatened by human activities;
3. Restocking of Hermann tortoise and Ammodytes viper populations;
4. Enlarging the area for several species with limited spreading in Romania using water surface of the reservoir (*Ciconia nigra, Egretta garzetta, Nycticorax nycticorax, Phalacrocorax pygmaeus,* wild ducks, swans etc.).

It is also decent to underline the positive impacts upon human communities in the two towns and 15 villages of the park. The interviews applied on 10 people aged over 14 reflect perception about brought benefits in the analysed period.

All respondents recognised an increasing in tourists' number especially after 2007. Rural communities appreciated the opportunities for agro-tourism and rural tourism and stimulation of multiculturality values. In the last 10 years 26 boarding houses were built, all of them being classified and having specific leisure facilities. Local commuitites were trained to develop art craft souvenirs and to respect the environment.

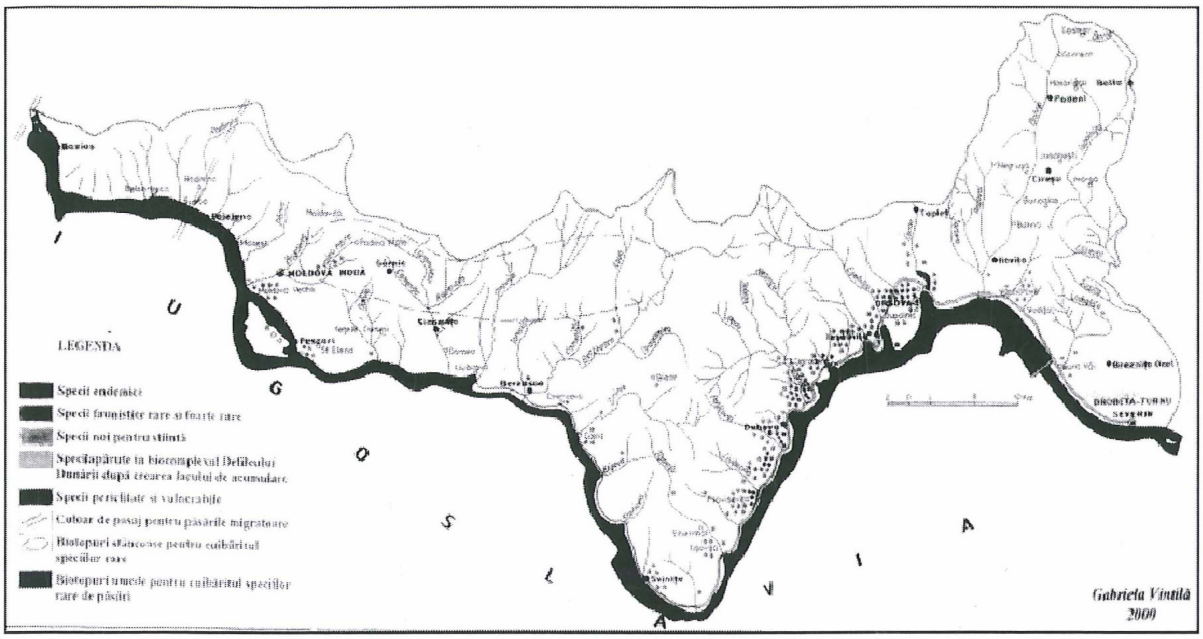

Figure 1: Fauna species as biodiversity tracers in the Iron Gate Natural Park

As the initial target was protection of 349 fauna species and 117 plants species, threatened by extinction due to impact of flooding by the Iron Gate Lake formation, the largest reservoir dam built ever in Romania or mining activities, land use and deforestation, several regulations were approved: Law no 5/2000 concerning the approval of the National Spatial planning, Section III-protected areas and the Environmental Ministry (MAPPN) Act, no. 84/1998. Despite all completitions and success there were identified some unfullfilments, pressures and constraints.

A main topic recognized both by local authorities and communities is the bureaucracy which delays the administration as a formal body and hence the repercussions in monitorising and penalisation of informal fishing or hunting episodes. It is also well-known the disjunction between some articles of the Environment Law and Public Administration Act. Before European adheration the insufficient funds were reinterred, because only 0.2% of GDP was directed toward the environment at all.

Another problem is the continuous demand for second home residence, even the approval of them is closed and specific urban facilities are limited (tap water, sewage system etc.). The poorness in domestic waste disposal management determines the cleaning activities done by the park employees. At last but not least, the spreading and increasing of rabbits (*Oryctolagus cuniculus*) of homeless dogs, horses on the Modova Veche Island-2000 Nature site-compromise the quality of this wet habitat, meanwhile the biologist position dissapeard due to the lack of financial subsidiaries.

In conclusion, after ten years of existence the park can't self sustain and needs access to structural funds, needs a new vision in organizing tourist's entrance, develop ecotourism (CEBALLOS-LASCURAIN, 1996), booking and fees payment system, diversifying of tourist accommodation and leisure facilities on water sports, green promotion and stimulation of suitable alternative sources of energy. Probably, these and other studies could lead local authorities in collaboration with scientists to develop and to influence a large participation in protection and at least in students' minds they remain as a part for environmental education.

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Historical elements on national parks and scientific research in the French Alps

Isabelle Mauz

National parks are a recent creation in France. After a first failed attempt before WW1 (ZUANON, 1995), the French turned towards their colonies to found protected areas (MAUZ, 2003; SELMI, 2006) and became aware during the decolonization that they would remain the only country in Europe without any national park. A law was eventually passed in 1960 and the Vanoise national park (VNP) was created in 1963. The two other national parks created in the French Alps are the Ecrins national park (ENP) in 1973 and the Mercantour national park (MNP) in 1979.

At that time, two extreme models existed concerning the relationship between national parks and science with, on one hand, the Swiss national park designed by and for nature scientists and, on the other, U.S. parks which had taken a clear recreational orientation (KUPPER, 2009) during the period between the two World wars.

Which route was chosen in France? What has been the role of scientists in the design and management of national parks in the French Alps? And, symmetrically, what has been the role of national parks in the progress of the natural sciences?

My communication aims to show that national parks in the French Alps have become important research sites, even though true scientific programs have not been set up, but that scientists have failed to become important actors in park management, even if they have led and won the battles against infrastructure projects. It draws on an in-depth survey on the history of the VNP, on elements about the history of the ENP and MNP, collected while carrying out investigations in these two parks, and on a document written by Jean-Pierre Raffin[24] in 2006, after he chose to quit chairing the ENP's scientific council.

The near absence of scientists at the inception

When the VNP project emerged, French ecologists had been involved in the creation and management of small nature reserves for a long time. These reserves were strictly protected and their access was restricted to scientists, who regarded them as well suited for scientific research. However, they were wary of large national parks where, they believed, regulations would be difficult to enforce and research less interesting because of human activities interfering with "natural" processes. In particular, they were not eager to support the VNP, which sought to combine two very different projects, first a "cultural" project aimed at saving the "Alpine civilisation", which did not appeal at all to scientists, and secondly, a more naturalist project, aimed at saving the ibex. The man who supported this project was both a well-known naturalist and a passionate mountain hunter who, after being caught several times hunting illegally in protected areas and condemned, was shunned by ecologists.

For all the above reasons, scientists showed little interest in the 1960 law and in the creation of the VNP. No wonder then, that scientific activities were not a major consideration in the debates and the law itself made no mention of national parks participating in the production of knowledge or even the existence of a scientific council.

The lack of genuine scientific programmes

However, the spatial organisation selected for national parks did take into account the scientists' views on protected areas. Three zones were created on the paper, a buffer zone, a core zone and fully protected reserve zones, the latter being set aside for research and accessible to scientists

[24] I am very grateful to Jean-Pierre Raffin for having sent me this document, entitled *Research, scientific councils and national parks: some history* (unpublished, 6 p.)

only. And while a scientific council had been forgotten in the decree creating the VNP, it was created by the park advisory board during its first meeting.

The scientific council was an interdisciplinary board of renowned scientists. It had two priorities, draft a scientific programme and designate the reserve zones. The question of fully protected reserves was much discussed during the initial meetings of the council, but no agreement could be reached. The topic progressively faded out and was eventually given up[25]. It also turned out to be very difficult to design a genuine research programme. Scientists each had their own research priorities and deciding which to favour was a thorny issue. Moreover, they were not always interested in the questions raised by the park authorities and were offered small budgets. The lack of budget and of clear ideas on what research could and should be done in a national park did not help in drafting a scientific programme. It was even more difficult to coordinate research activities at the national and international levels. In 2003, the chairs of the park scientific councils repeatedly asked the director for nature and landscapes to organise a meeting to improve the coordination of scientific work in and for national parks. The meeting was eventually organised in 2004 and the project to create an inter-park structure was announced, which has become "National parks of France".

Important research fields

National parks have become important research fields for ecologists. The field staff hired by the park authorities has progressively acquired precious naturalist skills and their permanent presence in the field has been an important asset for researchers. After a series of meetings held in 1979, scientific departments were created in national parks. Although a letter from the director for nature protection stated in 1986 that scientific departments should not themselves conduct research, they have all built databases and exchange data and ideas with scientists. In addition, the certainty that research sites will not be disturbed has encouraged scientists to undertake long-term observations and experiments. As time passes, the data collected in national parks have become increasingly valuable and national parks are now considered by ecologists as ideal places to study ecosystem responses to global changes. Significantly, scientific departments often present the parks as "open-air laboratories".

Scientists as defenders of the parks

Whereas scientists had been nearly absent when the first national park was created, they were very active when its integrity was threatened. At the end of the 1960s, a project to build a ski resort in the core zone of the VNP emerged. It was backed by politicians who happened to chair the park advisory board. At the local and national level, young scientists set out to defend the park. They launched a battle which is now considered the first environmental battle in France (Charvolin, 1993; Mauz, 2003). After two years, they had succeeded in transforming the project into a national affair and had learnt to talk with politicians, fight them if necessary, and organise an environmental battle. In short, they had become activists. A second "Vanoise affair" broke out a few years later (Mauz, 2005; Selmi, 2006). This time, a dam was to be built in the core zone. Again, though the park authorities supported the project, the scientists led and won the battle. After these two affairs, they were in a position to present themselves as the main defenders of national parks.

A minor role in the decision-making process

In 1970, an international conference on European national parks was organised in Paris, which recommended that "the scientific councils play an important role in the choice of the major options in the park management". But the role of scientific councils in park management was never totally clarified, despite several attempts and announcements. For example, in 1979, the director for nature protection announced his intention to constitute a group to coordinate scientific work in national parks. That same year, a letter from the Prime Minister reinforced the scientific mission of national parks and requested that research organisations, each in their particular field, contribute to the scientific work in the parks. In 1982, a national committee for research in protected areas was constituted, but then abandoned after three meetings. Another committee was founded in 1984, with the same fate. The 2006 law on national parks did not officially recognise the existence of scientific councils. But some more power was given to scientific councils, whose chair now sits on the park advisory board, as well as more responsibilities, in that scientific councils must now advise on projects within the "heart" (former core zone) of the parks.

[25] Only one fully protected reserve was finally created, in the ENP.

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The Resettlement of Brown Trout in Alpine Streams of the National Park Hohe Tauern

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Keywords

brown trout, *Salmo trutta fario*, autochthonous species

Introduction

During the last ice-age the European river systems have been formed. After glacier retreat the emerging rivers have been colonised by brown trout, *Salmo trutta*. Nowadays at least five genetically distinct lineages of brown trout are found (BERNATCHEZ 2001). The major part of Austrian waters belongs to the Danubian drainage system and it can be assumed that most autochthonous populations of brown trout belong to the Danubian clade (WEISS et al., 2001). Trout from the Rhine river system belong to the Atlantic clade. In the medieval age man started to stock brown trout from the rivers in fishless lakes and brooks. Thus, trout can be found in almost any mountain water body.

Beginning in the late 19th century trout populations began to decline due to the destruction of natural habitats by human activities and overfishing. As a consequence intensive stocking activities were initiated. However, most of the stocked brown trout in Austria belonged and still belong to domesticated strains of the Atlantic lineage. Furthermore, American species, namely the rainbow trout, *Oncorhynchus mykiss*, and brook trout, *Salvelinus fontinalis*, have been introduced. This introduction of allochthonous material led to altered population structures in most Austrian waters (LARGIADÈR & SCHOLL, 1996; OSIMOV & BERNATCHEZ, 1996; HANSEN. et al., 2000; WEISS, 2000, 2001; DUFTNER et al., 2003). Only in a few remote lakes and brooks descendants of the ancient populations survived until today.

Trout populations isolated from managed water bodies were sampled and the sequence of the mitochondrial control region was determined. This allowed for a separation between allochthonous Atlantic type and presumably autochthonous Danubian type trout. The fish populations from Anraser See and from Gossenköllesee were among the first being identified as homogeneous Danube clade brown trout (DUFTNER et al., 2003). Up to now at least 10 different homogeneous populations have been found in Austria. Microsatellite analyses of these populations indicate a very high homogenity of these populations while overlapping alleles between populations are almost absent.

Field Experiments

The brown trout populations from the high moutain lakes Gossenköllesee and Anraser See were the first which were reproduced successfully and for which sufficient offspring was available to conduct stocking experiments in the field. Before stocking the brooks were electrofished to remove or to reduce the previous populations consisting of brook trout (*Salvelinus fontinalis*).

In all cases the reproduced Danube clade trout showed good survival and growth. Moreover, they stuck remarkably to the location where they were released and survived even high waters accompanied by massive gravel transport. Some data from Windbach are shown in Fig. 1.

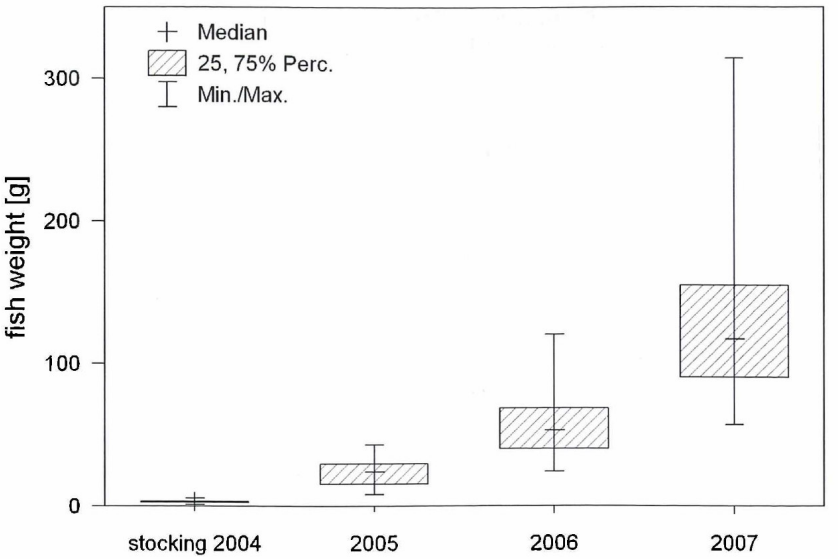

Figure 1: Growth of brown trout of the Anraser See clade in the Windbach (NP Hohe Tauern, Salzburg).

Laboratory Experiments

The growth rates of the reproduced fish fry were determined in the laboratory at 7 and 12°C offering commercial fish food *ad libitum*. Fig. 2 shows an example where the growth of commercially available fish fry (Atlantic clade) is compared with the growth of Danubian clade fry from the Anraser See population. Note that at the lower temperature growth rates for both are essentially equal as demonstrated by equal slopes of the regression lines. In this experiment the Atlantic fry was bigger at the start of experiment. This difference persisted during the whole experiment.

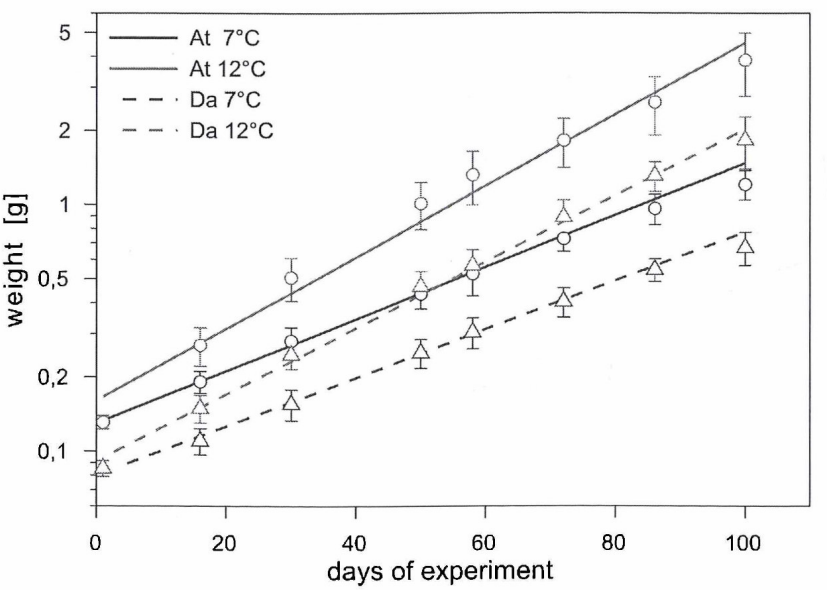

Figure 2: Growth of commercial (Atlantic clade, At) trout fry (circles and solid lines) and from the Danubian clade, Da, (triangles and dashed line) at 7 and12 °C ± S.D.

Discussion

Our data suggest that reproduced brown trout from relic populations are ideal for stocking in Alpine high mountain brooks. Most of these relic trout populations are small and have undergone some bottleneck selection. Although some of these populations survived for centuries in small mountain lakes (like in Gossenköllesee and in Anraser See) they still have the ability to settle and thrive in a brook. This advantages makes them the ideal fish for stocking the harsh and cold environments of the Alps.

Additional advantages include:

They are a native strain.

They are more resistant against high waters than hatchery raised domesticated trout.

They stay close to the stocking point.

Recapture efficiency is high.

Possible disadvantages:

Females gain full sexual maturity after 4 years only.

They may loose competition for food and space against allochthonous species, but presumably only in low land waters.

Most field experiments were done in the National Park Hohe Tauern. Only this shielded environment guarantees undisturbed development of fish populations.

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Ecological classifIcation of water systems in the Julian Alps and Karavanke belt (Slovenia) using spring biota

Nataša Mori, Bašak Oz, Anton Brancelj

Abstract

The Julian Alps and Karavanke mountain belt are extremely rich in water sources and can serve as potential source of drinking water in the future. The ecological assessment and characterization of groundwater ecosystems in this area is needed together with identification of vulnerable water systems endangered by extensive human use and climate change impacts. The study is carried out within the European project "Water Management Strategies against Water Scarcity in the Alps (Alp-Water-Scarce)", with starting date of October 2008. The first part of the project involves collecting of existing spatial data on water and land use in this area. The second part of the project includes the selection of reference sampling sites – springs. Two methodological approaches will be used: (1) sampling of springs as "access points" that can be used to collect the groundwater fauna living in aquifer studied, and (2) sampling of spring fauna, where springs will be considered as special habitats with little oscillation in temperature through the year. In order to obtain representative data sampling of invertebrates will be conducted in spring and autumn season. Field and laboratory measurements will include measurements of the most important environmental factors (temperature, conductivity, oxygen, nutrient contents). Distribution of groundwater and spring fauna will be analysed, indicator species identified and vulnerability maps supplemented by faunistic data. The results will contribute to the better knowledge of aquatic biodiversity, water quality and quantity and pressures due to human use and climate change impacts in the Julian Alps and Karavanke beit, and could be used in future conservation and management plans.

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PHENOALP: a new project on phenology in the Western Alps

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Abstract

PHENOALP is a new EU co-funded Interreg Project "Italy–France (Alps-ALCOTRA)", aiming to get a better understanding of phenological changes in the Alps. Two major goals of the project concerning research are the implementation of an observation network in the involved territories and the definition of a common observation strategy. Project activities are:

1. Pheno-plantes: definition of common observation protocols of different alpine flora species, analysis of the relations between climate and phenological events, application and evaluation of phenological models.
2. Pheno-detection: remote sensing of European larch and high elevation pastures with MODIS data; multitemporal analysis (2000-2011) of phenological variations in the Western Alps.
3. Pheno-flux: analysis of the relation between the seasonal and interannual variability of plant phenology and productivity, assessed measuring CO_2 fluxes (eddy-covariance technique), radiometric indexes and phenological events at specific (European larch stand and alpine pastures) monitoring site.
4. Pheno-zoo: definition of common observation protocols for the phenology of animal taxa (birds, mammals, amphibians and insects) along altitudinal gradients.
5. Inter-pheno: integrated analysis of the relationships between plants and animals phenology and their relation with climatic and other environmental conditions.
6. Meteo-reseau: implementation of a monitoring network of temperature data in the sites where phenological observations are done.
7. Pheno-form: involvement of community members (e.g. schools, naturalistic guides, ...) in the observations and diffusion of results.

Aims and study area

PHENOALP is a new EU co-funded Interreg Project, under the operational programme Italy–France ALCOTRA 2007-2013, aiming to get a better understanding of phenological changes in the Alps. The major goals of the project are:

1. The implementation of an observation network in the Aosta Valley and the Savoies (Western Alps);
2. The definition of a common observation strategy and protocols;
3. The involvement of local community members (e.g. through schools) in the observation activities as a way to increase the awareness on the issue of the effects of climate change.

Project leader is the Environmental Protection Agency of Aosta Valley (IT) and the partners are the CREA-Alpine Ecosystems Research Center (FR), "Mont Avic" Regional Park (IT), "Massif des Bauges" Natural Regional Park (FR) and the Protected Area Service of the Autonomous Region of Aosta Valley (IT).

Planned activities

PHENOPLANTES

The aim of the action is to develop climate change indicators from plants phenology. Regarding ten forest species the knowledge and the experience arising from the Phénoclim Project (www.crea.hautesavoie.net/eng/phenoclim/) will be transferred to the Italian partners territories (Aosta Valley). Observation protocols lead to the estimation of both the beginning and the end of the growth season; observations will be done either by specialist and volunteers.

A new protocol for alpine grasslands is under development; seven groups are considered: cyperaceae, graminoids (palatable and non palatable), evergreen and deciduous shrubs, asteraceae and leguminous. For each group, quantitative variables (e.g. leaves length, bud number, fruits number, ...) will be monitored along the growth season. Observation sites are located along an elevation gradient; observations will be carried out on marked individuals located in permanent plots. Phenological data will be processed to analyse the relationships between vegetation, climate and topography. This data set will allow the application and evaluation of phenological models aiming to estimate the onset and the duration of the growth season. (MIGLIAVACCA et al., 2008)

PHENODETECT

The aim of PHENODETECT action is to use remotely sensed data for monitoring European larch forests and alpine grasslands phenology. MODIS NDVI time series regarding the territories involved in the project (Aosta Valley and the Savoies) will be collected and analysed according to a method developed in the framework of the REPHEX Project (www.arpa.vda.it ; BUSETTO et al, 2009) in order to retrieve phenological events Data collected in the PHENOPLANTES action will be used for the validation of the algorithms. A multi-temporal analysis (2000-2012) of phenological variations in relation with climate will be done. In some of the observation sites (a grassland and a larch forest) continuous phenological observations will be done using webcams. The elaboration of the images, based on recently proposed algorithms (RICHARDSON et al., 2007) will lead to the automatic detection of the onset and the end of the growth season. The data will be included in the PhenoCam network (http://klima.sr.unh.edu/).

PHENOFLUX

The aim of PHENOFLUX action is to analyse the relationship between inter-annual variability of plant phenology and productivity, assessed measuring CO_2 fluxes by using the eddy-covariance technique. The rationale behind this activity is related to the open question regarding the effect that longer growing seasons could have on the seasonal net ecosystem productivity (BALDOCCHI, 2008).

The data coming from two eddy towers will be linked to phenological observations (field observations and webcam). The sites are located in an alpine grassland (2160 m asl) and an European larch forest (2150 m asl). Data elaboration (pre-processing, post-processing, gap-filling and partitioning) is done following the EUROFLUX methodology (AUBINET et al., 2000). Flux data will be delivered to the CARBOEUROPE, CARBOITALY, IMMEC and FLUXNET database

In the two eddy tower sites, along with CO_2 flux measurements continuous spectroradiometric measurements will be done with the aim of monitoring traditional vegetation indexes (e.g., NDVI, MTCI etc) and radiative quantities related to photosynthetic efficiency (Fluorescence, PRI). A robotic system (HyperSpectral Irradiometer, his) was developed and tested and is going to be installed at the experimental sites.

PHENOZOO

The aim of PHENOZOO action is to develop climate change indicators from animal phenology. A wide range of animal taxa is considered in order to detect which are the most suited for phenological monitoring and which are the most sensitive to climate change.

The effect of changing climatic conditions on the reproductive behaviour of some passerines will be studied using artificial nests installed along altitudinal gradients in 4 monitoring sites; deposition dates, clutch and brood size are the observed variables. Chamois and Mountain Sheep will be considered for: (*i*) a retrospective analysis of previously collected data in order to understand the influences of climatic conditions on demographic parameters and (*ii*) the definition of a protocol for the observation of breeding dates. Black Grouse will be considered to: (*i*) test the effects of snow cover changes on the behaviour during the winter season and (*ii*) set up an observation protocol of early reproductive phases. The phenology of some insects and amphibian species will be considered as well and specific observation protocol will be defined.

METEORESEAU

The aim of METEORESEAU action is to create a network of temperature measurement stations in the involved territories. The network will be composed by almost a hundred of stations. The stations will be located close to the sites where plant and animal observations will be carried out in order to tightly link phenological shifts with temperature trends. The stations record soil temperature at a depth of 5 cm, surface temperature, and air temperature at 30 cm and 2m height.

INTERPHENO

The aim of INTERPHENO action is to conduct an integrated analysis of the relationships between plants and animals phenology and their relation with changing climatic conditions.

PHENOFORM

The aim of PHENOFORM action is to (i) create a network of partners in education that can diffuse and promote phenological observation as a way to increase the public awareness on the effect of climate change impact in the Alps and to (ii) involve community members in the observations and diffusion of the PhenoAlp project results.

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Perception and acceptance – key factors for participatory planning of protected areas in Europe

Ingo Mose

Summary

While protected areas become increasingly connected with a multitude of functions, they often suffer a lack of acceptance at the same time. This is often due to planning procedures that are executed in a top down manner, neglecting perceptions of population and actors concerned. Appropriate forms of participatory planning can help to build a fundament for substantial acceptance as well as acceptance provides a basis for the involvement of relevant actors. Thus, successful management of protected areas is dependent on the inclusion of multiple actors and the use of their competences. As a result protected areas may even become future models of sustainable development.

Keywords

Perception, acceptance, participatory planning, regional development

Protected areas: instruments of regional development

Protected areas play an outstanding role for nature conservation today. They are steadily growing in number and size. At the same time they experience considerable change regarding their aims and functions. In fact, many protected areas are no longer "only" areas of protection but rather fulfil a multitude of different functions: tourism, environmental education and research represent well known utilisations of protected areas since long. Further functions are continuously being applied (agriculture, renewable energies, etc.) and contribute to a more general debate about the role of protected areas today. Therefore, protected areas are more and more defined by the integration of protection *and* development functions and thereby are increasingly regarded as instruments of regional development (MOSE, WEIXLBAUMER 2007). By definition this is especially true for biosphere reserves, but also other types of protected areas under IUCN category V (nature parks, regional parks, etc.) throughout Europe (HAMMER 2003).

Even though having gained significant importance, many protected areas are subjects of controversial debate at the same time. Hence, protected areas often suffer a lack of acceptance and are the cause of political opposition and denial among concerned population and actors (STOLL-KLEEMANN, WELP 2006). Although this may seem odd, reasons for such negative reaction are quite obvious. As protected areas get increasingly connected with the aims of regional development, such projects challenge efficient planning and communication. But for too long planning of protected areas has been executed in a rather top down manner, solely building on an outside perspective, whereas neglecting the need to explore and understand the inside perspective as well. This practice explains glaring deficits of acceptance in regions affected by protected areas planning, building up considerable burdens for the implementation of corresponding plans.

Perception and acceptance: tools of understanding

Lack of acceptance provides a warning signal which should not be dismissed, especially with regard to possible political frictions that may result from this. Hence, there is an increasing understanding nowadays that high ranking projects in nature conservation require early communication to identify relevant perceptions of those who are concerned. As COY & WEIXLBAUMER (2009) point out, successful projects in nature conservation are equally dependent on the outsider and insider perspective both of which should not be overvalued to the others expanse. Traditional approaches to protected areas were (and sometimes still are) predominantly based on external aims and executed in a top down manner hardly taking into account any of the local or regional perceptions, concerns, expectations or ideas. Not surprisingly, acceptance of such projects turns out to be

rather low and can only be earned long after official implementation – often with enormous efforts to overcome scepticism and distrust.

Taking the insider perspective more seriously will require appropriate forms of investigation to explore people´s perceptions towards a protected area but also the region as a whole. A number of instruments, mainly of informal nature, offer appropriate tools to identify different dispositions, arguments and attitudes, such as opinion surveys, community appraisals, internet forums, etc. These methods are well proved and supply sufficient information for better understanding of both the insider and outsider perspective. Thus, this will also allow for appropriate measures to communicate a protected area and hence earn greater acceptance for a specific project (MOSE 2009).

Consequently, acceptance can be regarded as a key factor for participatory planning of protected areas. Although this might appear only as a buzzword, the need for participation in the context of planning processes is without question and has been discussed at lengths. As a result, new forms of participatory planning have emerged. Besides legally binding elements especially informal instruments like future workshops, round tables, planning conferences, etc. can provide sufficient incentives for participation. Sometimes application of these instruments may even result in the creation of more permanent network types of cooperation including actors both from the public, private and civil sector (FÜRST 2004).

Relations between participation and acceptance are twofold: Whereas sufficient acceptance will contribute to the establishment of appropriate forms of participatory planning, the latter can also support the development of acceptance. As COY & WEIXLBAUMER (2009) point out, acceptance is something that only can be acquired.

Empirical research: case study findings

Systematic research on perception and acceptance as key factors for participatory planning of protected areas is still a young area of research dating back to the late 1980ies. Since then, a growing number of studies have been recorded, often conducted after the creation of a protected area or (more seldom) shortly before. In recent years research on perception and acceptance has gained increasing attention, namely through the work of JOB (1996), WEIXLBAUMER (1998) and STOLL (1999) to name but a few.

Present research underlines the importance of well designed empirical research to explore perception and acceptance as well as appropriate forms of participatory planning that may build upon these prerequisites. Especially with regard to new protected areas (either being prepared or just having been installed) a number of case studies from The Alpes have proved the value of differentiated knowledge:

In the case of the Biosphere Park Großes Walsertal (Austria) research surprisingly displayed an even stronger attitude of local population towards the protective dimension of the area than was expressed by academic, political and regional development experts from outside (COY, WEIXLBAUMER 2009). At the same time participation in the region is actually growing from strength to strength and thereby reflects a high grade of general acceptance. Slightly different findings are reported from the area of the future Biosphere Reserve Val Müstair – Parc Naziunal (Switzerland). According to KARTHÄUSER (2009) associations of local population are focussing explicitly on the perspective of regional development and less on that of nature protection, which clearly mirrors the perception of the Biosphere Reserve as an instrument of regional development in a rather less favoured peripheral region. Opposite to this the vast majority of tourists see the area mainly as an attractive holiday destination.

Outlook

Future development of large protected areas will highly depend on the implementation of participatory planning accompanied by efficient forms of communication and cooperation. To support these challenges, reliable knowledge about perception and acceptance regarding nature protection certainly is of great value. According to STOLL-KLEEMANN & WELP (2008) participation in protected areas planning does not only take into account the reality of multiple actors being concerned but also reflects increasing experiences that involvement of these actors will result in sustainable acceptance and practical support. Finally, growing complexity of problems connected with protected areas more and more demands the inclusion of multiple actors and their competences to safeguard the quality of protected areas.

Against this background there is a need for continuous improvement of appropriate techniques in participatory planning as well as regarding identification and interpretation of perceptions, attitudes and expectations of those who are concerned. Hence, empirical research can make major

contributions to establish efficient forms of management which allow protected areas to become real models of sustainable development.

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Detection and monitoring of vegetation patterns and borderlines in high mountain environments by using combined terrestrial and remote sensing methods in the Hohe Tauern National Park

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Summary

The GLORIA network collects ground-based, multi-site, long-term monitoring data since 1999 to document how changes in biodiversity and vegetation patterns correlate with climate change in the world's high mountain ecosystems (www.gloria.ac.at). To broaden GLORIA's basic multi-summit approach, this project will apply more terrestrial and remote sensing methods. All methods will be combined in order to use the synergetic effects of detailed information at a large scale as well as area-wide information at a smaller scale.

The proposed study site is located in the Hohe Tauern Range, Austria, which will serve as the first study site to realize this conception. A second study site is located in the Norwegian Scandes and is chosen to validate the innovative monitoring-concept.

Retrospective analyses of orthophotographs will reveal the previous development of the study regions. Current vegetation patterns and critical borderlines will be recorded by terrestrial vegetation mapping as well as by semi-automated classifications of very high resolution satellite data and aerial photographs. Furthermore transects with permanent plots perpendicular to the borderlines in question will be implemented. The results will be used for a sub-pixel classification of RapidEye data which provide very high temporal resolution. Phenological time series will be defined. Consequently, change detection will be accomplished to test the feasibility of the data for a monitoring system.

Thus, the concept should afford the monitoring of the changes in community distribution and altitudinal determined borderlines beyond the GLORIA summit areas and the processes involved.

Keywords

Remote sensing, very high resolution satellite data, QuickBird, RapidEye, subpixel classification, high mountain environment, vegetation monitoring, GLORIA network

Background and Objectives

High mountain environments are sensitive to climate change, because climate-related ecological factors become dominant with increasing altitude. Therefore, the effects of climate change may be more pronounced compared to ecosystems of lower altitude. A key aspect is the presence of narrow ecotones, where changes are significant over short distances. This may lead to rapid recognition of changes if boundaries shift – it also allows gradient studies within smaller areas. Reinvestigations of old "monitoring summits" in the Alps have shown that plants have migrated upwards during the 20th century. An increase of mean annual air temperature (MAAT) since the late 19th century is the most likely cause of this upwards shift (Pauli et al. 2005). Auer et al. (2002) report from a rising of the MAAT of 1.6°C since 1886 at the Hoher Sonnblick Meteorological station (3106 m a.s.l., 15km E of Hinteres Langtalkar) which is above the global average of 0.74°C (IPCC 2007).

The Global Observation Research Initiative in Alpine Environments (GLORIA) is a large-scale worldwide observation network for changes in mountain biodiversity and vegetations patterns. The initiative offers a long-term in-situ monitoring, based on network of standardized observation sites

in the world's high mountain environments (www.gloria.at). One GLORIA "Target Region" contains four summits of different elevation, which cover the major ecotones (subalpine / lower alpine, lower alpine / upper alpine, upper alpine / subnival, subnival / nival), or (in lower mountain ranges) at least a certain altitudinal gradient from the treeline ecotone upwards. The standardized sampling design consists of three different plot types arranged around each summit: Detailet vegetation recording, accurate cover estimations and frequency counts in $1m^2$ plots, a species list with coarse cover estimations for the whole summit area (upper 10m) and, since 2008, a modified frame pointing in $100m^2$ quadrats. Continuous measurements of the soil temperature are conducted to compare temperature and snow regimes (PAULI et al. 2005, PAULI et al. 2004).

In this project, GLORIA's basic multi-summit approach should be broadened: more terrestrial methods and remote sensing methods in addition will be applied combined in order to use the synergetic effects of detailed information at a large scale as well as area-wide information at a smaller scale. The new RapidEye data will be tested due to their feasibility in high mountain environments. By applying terrestrial and remote sensing methods parallel and in combination, new aspects regarding to content and methods are expected.

Study Area, Data and Methods

The proposed target region is located in the Hohe Tauern Range in the Alps, Austria, which will serve as the first study site to realize this conception. A second study site will be chosen in the Norwegian Scandes to validate the remote sensing part of the innovative monitoring-concept.

Satellite data (QuickBird, RapidEye), orthophotographs and digital elevation models (DEMs) will be used for investigations. Orthophotographs and QuickBird data provide very high geometric resolution, whereas the RapidEye system yields very high temporal resolution due to the constellation of five identical earth observation satellites which are capable of imaging any point on earth each day.

Table 1: Characteristics of the used satellite data

	QuickBird	**RapidEye**
Geometric resolution	0.6 m pan, 2.4 m multi-spectral	6.5 m
Bands	4 (vis & nir)	5 (vis & nir & red edge)
Dynamic range	16 bit	12 bit
Scene size	16.5 x 16.5 km	77-km-wide swaths extending at least 1,500 km in length
Revisit time	3 to 7 days	Off-nadir: daily; Nadir: 5,5 days

Retrospective analyses of orthophotographs and historical data will reveal the previous development of the target regions in order to estimate land use and climate impact. The current situation of vegetation patterns and borderlines will be recorded by terrestrial vegetation mapping (according to Braun-Blanquet) as well as by semi-automatic classifications of the QuickBird data. Subsequently, the terrestrial mapping will serve as validation for the semi-automatic classification. To investigate critical borderlines, transects with permanent plots perpendicular to the borderlines in question (treeline, upper vegetation limit, snow cover thresholds) will be implemented. The results will be used as basis for a sub-pixel classification of the RapidEye data. These data will be used to define phenological time series to find the best point in time to separate the classes of interest. Consequently, change detection will be used to test the feasibility of the data for this monitoring system.

Outlook

Thus, the concept should afford the monitoring of the changes in community distribution and altitudinal determined borderlines beyond the GLORIA summit areas. We expect to achieve very detailed information about vegetation patterns and the processes involved. Both, information and a tool set for including remote sensing in combination with and beyond GLORIA-methods will provide a basis for long-term vegetation monitoring. Summarized, in this project, a monitoring method will be developed by observing two target regions at three spatial and two temporal scales to provide information about changes in vegetation cover.

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Surface characteristics of alpine cirques and valley heads in Central Austria with respect to permafrost distribution

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Summary

Surface characteristics (e.g. bedrock, scree slope, vegetated terrain) influence the thermal behavior and hence permafrost distribution in alpine environments. Consequently, global warming will not change evenly the permafrost distribution pattern in such environments. In this study different types of surface covers have been mapped at seven alpine study sites in central Austria (three of them are located within the Hohe Tauern National Park) based on true-color and color infrared orthophotographs. An interpretation key was developed for the requirements of the project ALPCHANGE. This ALPCHANGE Interpretation Key is comparable to the HABITALP-Interpretation-Key and consists of four hierarchical levels. Results of all study sites in the Hohe Tauern National Park show that *debris*, *glacier* and *rock* are the dominant surface coverages. Regarding *debris*, *coarse debris* dominates all three study sites (69-71%), followed by *fine debris* (14-22%), *coarse debris with vegetation less than 60%* (5-11%), and *fine debris with vegetation less than 60%* (2-3%). As a consecutive step, these data will be combined with temperature measurement data and other topographic information from the same study sites in order to calculate the present permafrost distribution.

Keywords

ALPCHANGE, surface interpretation key, Hohe Tauern National Park, Dösen Valley, Pasterze Glacier area, Gössnitz Valley

Background and objectives

Permafrost – as a thermal phenomenon is defined as ground where temperatures remain below 0°C for a period of at least two consecutive years. Amongst others surface characteristics strongly influence the thermal behavior and hence permafrost distribution in alpine environments. Mountain permafrost – in the Alps mostly discontinuous permafrost defined on the amount of spatial coverage – can be found in altitudes above 2500 m a.s.l. depending on topoclimatic conditions (Barsch 1996). Temperatures in coarse-grained scree slopes for instance are significantly lower than temperatures in similar slopes that consist of fine grained material or bedrock (Kellerer-Pirklbauer & Kühnast 2009). Therefore, global warming does not change the permafrost distribution in high mountain environments uniformly.

In this study an surface interpretation key was developed similar to the HABITALP Interpretation Key (Demel et al. 2006) thereby considering the specific requirements of the project ALPCHANGE (for more information see Kellerer-Pirklbauer et al., in this volume; or www.alpchange.at), These requirements are mainly studying the effects of different surface characteristics on global warming by combining point temperature data derived from continuous ground surface and near ground surface temperature measurements by miniature temperature data sensors (MTD) with the areal data (slope, aspect, elevation and surface characteristics).

Different types of surface cover were mapped at seven alpine study sites within ALPCHANGE in central Austria: Central Schober Mountains (Gössnitz Valley), Hintereggen Valley, Fallbichl-Schareck, Pasterze Glacier area, and Dösen Valley within the Hohe Tauern Range, and Reichart Cirque as well as Höll Valley in the Reichart area within the Niedere Tauern Range. Three of seven sites are located within the Hohe Tauern National Park (Fig. 1 and Table 1). Results of all seven study sites are presented here.

Study sites and data base

The mapped area at each study site varied between 0.9 km^2 and 30.2 km^2. The main optical data used for the analysis were true color (TC) or near infrared (NIR) orthophotographs, acquired between 1983 and 2003 (Table 1). In addition analysis in Dösen Valley used very high resolution satellite data (QuickBird).

Table 1: Location, areal extent and used data for surface mapping of the seven study sites.

Mountain Range	Study site	Mapped area in [km^2]	Mapped elevation range in [m]	Used data
Hohe Tauern Range	Gössnitz Valley (CSM: Central Schober Mountains)	8.2	2360 - 3250 890 m	TC, 0,5 m, 2003
	Hintereggen Valley (HEV)	2.4	2050 - 2774 724 m	TC, 0,5 m, 2003
	Pasterze Glacier Area (PAG)	30.2	2050 - 3798 1748 m	TC, 0,5 m, NIR, 2003 Orthophotos, 1983
	Fallbichl-Schareck (FAS)	0.9	2050 - 2570 520 m	TC, 0,5 m, NIR, 2003
	Dösen Valley (DOE)	4.3	2265 - 3086 821 m	TC, 0,5 m, 2003; QuickBird 2003; TC,1,2 m, 1997 TC, 1983
Niedere Tauern Range	Hochreichart cirque (REI)	1.9	1750 - 2380 630 m	TC, 0,5 m, NIR, 2003
	Höll Valley (HOV)	2.9	1700 - 2390 690 m	TC, 0,5 m, NIR, 2003

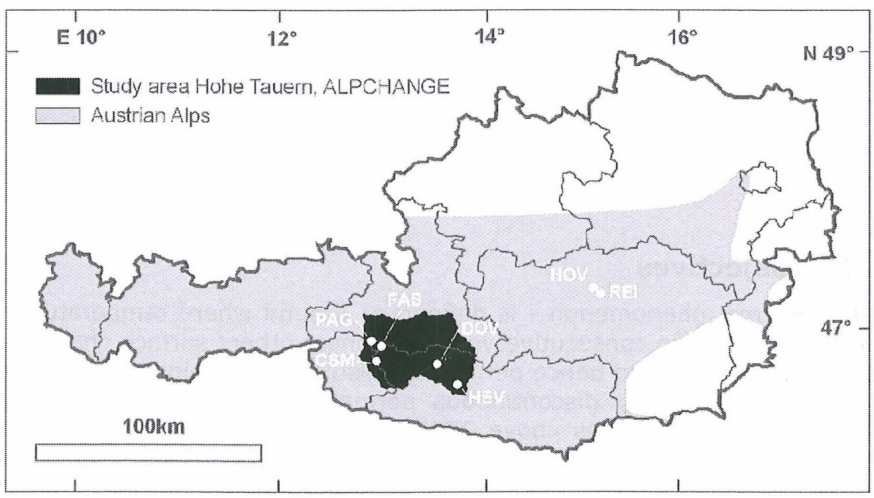

Figure 1: Location of the seven study sites of ALPCHANGE within the Austrian Alps. For abbreviations refer to Table 1.

The ALPCHANGE Interpretation Key and mapping rules

The ALPCHANGE Interpretation Key (AIK) consists of four levels (Table 2). The first and second level of the AIK is built-on hierarchically (digits 1 and 2 in the code). In the third and fourth level the character and the degree of the coverage are considered (digit 3: character and digit 4: degree). The first level contains the dominant surface characteristic such as *rock*, *debris*, *vegetation* or *glacier*. The second reveals more details such as *coarse* or *fine debris with or without vegetation*. In the third level the second-dominant surface cover is described (e.g. *alpine meadow*). Finally, the fourth level shows the degree of coverage of the different units (e.g. *alpine meadow* 10-40%)(Fig. 2).

Table. 2: The ALPCHANGE surface interpretation key

Digit 1: Level 1	Digit 2: Level 2	Digit 3: mixed with ...	Digit 4: Degree of coverage
1... Rock	11.. Rock 12.. Rock with vegetation	..1. Rock ..2. Coarse debris > 1 m ..3. Fine debris < 1 m ..4. Alpine meadow ..5. Dwarf shrub heath ..6. Mountain dwarf pine ..7. Green alder	...1 0 – 10 % ...2 10 – 40 % ...3 40 – 60 %
2... Debris	21.. Coarse debris > 1 m 22.. Coarse debris > 1 m with vegetation 23.. Fine debris < 1 m 24.. Fine debris < 1 m with vegetation	..1. Rock ..2. Coarse debris > 1 m ..3. Fine debris < 1 m ..4. Alpine meadow ..5. Dwarf shrub heath ..6. Mountain dwarf pine ..7. Green alder	...1 0 – 10 % ...2 10 – 40 % ...3 40 – 60 %
3... Vegetation	31.. Alpine meadow 32.. Dwarf shrub heath 33.. Mountain dwarf pine 34.. Green alder	..1. Rock ..2. Coarse debris > 1 m ..3. Fine debris < 1 m ..4. Alpine meadow ..5. Dwarf shrub heath ..6. Mountain dwarf pine ..7. Green alder	...1 0 – 10 % ...2 10 – 40 % ...3 40 – 60 %
4... Ice / Snow	4100 Glacier, not debris-covered 4200 Glacier, debris-covered 4300 Glacier, firn-covered 4400 Snowpatch		
5... Water	5100 Waterbody 5200 Creek		
6... Shadow	6100 probably rock 6200 probably debris 6300 probably vegetation		
7... Buildings	7100 Buildlng 7200 Road 7300 Path 7400 Other	7110 Hut / House 7410 Avalanche barriers ..20 Dam	

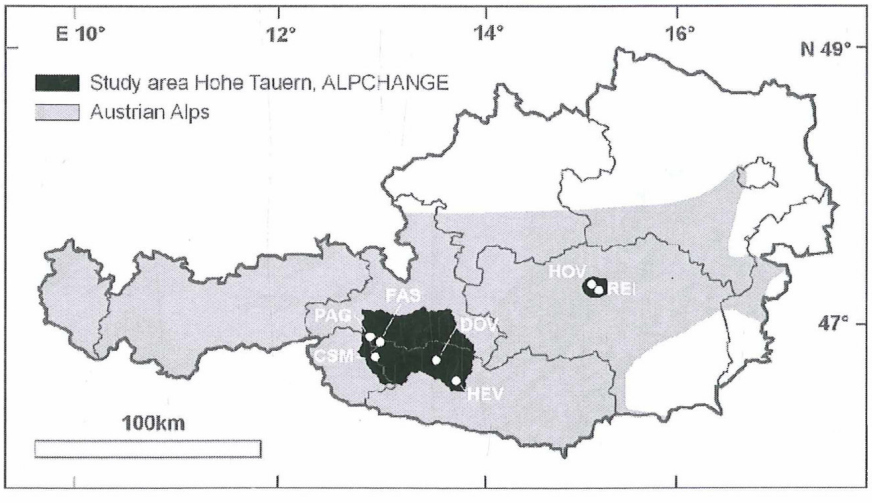

Figure 2: Exemplary detail of the Hochreichart area - Class 2442: *Fine debris with vegetation*: *alpine meadow* 10–40 %

The mapping is based on monoscopic orthophoto-interpretation with the directive that all polygons were created area-wide and do not overlap. One polygon had to define one particular homogeneous area and was assigned to a class by determining the dominant surface cover (principle of dominance) (DEMEL et al. 2006). The minimum-width was defined with 2 m, the minimum area with 100 m², and the minimum-mapping-unit with 10x10 m. The mapping was performed at a scale of 1:1,500.

For the separation of the class "*debris*" in "*coarse debris*" and "*fine debris*" boulders of 1 m were defined as border between the two classes. Dominant geomorphologic phenomena such as moraines, rockglaciers or mudflow-accumulations were considered priorily.

Results and discussion

This analysis only presents mapped classes which are essential for the ALPCHANGE project: *rock*, *rock with vegetation*, *coarse debris*, *coarse debris with vegetation*, *fine debris*, *fine debris with vegetation*, *vegetation* and *glacier* (Fig. 3, 4).

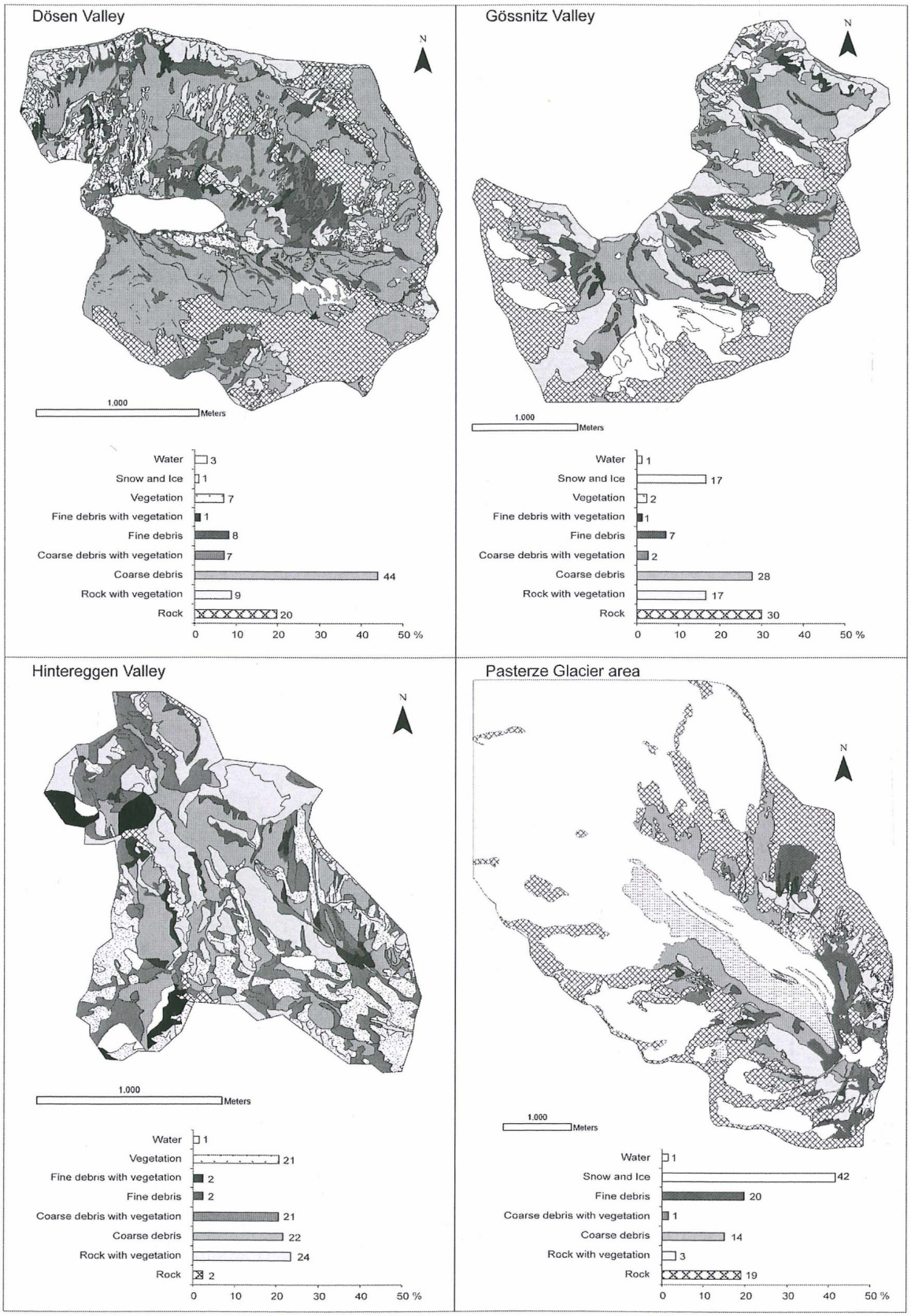

Figure 3: Mapping results and coverage percentages of *rock* and *debris* at first and second level and *vegetation* at first level for the study sites Dösen Valley, Gössnitz Valley, Hintereggen Valley and Pasterze Glacier (for map key see Fig. 5)

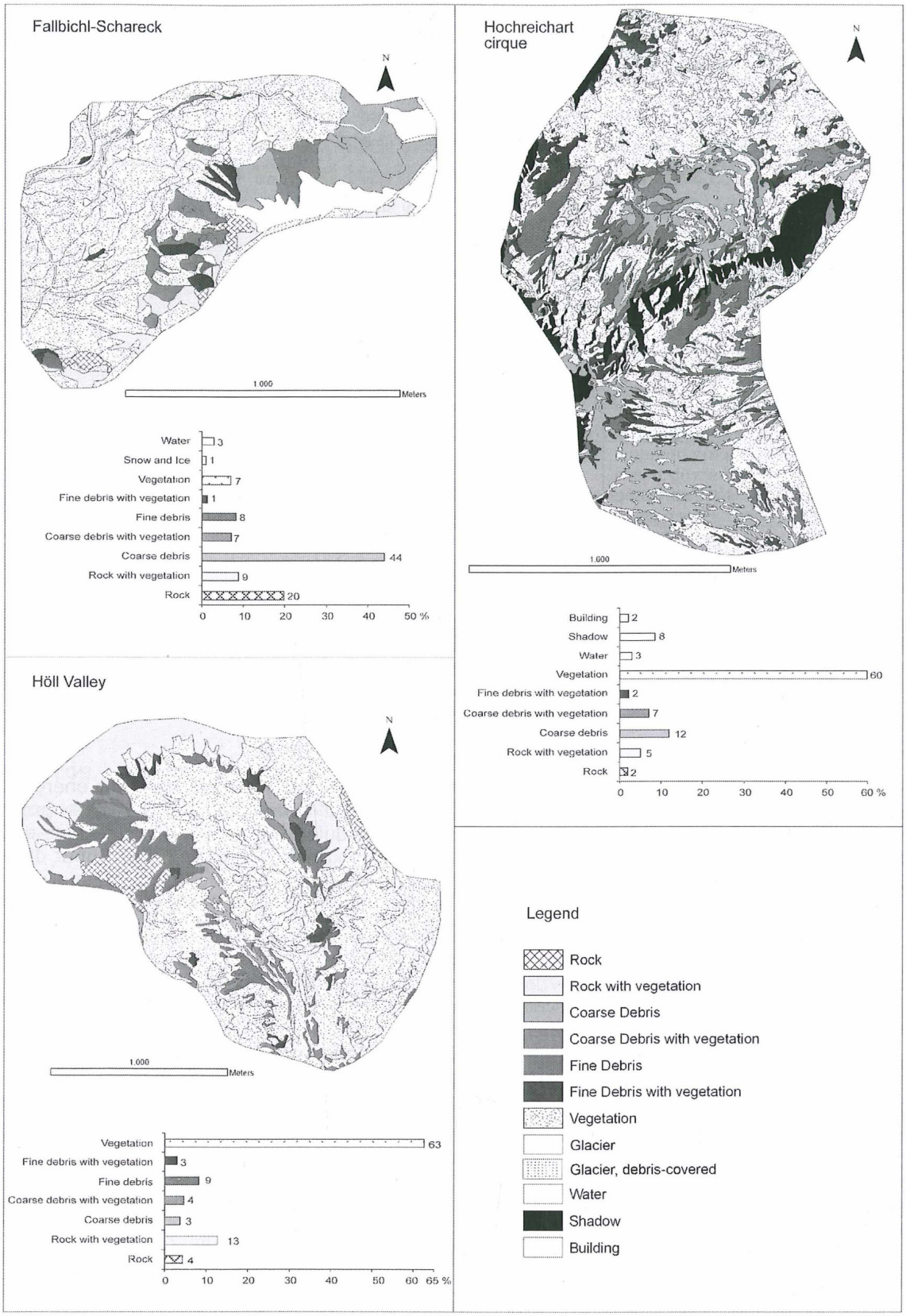

Figure 4: Mapping results and coverage percentages of *rock* and *debris* at first and second level and *vegetation* at first level for the study sites Fallbichl-Schareck, Reichart Cirque and the Höll Valley

Results of the study sites in the Hohe Tauern Range show that *debris*, *glacier* and *rock* are the dominant surface coverages. Especially the type *coarse debris* can be addressed as a crucial factor for supporting permafrost formation in the study sites. Dösen Valley shows a notably amount of *coarse debris* (45% + 7% *debris with vegetation less than 60%)* followed by Gössnitz Valley (25% + 2% *with vegetation* < *60%*), Hintereggen Valley (22% + 21 *with vegetation* < *60%*) and

Pasterze area (14% + 2% *with vegetation <60%*). In the Pasterze area the classes *glacier* and *debris-covered glacier* are predominant with 54% and 5%, respectively. Thus, permafrost is only probable in 16% of debris and 26% of rock covered area.

The two study sites in the Niedere Tauern Range are dominated by vegetated areas due to lower elevation. These are mainly *alpine meadow* (21-33 %) and *dwarf shrub* (13-32 %). Only between 18% and 44% of the mapped area is covered with *debris* and *vegetation < 60%* and are therefore adequate for permafrost occurrence (Table 3).

Table 3: Percentage of the surface cover-types in the six study sites at level 2.

CODE: Level 2	Hohe Tauern Range					Nieder Tauern Range	
	Dösen Valley	Gössnitz Valley	Pasterze area	Hinter-eggen Valley	Fallbichl-Schareck	Hoch-reichart Cirque	Höll Valley
11.. Rock	19	33	22	2	2		4
12.. Rock with vegetation	9	18	4	23	5	14	13
21.. Coarse debris	45	25	7	22	13	2	3
22.. Coarse debris with vegetation	7	2	1	21	7	8	4
23.. Fine debris	8	8	4	2		6	9
24.. Fine debris with vegetation	1	1		2	2	28	2
31.. Alpine meadow	7	2		21	33	22	24
32.. Dwarf shrub heath					32	13	28
33.. Mountain dwarf pine						1	13
34.. Green alder							
4100 Glacier		11	54				
4200 Glacier, debris-covered			5				
4300 Glacier, firn-covered							
4400 Snowpatch	1		1				
5100 Waterbody	3		1	1	1		
5200 Creek			1		1		
6100 probably rock				2		2	
6200 probably debris				3		4	
6300 probably vegetation							

Outlook

In a following step the data generated in this surface-cover analysis are the basis for energy-flux-modeling which yields to modeled ground temperature and consecutively to a most probable permafrost distribution. The approach comprises a two-module system with a (i) surface-energy flux model and a (ii) thermal-offset model (*PERMABAL*; Stocker-Mittaz et al. 2002). Input data for (i) are surface characteristics (e.g. albedo, roughness) and meteorological data (*e.g.* air temperature) modeling the surface temperature, for (ii) temperature differences (*e.g.* gravel size, snow cover thickness) to model the ground temperature.

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Tourism in protected areas: potential or risk? A case study from the World Heritage Area Lake Baikal

Christian Opp, Christine Bild

Summary

Tourism in protected areas is a worldwide growing phenomenon. Numerous scientific studies deal with the effects, advantages and inconvenients that tourism bring in nature reserves. Depending on the individual circumstances, tourism in protected areas can be a potential or a risk.

Widespread nature based tourism has a potential to contribute to the sustainable development in the Baikal Region.

The study was carried out to get information about the status and problems of nature based tourism and its effects on areas of the Lake Baikal World Heritage Site, with focus on the Island of Olkhon. Olkhon's suitability for nature based tourism, the characteristics of the tourists and the institutional prerequisites were analyzed to evaluate the potential or risk for the protected area and for their inhabitants.

Results of this study show that the Baikal Region and the Island of Olkhon, despite some infrastructural defects, have a great potential for nature based tourism. However, this tourism does not contribute to a sustainable development today because the existing efforts are too weak to regulate the current form of tourism.

Keywords

Nature based tourism, protected areas, sustainable development, Lake Baikal, Olkhon Island

Nature based tourism is increasingly more important worldwide. Because of this, visits by tourists in protected areas are rising. However, a bigger number of tourists in protected areas can be a double-edged sword. On one hand tourism in protected areas can bring money, a support for conservation issues and can improve the livelihood of local people and the financial situation of the local communities. On the other hand it can have negative impacts on the natural and cultural heritage (BUSHELL & EAGLES 2003: 2,6). Whether tourism can support or not the conservation issues depends on diverse factors. The protected areas must be suitable for nature based tourism. It is only with the help of a purposeful institutional framework that tourism can contribute to the protection aims of protected areas (MÜLLER 1998: 31).

In 1996 parts of the economically weak Baikal Region became the status of the UNESCOs World Natural Heritage. Three National parks and other protected areas are located within the Baikal region. In this region, nature based tourism is seen as an important instrument to reaching sustainable development (BBN 2002: 140).

Since tourism in protected area does not have a long tradition in the Russian Federation (BBN 2002: 156), it is very interesting to show whether the growing tourism in Russia is compatible with the objectives of nature conservation and whether this type of tourism really has the potential to promote a sustainable development of the region or not.

In order to collect information on tourism as well as its institutional framework and contribution to a sustainable development, quantative and qualitative methods were used. During the summers of 1987, 2006 and 2007 field surveys at touristic sites in the World Heritage Area Lake Baikal were held. In 2007 observation and mapping of the previous years were broadened with interviews.

The World Heritage Area Baikal includes the Lake itself and its coastal regions and bordering protected areas. Big cities are excluded from this area.

In 1987 and 2006, observations and mapping took place within the Pribaikalski National Park with a focus on the Island of Olkhon. The Island of Olkhon was in the focus of the observations in 2007.

With a surface of 720 km2 Olkhon is the biggest and only inhabited island of Lake Baikal and one of the main Baikal tourist destinations.

The recreational potential (attractiveness) and the recreational capacity (receptivity) of the Baikal Region, and especially of Olkhon Island, were observed to verify the suitability for nature based tourism. Additionally interviews with tourists, residents and providers of touristic performances helped us to analyse the behaviour of the tourists.

To detect if tourism can support a sustainable development and, if so, how, the institutional framework and the effects of tourism on ecology, economy and socio-cultural milieu were evaluated.

This study shows that Lake Baikal and the Island of Olkhon, with its unique natural and cultural heritage, have a great potential for nature based tourism. However, the lack of transportation and accommodation infrastructures, the existence of scarce waste disposals and harsh climatic conditions in winter are factors that hinder nature based tourism. This is especially true during the main touristic season when the infrastructure is overloaded. Another lack is the existence of only low level touristic management in the protected areas.

Nevertheless tourism at Lake Baikal increased during the last decades. National and international tourists come to Lake Baikal seeking its unique nature. Exceptionally attractive locations at the shore of Lake Baikal become touristic hot spots during the main tourist season. One of these hot spots is the Island of Olkhon.

The interviews show that enjoying the nature is the principal motivation of tourists for coming to Lake Baikal. Thus camping, with a preference to wild camping, is the favourite accommodation form. Wild camping and the uncontrolled construction of resorts are the main reasons for the conflict between tourism and nature protection at the Baikal Region. Hence, the so called "Baikal Law" and the legislations refered to national parks call for a regulated, nature saving tourism. However, the understaffed and underfinanced protected nature reserves are bad prerequisites to guarantee this.

This situation produced a broad spectrum of negative effects on the environment of Olkhon due to touristic activities. The sensitive vegetation gets destroyed by hikers, wild camping and the need for firewood. The fauna also gets disturbed by uncontrolled tourism tours. Rubbish left behind in touristic places is a common feature.

Tourism is indispensable for the economy of Olkhon Island. Most of the residents of the island work in the tourism sector. Among the asked residents, 93 per cent offer tourist services That is why tourism improves the living conditions of the locals. Critically must be seen that tourism on Olkhon is characterised through a limited seasonality. However, the economic development depends on it.

In general, the residents of Olkhon Island do not see the tourism as a stress. However, tourists often do not respect the cultural heritage, rites and traditions.

The potential of nature based tourism in the World Heritage Area Baikal is still not used in a protected area adapted way, and the "wild" tourism can flourish. To stimulate that potential it is obviously necessary to create a more effective tourism management in the Heritage area and the nature reserves. The deciding question consists in the strategy for an effective tourism management. More, intensive studies on the tourism could bring the answers by demonstration the needs of the tourism and the specific conflicts between tourism and nature conservation.

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Celebrating 100 Years of National Parks in Europe

Morwenna Parkyn, Carol Ritchie

The EUROPARC Federation

Summary

In 2009 Europe celebrates the 100th anniversary of the establishment of its first nine national parks in Sweden. To mark this occasion the EUROPARC Federation, the foremost and largest NGO representing European protected areas in 39 countries, has developed the project "Celebrating 100 Years of National Parks in Europe". The project aims to proclaim anew the values and benefits of National Parks across Europe and examine their 100 years of history and runs from September 2008 to September 2010.

Keywords

National Parks, Europe, 100 Years, Anniversary, Protected Areas, EUROPARC

Europe's protected areas are the life support system of the continent and the repository of it's iconic landscapes and cultural treasures. Our national parks are reservoirs of biodiversity, sources of water, cultural and economic assets and places of recreation and spiritual replenishment. They also play an important role in reducing and adapting to the effects of climate change as well as in the realization of the CBD (Convention on Biodiversity) guidelines.

In 2009 Europe celebrates the 100th anniversary of the establishment of its first nine national parks in Sweden. To mark this occasion the EUROPARC Federation, the foremost and largest NGO representing European protected areas in 39 countries, has developed the project "Celebrating 100 Years of National Parks in Europe". The project aims to proclaim anew the values and benefits of National Parks across Europe and examine their 100 years of history and runs from September 2008 to September 2010.

This project does not focus on scientific research as such but achieves its objective through a number of project activities. The main project outcome will be a publication, whose main purpose is to bring the idea of national parks and nature conservation in Europe, their relevance to European society over the last 100 years and their role in the future of the continent closer to the general public. It will present this information in a tangible, accessible and engaging way and targets those working in protected area management and visitors to and advocators of National Parks. It will be launched at the EUROPARC Conference in 2009 (9 – 13 September).

The book will be mainly visual and will be divided into four main parts:

Part 1 - General information on European national parks, their benefits and values, plus a map and information about protected areas with the same IUCN designation as national parks.

Part 2 – Information, critique and concrete examples highlighting the development of national parks and conservation in Europe over the last 100 years

Part 3 – Profiles of the first national park founded in each EUROPARC member country

Part 4 – What does the future hold for national parks and nature conservation in Europe?

The project will investigate and present the development of national parks in Europe over the last 100 years and will also look to the future of nature conservation, the possibilities or issues that could develop in this field over the next 100 years. This perspective should not only help protected areas across Europe but also other stakeholders in nature conservation to reflect on past issues and solutions and learn from these for the management of protected areas over the next generations. In addition, the project outcomes ensure a greater publicity of these issues and the topic of nature protection and national parks across Europe, raising the profile of Europe's national parks, their management and the role of protected areas in Europe in general.

Other outcomes of the project will include a timeline depicting the last 100 years with information on European national parks at the year they were founded and a mobile exhibition also presenting the pictures and short texts about the first protected area founded in each European country. The exhibition will travel around Europe's capitals from September and will also focus in on the topics of biodiversity and climate change. The centenary of European National Parks will also be celebrated at this year's EUROPARC Conference "100 years of National Parks in Europe. A shared inheritance; A common future", in Sweden in September.

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The importance of long term monitoring in protected areas: The case of butterflies in the Swiss National Park

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Lepidoptera order, who counts more than 165'000 species in the world and about 3'660 in Switzerland (LSPN 1987; SAUTER & WHITEBREAD 2005), is classically divided into Macrolepidoptera and Microlepidoptera. The Macrolepidoptera are themselves separated in two groups: the Rhopalocera (Butterflies) and the Heterocera (Moths). In Switzerland, 196 species of Rhopalocera are considered as resident (GONSETH 1994).

Butterflies have long captivated amateur and professional scientists and more is known about them than is known about almost any other group of insects. They depend on resources and habitats that we can easily characterize. They have important links with vegetation (caterpillar's development and pollination by imagoes). They are relatively easy to census. But more important, they show variations in diversity and abundance from place to place, which may suggest the geography of their evolution. Moreover, changes in their number over time are powerful indicators of changes in their environment.

Between 1920 and 1941, Arnold Pictet conducted an elaborate study, in which he recorded the occurrence of Macrolepidoptera encountered across the Swiss National Park (SNP) and its surroundings (PICTET 1942). The Swiss National Park (SNP) was created in 1914 and a scientific research program in the SNP was first established in 1916 to allow scientists to increase our knowledge on this specific area. The SNP is situated in the eastern part of Switzerland (Canton of Grisons). Its surface of 172.4 km^2 is composed of 28% of forest, 21% of alpine lawns and meadows and 51% of bare rocks (http://www.nationalpark.ch/). Nature is therefore evolving more or less sheltered from human disturbances since about 100 years.

During 21 consecutive years, Pictet observed 102 species of Rhopalocera. More recently, new monitoring (in 1998, 2001 and 2004) updated Pictet's records and allowed tracing population dynamics since 1942 (PASCHE et al. 2007). The sampling method is an easy-to-use one, and well adapted to protected areas (GONSETH et al. 2007). It is based on 1 ha (specific diversity) and 0.25 ha (relative specific abundance) plots. Such plots are also well adapted for monitoring other taxonomic groups as for example Orthoptera, Spiders, Coleoptera or for botanical statements. In recent inventories, 89 species of Rhopalocera were recorded, representing 87% of the Rhopalocera diversity observed by Pictet and almost half of the Swiss Rhopalocera species. Butterfly diversity of the SNP remained almost unchanged for over 80 years. The SNP plays well its role of protection. Most of the species that were not re-sampled occur in habitats that were not involved in recent studies (e.g. forest or habitats under 1600 m). However, the monitoring revealed a decrease in the abundance of some species, in particular alpine species *Pontia callidice* (Hübner, 1800), *Euphydryas aurinia debilis* (Oberthür, 1909), *Euphydryas cynthia* (Denis & Schiffermüller, 1775) and *Melitaea asteria* (Freyer, 1828). For these four species, the contrast between 1920-1942 and nowadays is really impressive. According to Pictet, these species were common and well distributed in the whole park. Nowadays, only some specimens were observed. In addition, the distribution range of some species apparently shifted towards higher altitudes between 1942 and today (e.g. *Spialia sertorius* (Hoffmannsegg, 1804) observed 500 m higher in 1998 than in 1942). These results indicate that climate changes, such as global warming, may have a strong influence on the diversity, the abundance and the distribution range of SNP Rhopalocera species. That's the reason why in 2009, a detailed survey of *Spialia sertorius* (Hoffmannsegg, 1804) has been initiated in the SNP. The presence and reproduction of this species has to be confirmed and verified in particular in one valley (Val Trupchun) where it has shifted towards higher altitude. In parallel to that study, a new sampling area has been selected (6 plots) in high altitude grazed area (Val Mora). This future biosphere reserve adjacent to the SNP will bring more data for comparisons.

But these recent surveys have another objective. We dispose today of a network of reference plots for long-term monitoring of Rhopalocera. In 2006, some plots studied in 1998 or 2001 were re-sampled for the first time, providing the opportunity to monitor how the diversity and distribution of Rhopalocera species evolved during recent years. It appears that the populations of Rhopalocera are almost stable in SNP during this time interval. There are only small differences between comparisons (species not seem or new species encountered). We discovered three new species in 2006.

Long term monitoring of butterflies in the SNP and adjacent areas will become a very useful tool to the Park Direction towards management decisions.

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Alpine soil crusts, the biocoenosis which braves the cold

Thomas Peer, Johann Peter Gruber, Angelika Tschaikner, Roman Türk

Summary

In an interdisciplinary approach, soil crusts were studied in the vicinity of the Grossglockner road, in the area of Hochtor, at 2575 m a. s. l. The study is focused on organism composition, function and development of soil crusts in alpine altitudes. Within the soil crusts, eukaryotic algae are present with 42 taxa and Cyanoprokaryota with 3 taxa. The lichen flora includes 23 taxa with *Thoniniopsis obscura* being the most common species. The total number of bryophytes achieves up to 14 taxa, and approximately 40 different vascular plants are scattered throughout the soil crusts. Compared to bare soils, crusts accumulate more silt and clay, have higher contents of humus and nitrogen, and have higher water storage capacity. The specific biological, physical and chemical traits of the crust contribute to significant higher soil stability and to better establishment for vascular plants. However, soil crusts are extremely sensitive toward mechanical disturbances and thus they need rigorous protection.

Keywords

Biological crusts, organism composition, soil characteristics, National Park of Hohe Tauern, Austria

Introduction

Biological soil crusts (BC) are an intimate association between soil particles and cyanobacteria, algae, microfungi, lichens, and bryophytes which live within or on top of the uppermost soil (Belnap & Lange 2003). In contrast to the numerous studies from semiarid and arid regions, knowledge about BC in alpine ecosystems is fragmentary. With the exception of Pérez (1997) and Gold et al. (2001), only Huber et al. (2007) give a first description of alpine soil crusts. In continuation of this study, further investigations were done in 2007 and 2008. We included new sites in order to extend our knowledge about (i) the biotic (organism) composition of BC, (ii) the environmental conditions for BC, and (iii) their function within the alpine ecosystem. All our studies were kindly supported by the Glockner Öko-Fonds.

Study area

The study area is situated in the mountains Hohe Tauern (Austria), close to the Hochtor-Tunnel at 2505 m elevation. The sample plots were set east of the Hochtor, where Rauwacke, dolomite and calc-marble prevail (Seidlwinkl Triassic), and west of the Hochtor with different bedrocks of the Brennkogel facies, such as black phyllites, mica-schists, quarzites, prasinites, and garnet chloritoide schists (Fig. 1). The climate is alpine; the mean air temperature ranges from -10 °C to -8 °C in January and from 2 °C to 4 °C in July. On an average, 250 frost days, 150 to 200 ice days and 80 to 90 frost alternation days occur per annum. The mean annual precipitation lies between 1750 mm and 2000 mm. 70 % to 80 % of the precipitation falls as snow, the snow cover lasts 270 to 300 days.

Methods

Along 10 transects of 5 to 10 m length, abundance and frequency of lichens, bryophytes, and vascular plants were recorded in distances of one meter, using a frequency frame of 10 cm x 20 cm. The abundance of species was estimated as percentage groundcover. Additionally, soil types were described and classified according to the rules of the Austrian Society of Pedology and the World Reference Base for Soil Resources (FAO, 2006). Soil samples were taken both, from the crust layer and underlying/bare soil. The samples for microbiological analyses were collected at the sites of the sample plots, using metal cylinders (Ø 5 cm, length 1 cm). For methodical treatment of the algal culture see Bischoff & Bold (1963). The soil analyses include: pH, particle-size distribution, Kjeldahl-nitrogen, organic matter content, heavy metals, water absorption capacity, and aggregate

stability. ISO-standards on soils were applied. All analyses were done on 5 replicate samples. Taxon identification and nomenclature followed for Cyanoprokaryota and eukaryotic algae ETTL & GÄRTNER (1995), for mosses and liverworts FREY et al. (1995), and for lichens POELT (1969) and WIRTH (1995). Vascular plant nomenclature follows that in FISCHER et al. (2005). To compare the differences between soil crusts and underlying/bare soil, the non parametric Mann-Whitney U-Test was applied (SPSS-programs for Windows).

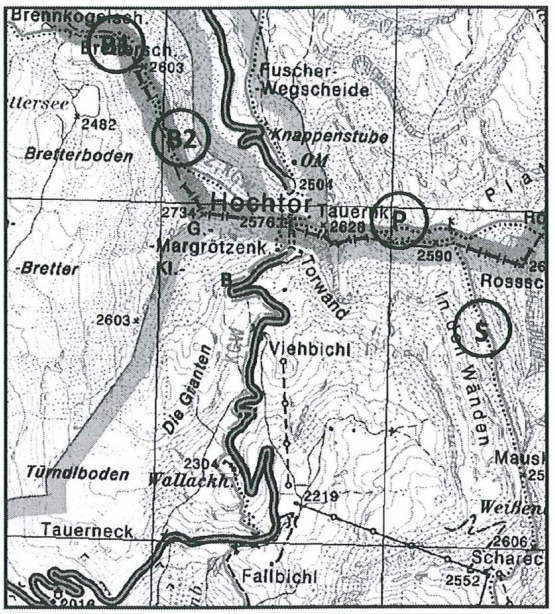

Figure 1: Localization of the sites from where the samples were taken (B1, B2 = Brennkogel, P = Plattenkar, S = Schareck)

Results and discussion

Approximately 45 taxa of eukaryotic algae and Cyanoprokaryota were recorded in samples within transects. Green algae (Chlorophyta) are the biggest group with 35 taxa; yellow-green algae (Xanthophyta, Eustigmatophyta) exhibit 7 taxa, and blue-green algae (Cyanoprokaryota) 3 taxa. Within Cyanoprokaryota, the species *Nostoc punctiforme* is most frequent. The genera *Anabaena* and *Pseudanabaena* are filamentous algae and like *Nostoc* capable of nitrogen fixation. Cyanoprokaryota are also known to aggregate soil particles by producing extracellular polysaccharides. The yellow-green algae *Botrydiopsis constricta* and *Eustigmatos vischeri* have coccoid forms, whereas the species of *Xanthonema* (*X. hormidiodes*, *X. montanum*, *X. debile*) are filamentous. Filamentous forms are suitable to bind mineral particles together and thus to facilitate soil aggregation. Within green algae, the taxa *Stichococcus* sp., *Coelastrella* sp., *Chlorella* sp., *Cylindrocystis* (*brebissonii*), and *Klebsormidium* sp. are most common. In general, algae represent the first community to colonize bare soil, and together with aeolian deposits they contribute to a first pedogenesis.

The lichen flora includes 23 taxa with *Thoniniopsis obscura* being the most common species of biological crusts. *Toniniopsis obscura* forms dark coloured, granular crusts on carbonate soils, and contributes essentially to the fixation of the upper soil layer. *Buellia elegans* also forms solid crusts, which are firmly connected with the upper layer of the soil. As additional lichens of high frequency, *Cladonia symphycarpa, Collema fuscovirens, Dacampia hookeri*, *Solorina saccata*, and *Myxobilimbia lobulata* are to be found in the study area.

Compared to algae and lichens, bryophytes are of minor importance on our sites. This fact is probably linked with the competition pressure of lichens, primarily by the crust forming *Thoniniopsis obscura*. Approximately 14 taxa, among them 4 liverworts, were recorded in the study area. Most of them are ubiquists and exhibit a wide altitudinal range (colline to alpine). Within mosses, species of the genus *Bryum (B. argenteum, B. imbricatum, B. pallescens)*, and within liverworts, *Blepharostoma trichophyllum* and *Lophozia sudetica* are very common on our sites. Many mosses and liverworts were juvenile and in a gametophytic stage, thus an exact determination was partly impossible. In contrast to the low biomass of bryophytes on the soil surface, the subterranean moss protonemata and rhizoids are widespread and are likely to contribute to soil stability.

The total number of vascular plants with 40 species is relatively high, but only 11 species are frequent and have a higher abundance. Typical plants of the bare scree slopes are cushion plants, like *Saxifraga oppostifolia, S. rudolphiana* (both develop long runners), *Silene acaulis*, and *Minuartia sedoides.* Furthermore, *Salix serpillifolia* as a creeping plant, and *Oreochloa disticha* as a tuft-grass occur. Higher humidity and more favourable nutrient supply within the biological crust layer facilitate growing conditions for vascular plants, provided seeds can find suitable gaps to germinate. Within BC, the species *Carex atrata*, *Cerastium uniflorum*, *Euphrasia minima*, *Gentiana orbicularis*, *Minuartia gerardii*, *Persicaria vivipara*, *Primula minima*, *Saxifraga oppositifolia*, and *Silene acaulis* are frequent. Alpine grasslands with *Carex curvula* or *Elyna myosuroides* need deeper and better consolidated soils; between the alpine swards biological crusts are largely lacking. Many species colonize several habitats, and there is also a mix between calcicole and calcifuge plants, which could be caused by aeolian mineral deposits (originating from the heterogeneous parent material in the Grossglockner area), and/or is probably an indication of the wide ecological amplitude of those species.

Depending on parent material and the geomorphologic situation, pedogenesis varies in a wide range. On slopes, weakly developed soils prevail. The soil-depth is 15 cm to 25 cm and stones of different size intersperse the entire profile. Because of permanent slope movement, distinct horizon differentiation is generally lacking, but a slight brownish discoloration within the solum points to chemical weathering processes and the presence of Fe-oxides and clay-minerals as well. Therefore we classified the soils as Skeletic Regosols, Rendzic Regosols, Cambic Regosols, and Skeletic Cambisols. The two latter require an advanced pedogenesis. The texture ranges between loamy sand and silty loam, the crusts are provided with somewhat more clay and silt. Compared to bare soils, crusts have remarkable higher contents of organic carbon and organic nitrogen, and the accumulation of stabilizing substances like clay minerals and organic substances affects both, higher water absorption capacity and significantly higher aggregate stability. Furthermore, crusts are also effective captors for pollutants like Pb, Zn and Cd, probably originating from long distance transport and/or local traffic emissions (Tab. 1).

Table 1: Chemical and physical properties of crusts and bare soils. Differences tested by Mann-Whitney-U-test, * $p < 0,05$)

	pH ($CaCl_2$)	clay	silt	sand	org. C	Kjeldahl-N	water abs. capacity	aggregate stability	Cu	Ni	Pb	Zn	Cd
		%	%	%	%	%	ml/cm³	%	mg/kg DM				
crust (n= 21)	6,6	8,6	24,0	67,3	4,5*	0,17*	0,57	85,28*	11,07	22,38	87,93*	50,07*	0,33*
bare soil (n=21)	6,9	8,1	22,3	69,5	2,3	0,06	0,49	36,16	13,09	25,38	42,55	31,24	0,12

Conclusions

Alpine BC are composed mainly of lichens; bryophytes and algae are of minor importance. BC accumulate fine material, humus, nutrients and atmogenic heavy metals. BC protect underlying soil against erosion forces and improve conditions for plant growth. BC require fine weathering deposits, sufficient humidity during the entire year, and moderate steep slopes without any disturbances. Mechanical disturbances such as foot paths do crush the thin-layer and fragile crusts. It is necessary to intensify the research on alpine soil crusts, and to anchor the results in the minds of the general public.

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Visitor nodes: A customizable instrument in visitor management

Johanna Pfeifer, Sabine Hennig, Christian Opp

Abstract

Today, enjoying nature is one of the main reasons for recreation. Especially, protected areas attract visitors. Within visitor management, infrastructure plays an important role. To efficiently use infrastructure for its issues there is a need in data. This demands concepts to support data collection, management, analyses and visualisation. One approach is the concept of visitor nodes. Visitor nodes are characterized and classified into different categories by their infrastructural supply and recreational activities. With the use of databases, statistics and GIS special aspects like *family-friendliness* can be analysed. Thereby, visitor nodes can be used as a customizable instrument in visitor management. This is shown by the example of Berchtesgaden National Park.

Keywords

visitor management, recreation, infrastructure, visitor nodes, GIS, data management

Background & Aims

In recent years, recreation changed remarkably. Today, to visit and enjoy nature are main motives (Opachowski 2005; Wages, McColl & Haynes 2002). Thus, nature-based recreation shows growth potential: A rising number of persons with changing demands and behaviour perform an increasing number of activities in nature. Protected area management and visitor management are confronted with the complex task of balancing ecological and social benefits and disadvantages that visitors cause (Newsome, Moore & Dowling 2004). Here, infrastructure is one instrument: Infrastructure can be used to guide and to manage visitors in an area because it enables access to the area, facilitates visitor activities and meets visitor expectations on information, orientation and nature experience. However, to be used in visitor management a detailed survey of infrastructure is needed (Worboys, Lockwood & De Lacy 2005). For several reasons (multitude of different elements, large size of protected areas etc.) infrastructural data shows deficits (availability, completeness etc.). An approach how information on recreational infrastructure can be made available to visitor management is necessary. This must occur in a structured and flexible way to give an overview, to evaluate and to deduce measures on infrastructure. Thus, the concept of visitor nodes is applied exemplary at Berchtesgaden National Park.

Visitor Nodes

The concept originates from Australian national parks. Visitor nodes are defined as areas of spectacular beauty, general interest, educational signage or unique settings. They provide an adequate infrastructural supply (benches, picnic tables, signs, information shelters, environmental education elements etc.) depending on visitor numbers, visitor activities and management objectives (Lockwood, Worboys & Kothari 2006; Pfeifer, Hennig & Opp 2008). Visitor nodes are classified in five categories by the recreational activities which take place there (see fig. 1). Each category is described by specific infrastructural elements defining an *infrastructure standard*. In consequence, the infrastructural situation of each visitor node can be compared with the standard of the belonging category. Deficits and satisfying situations can be identified; recommendations can be given. By combining different infrastructural and natural issues it is possible to distinguish and evaluate complex aspects. One example is *family-friendliness*. In the last years, families with children show growing visitor numbers in protected areas. For visitor management they are a main target group as they play an important role for environmental education (BayStMLU 2001).

Family-friendliness can be defined by e.g. the co-existence of elements for nature access/ experience, resting combined with possibilities to play and environmental education. All infrastructures must be adequate for children. This asks for barrier-free equipment – meaning accessibility to sites and suitable infrastructure for e.g. handicapped people, pregnant woman, families with children (Arnade & Heiden 2006).

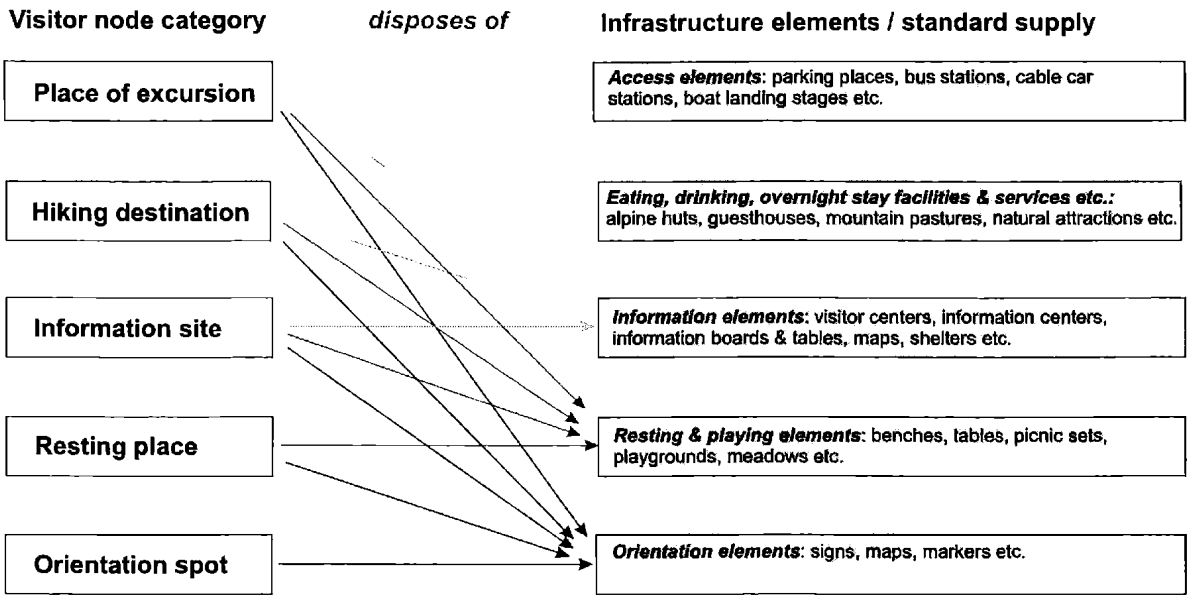

Figure 1: Visitor nodes: categories & infrastructure standard supply

Visitor Management & Visitor Nodes in Berchtesgaden National Park

In Berchtesgaden National Park, the concept of visitor nodes was applied. It is presented by the example of *Lake Königssee* focusing on visitor nodes being *family-friendly*.

Berchtesgaden National Park & Lake Königssee

Berchtesgaden National Park is situated in south East Germany, in the Alps. The whole region *Berchtesgadener Land* has a long history of recreation and tourism. Currently, more than 1.3 million people visit the park every year mainly during summer. Most performed recreational activities are walking, hiking and biking. In total the park provides 236 km of official trails, several visitor facilities, six information centres, nine huts, and many resting places. Landscape attractions include viewing points, alpine meadows, wildlife observation points, and lakes (BAYSTMLU 2001; JOB, METZLER & VOGT 2003). One main touristic destination is *Lake Königssee* with *St. Bartholmä* peninsula and *Salet*. Both locations, characterized by spectacular nature scenery and many touristic facilities (restaurants, mountain pastures, fisherman's hut etc.), can be reached by boat only. These most visited attractions ask for visitor management.

Infrastructural evaluation Lake Königssee

In Berchtesgaden National Park data on 81 visitor nodes were collected. To take stock and characterize them, GPS mapping and a particular survey were used. Other data was added from maps, literature and existing databases. All data was managed in a data model (RDBMS Oracle 10g XE, Oracle Spatial) which then was analysed and visualised using statistics and GIS (PFEIFER 2008). At *St. Bartholomä* (6) peninsula and *Salet (4)* 10 visitor nodes were identified, characterized and categorised (see fig. 2).

Focusing on *family-friendliness* the situation at the visitor nodes (named as VN 1- 10) can be described as follows:

Nature access & experience: 9 visitor nodes provide access to water, 7 offer natural playgrounds, and 6 dispose of both natural playgrounds and access to water.

Resting: Simple resting elements can be found at 7 visitor nodes. Picnic sets are nowhere available. One typical kid's playground is located at VN 1. Special possibilities to eat and drink are offered at VN 1, 7, and 9.

Environmental education: Environmental education elements can be found at 7 visitor nodes: one national park center (VN 1), one information table at VN 7 and VN 3.

Barrier-free: 30% of the visitor nodes are accessible barrier-free: they are reachable by boats. The further infrastructural situation at all visitor nodes does not consider barrier-free aspects.

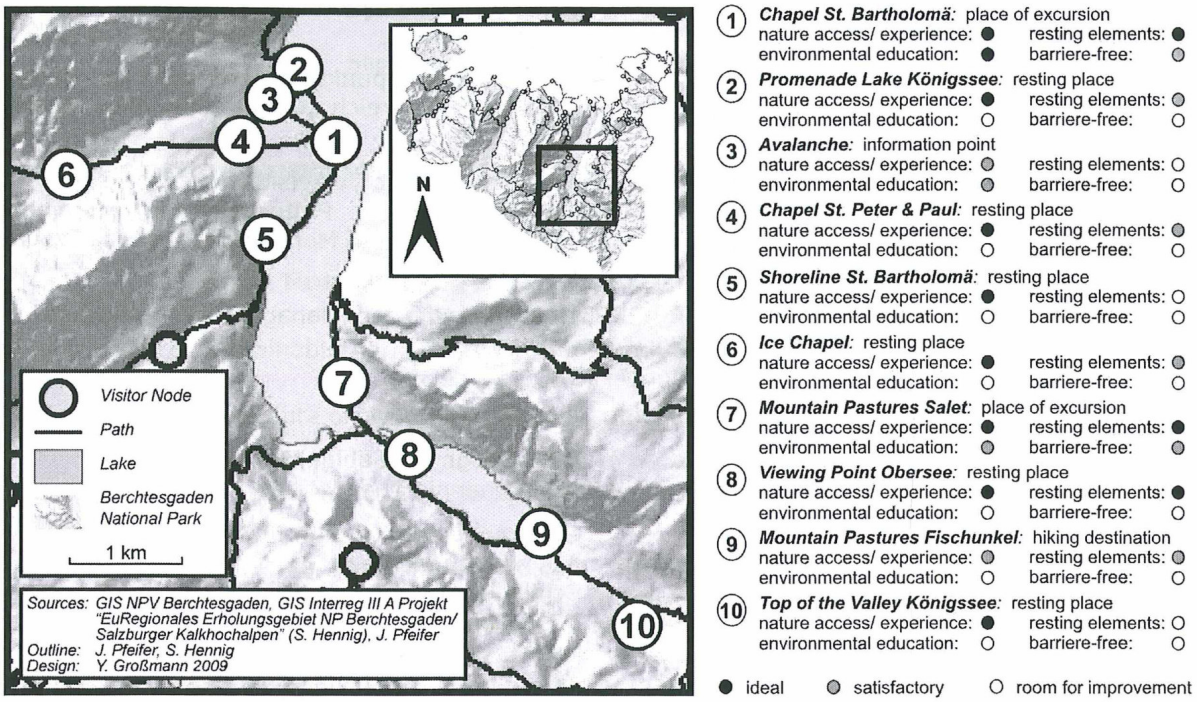

Figure 2: Visitor nodes at *St. Bartholomä* peninsula & *Salet*

In conclusion *St. Bartholomä* peninsula and *Salet* show high potential on *family-friendliness* aspects by their natural conditions. However, to meet the existing opportunities of nature experience and nature access, the infrastructural situation should be improved. Visitor nodes should provide multisensory and interactive elements for environmental education. Concerning the defined standard, all visitor nodes should offer simple resting elements; *places of excursion* (VN 1, VN 7) should dispose picnic sets. According the barrier-free aspects the entire situation has to be enhanced. More suitable infrastructure in *size, design* and *performance* must be available.

Outlook

For Berchtesgaden National Park, the concept of visitor nodes has been proven useful. Deficits can be found and adequate measures set up. Visitor nodes categorization and the consideration of infrastructure and attributes enable accessing and analysing data in a flexible and well organized way. With data management they are a customizable instrument in visitor management. Data is accessible for adaptation to different management aspects. Regular updating must be carried out to keep the data valid. Monitoring, as a part of visitor management (ARNBERGER 2007), is required for visitor nodes.

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Local plant knowledge of farmers' families in the Napf-region, Switzerland

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Summary

This contribution presents preliminary results of an ongoing PhD project which aims to explore linkages between plant diversity and local plant knowledge in the Napf-region in Switzerland. The central part of the Napf is a cultural landscape listed in the Federal Inventory of Landscapes and Natural Monuments of National Importance. Cultural Domain Analysis was used to get an overview of known and used plant species. In total 51 family members of twelve farmer families were asked to list indigenous plants, followed by semi-structured interviews about the use of the species. Roughly 400 wild and cultivated plant species were listed. The most frequently mentioned were *Taraxacum officinale* agg. and *Rumex obtusifolius* L.. Mentioned use categories, with declining frequency, were food, medicine for humans and animals, decoration, handicraft, toys and customs. Statistical analysis on the influence of demographic factors like age, gender, education, cultural background and farming system on plant knowledge revealed that age is the most important factor to explain knowledge variation.

Keywords

ethnobotany, local plant knowledge, biocultural diversity, Napf-region, Switzerland

Introduction

Research in the field of biocultural diversity demonstrates that biological and cultural diversity are inextricably linked and landscapes with their plant diversity coevolved based upon local peoples' land management strategies (e.g. MAFFI, 2001). A prerequisite for effective biodiversity conservation is therefore a better understanding of the interactions between local people and their environment.

In 2008 a PhD project was started to explore linkages between plant diversity and local plant knowledge in the Napf-region of Switzerland, a cultural landscape of national importance. The project aims at gaining insights into people and plant relationships in a mountainous area in central Europe, as a basis for applied projects in the fields of conservation, environmental awareness and education.

The present paper summarizes preliminary results and provides an overview of the local plant knowledge.

Research area

The Napf-region, bounded by a circular valley structure, encompasses around 500 km² and belongs to the northern alpine foothills (Figure 1). It harbours 1,063 different plant species (WELTEN & SUTTER 1982, WOHLGEMUTH 1993). The central part of the region (1,61.4 km²) is registered in the Federal Inventory of Landscapes and Natural Monuments of National Importance, deserving to be protected and managed with the greatest possible care (BLN site Nr. 1311, 1983). In this inventory the *Napfbergland* is described as a „cultural landscape with exclusively solitary farms, shaped by pasture farming and plenter forestry".

The border between the cantons of Berne and Lucerne runs across the summit of the Napf and divides the region in two parts with a protestant and a catholic background, respectively.

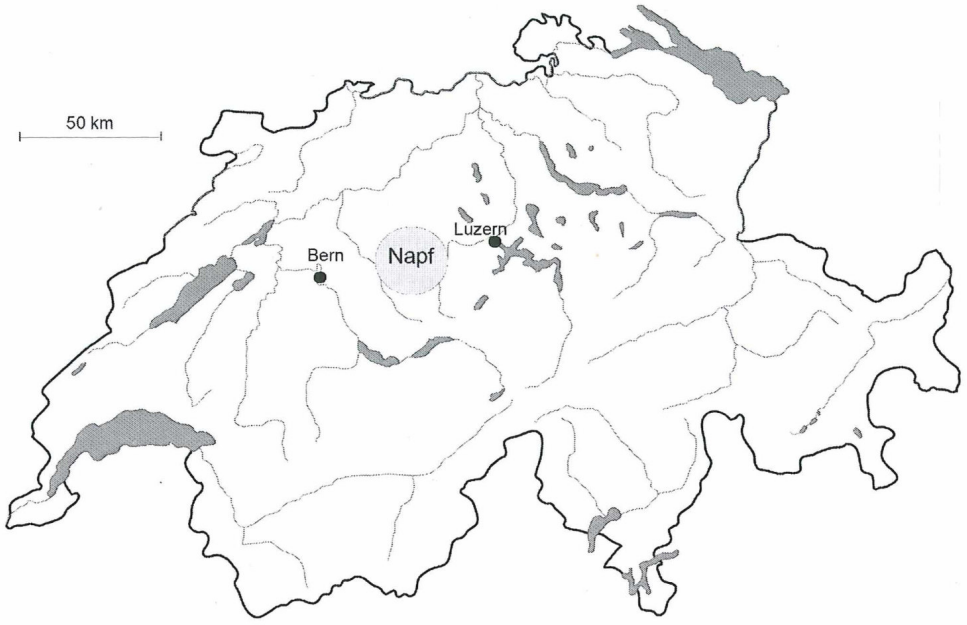

Figure 1: Research area: the Napf-region in Switzerland (map by author)

Because of the unique landscape, the cultural diversity and the solitary position of the farms which entail people to live in close contact with the environment, the Napf-region is well suited to provide new insights into biocultural diversity issues in mountainous central Europe.

Methods

A stratified sample of 12 farms was chosen. In both, the protestant and the catholic part of the Napf-region, three organic and three conventional farms were randomly selected.

Each person living on every selected farm was asked for an interview. During August and September 2008 a total of 51 informants were interviewed comprising 28 men and 23 women, 10 to 71 years old. Overall, 27 of the informants live in the canton of Lucerne, 24 in the canton of Berne, 32 were interviewed on organic farms and 19 on non-organic farms.

The interviews were conducted individually. They consisted of a freelist, followed by a semi-structured interview (WELLER & ROMNEY 1988, BERNARD 2002). The informant was asked to list all indigenous plants he or she could think of and was then asked for the uses of every listed item.

In presence of the informants, the non-cultivated species were vouchered. The specimens were identified according to the Flora Helvetica (LAUBER & WAGNER 2007) and deposited at the Natural Museum of Luzern (NMLU) and the herbarium of the University of Zürich (Z).

The software packages Anthropac (BORGATTI 1996a) and SPSS 16.0 for Windows were used for Cultural Domain Analysis and statistical analysis (BORGATTI 1996b, BERNARD 2002). To detect variation of knowledge among the informants, the similarity of the answers was calculated and tested against sex, age, residence, religious background, farming system, family affiliation and agricultural formation by linear regression.

Results

The 51 interviewees listed each between 7 and 108 plants (mean: 46.3; ±26.5). They mentioned 439 different plant items (341 species, 37 varieties and subspecies, 55 generic terms; 8 undefined), including 185 cultivated plants and 10 fungi.

Only 14 species were mentioned by more than 50% of the informants (Table 1). The first place holds *Taraxacum officinale* which was named by 46 informants, followed by *Rumex obtusifolius* which was named by 39 informants. Of the 439 plants 223 were named only once or twice.

Table 1: The 14 most frequently named species and their uses in the Napf region in Switzerland (n=51)

Species	Informants	Reported uses
Taraxacum officinale agg.	46	food&fodder: leaves for salad, flowers for jam and wine, root for coffee, forage plant for domestic animals and bees med: leaves in salad cleaning the blood, root for tea (liver) deco&play: bouquets, several children's games (e.g. yellow make-up, whistles, blowing away the seeds, water pipes) other: indicates by flowering resp. fruiting time for silage resp. hay harvesting
Rumex obtusifolius L.	39	food&fodder: alcohol made from roots med: ointment from leaves against burns, fresh leaves relieving and cooling (varices, distortions, headache), tea from root for cows with "bad milk", seeds against diarrhea of cows, cows need to eat some for their fertility deco&play: leaves and green bugs to play with other: roots loosen the ground, good compost
Rubus fruticosus agg.	34	food&fodder: fruits (eaten raw, jam, syrups, desserts, muesli), leaves in tea mixtures med: tea of leaves (prostata, stomach ache), leaves against diarrhea of cows
Urtica dioica L.	32	food&fodder: leaves for cooking (spinach, soup, omelettes), dried plant good fodder, food for caterpillars med: seeds good for immune system), tea of leaves (to clean the blood, drain the body, support the mind, for bladder and stomach, against fatigue) other: manure and biological pest control in the garden, improves the soil
Abies alba MILL.	31	food&fodder: important food source for bees med: branches fed to goats against worms deco&play: Christmas tree, advent wreath, branches for decoration other: wood (firewood, construction, furniture, poles), branches to cover plants in the garden during winter, small dried twigs to light fire, shield between house and road, important for mistletoes, forest as place to relax
Picea abies (L.) H. KARST.	31	food&fodder: jam of young leaves, important food source for bees med: syrup of young leaves against colds deco&play: Christmas tree, branches for decoration, ornamental tree in the garden, cones to play with other: wood (firewood, construction, furniture, cheese-boards, poles, shingles), cones to light fire, wood sold for cellulose production
Acer pseudoplatanus L.	30	food&fodder: important for bees deco&play: autumn leaves for decoration, fruits to put on nose and ears or to make propellers other: hard and white wood (furniture, carving, construction, handles of tools, good firewood), shadow for grazing animals
Rubus idaeus L.	30	food&fodder: fruits (eaten raw, jam, syrups, desserts, muesli, vinegar, alcohol) med: tea of leaves for pregnant women (facilitates birth)
Sambucus nigra L.	30	food&fodder: flowers deep-fried, puree of fruits eaten with potatoes, fruits for jam and ligueur, flowers for syrup and sparkling wine, goats eat the leaves med: tea of flowers and syrup of fruits against colds, fever and cough, fruits in alcohol and then distilled also against colds, in the past in front of every stable an elder tree because it was said to prevent from hoof-and-mouth disease, stables in the past also fumigated with elder wood deco&play: small pieces of elder branches to make necklaces other: leaves scare away mice
Trifolium repens L.	29	food&fodder: high-protein forage plant (but if the cows eat too much, their horns will not grow nicely) deco&play: children suck nectar out of the flowers, leaves with four leaflets are dried as good luck charms (and occasionally given as a present to the girlfriend) other: green manure
Trifolium pratense L. s.l.	29	food&fodder: high-protein forage plant (mainly cultivated), nectar for bees deco&play: children suck nectar out of the flowers other: green manure, nice to look at

Plantago lanceolata L.	29	food&fodder: young leaves in salad, forage plant med: tea of leaves (against colds, warming, expectorant), leaves grind and apply on wasp- and beestings, disinfecting on wounds, in Ricola candies
Malus domestica BORKH.	28	food&fodder: fruits (eaten raw, fed to the cows, eaten as pie, puree or dried, juice, to distill alcohol, for decoration), flowers important food for bees deco&play: beautiful when flowering, tree for climbing other: wood (firewood, occasionally for furniture), shadow for grazing animals
Fagus sylvatica L.	26	food&fodder: fruits eaten deco&play: cupules of the fruits used to make necklaces or as decoration other: wood (very good firewood, for construction, furniture), sprouting leaves indicate spring, forest as place to relax

Of the totally 439 plant items 368 were mentioned to have a use. *Taraxacum officinale* was by most informants (46) reported as useful species and got 85 use reports. It was followed by *Rubus fruticosus* (33/42), *Urtica dioica* (31/68), *Abies alba* (31/53), *Picea abies* (31/52).

The mentioned plant uses were assigned to 12 use categories. Food was the category with the most use reports (731), followed by fodder (433), medicine (292), and drink (277; Figure 2). The most broadly used species are *Abies alba* and *Picea abies*, occurring in nine use categories.

According to the regression analysis the plant lists were mainly influenced by age (R^2=0.483, $p<0.001$), professional education (R^2=0.356, $p<0.001$) and sex (R^2=0.254, $p=0.003$) of the informants

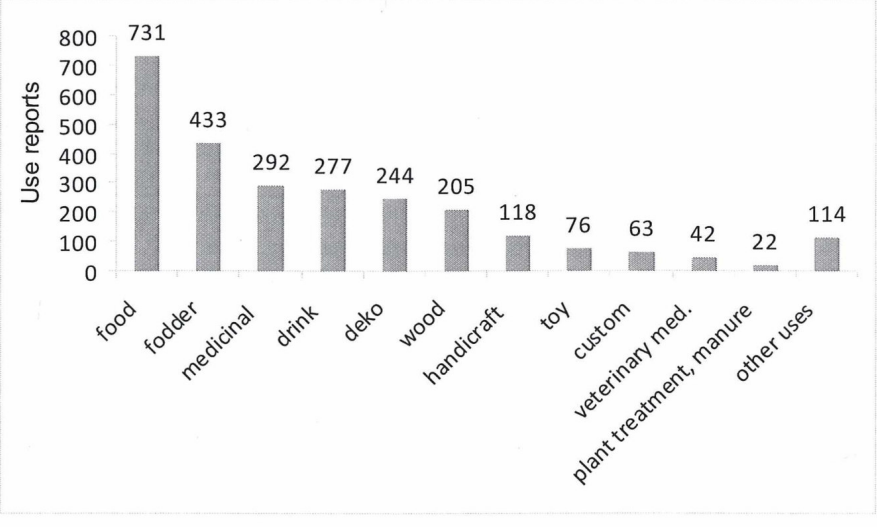

Figure 2: Use categories of the documented plant species in the Napf region, Switzerland (n=51)

Discussion

A preliminary overview of the local plant knowledge reveals that the Napf-region is well suited for biocultural diversity research. While in a recent study 6,000 Swiss adolescents only knew five different plants (LINDEMANN-MATTHIES 2002), people in the Napf-region mentioned averagely 46 plants and therefore seem to have a broad plant knowledge. The two most cited species *Taraxacum officinale* agg. and *Rumex obtusifolius* L. are abundant species of the nutrient rich grassland in the Napf-region. Almost all (46) informants mentioned some uses for *Taraxacum*, but uses for *Rumex* were only occasionally indicated. This nasty grassland weed seems though to be of cultural significance: the general saying that farmers in the canton of Berne and Lucerne respectively handle it differently reflects the inner-Swiss cultural border following the Brünig-Napf-Reuss line (WEISS 1962). While the ethnotaxonomical knowledge of the people is mainly influenced by age, education and gender, further analysis of the use of culturally important plants may provide additional insight into cultural variation of plant knowledge and management (PFEIFFER & BUTZ 2005).

Most of the interview partners welcomed the present project and the idea to disseminate its results in the form of a popular book, which would contribute to the awareness and valuation of the local plant knowledge and plant diversity of the *Napfbergland*.

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On the trail of gallinaceans in the Hohe Tauern National Park

Christian Ragger

Summary

In the years 2006 and 2007 there was a survey of grouse and rock partridge in the western part of the Hohe Tauern National Park in Tyrol. With the data of the survey a model of the distribution of birds was built and the density of birds was determined.

Client

Hohe Tauern National Park Tyrol

Processor

Hafner, REVITAL ZT GmbH, Waldplan Senitza

Project duration

11/2006-07/2008

Keywords

modelling, survey of species, density of birds, dispersion
Wood Grouse, Black Grouse, Snow Grouse, Hazel Grouse, Rock Partridge

For the native, feral gallinaceans the Hohe Tauern National Park is an important habitat. The main part of the European population is found in the alpine region.

Apart from the Wood Grouse and the Hazel Grouse, which are living in the near-natural native forests, the Hohe Tauern National Park takes special care of the preservation of the Black Grouse, the Snow Grouse and the Rock Partridge.

The wide near-natural areas below and above the timber line provide a suitable habitat for these species.

The exact breeding habitats and the requirements of such habitats of these species are unknown in the Hohe Tauern National Park.

So the administration of the Hohe Tauern National Park decided to conduct a scientific research into the occurrence and distribution of feral gallinaceans in the Tyrolean part of the National Park, west of the Tauernbach and Isel.

A complete area wide investigation is very difficult because of the size of the National Park.

On the basis of the methodology developed by Hafner and Senitza only a few areas („reference areas") should be investigated. The results of the investigation should be calculated with a computer based model for the whole study area.

The objective of this ambitious project was not only the modelling of the distribution of the birds but also to create a base for the protection of the feral gallinaceans.

Nine biologists searched for gallinaceans in an area about 40 sq. km in May and July of this year.

In the early morning hours the courtship display was documented and after sunrise further direct and indirect proofs (feathers, tracks, droppings, ...) were searched.

At every reference point different information e.g. type of vegetation, gradient, sea level, was collected. With this information it was possible to describe the habitat elements in detail.

Special thanks to the hunters without whose support the development of this project would not have been possible.

The knowledge of the hunters was a great help in choosing the study areas. The field researches were made easier through their cooperation and local knowledge.

All in all more than 700 (!) proofs were provided. As expected the main focus of the monitoring was the Snow Grouse (more than 400 observations) and the Black Grouse (more than 200 observations). The monitoring of the Rock Partridge resulted in more than 60 proofs.

The results of the field research were evaluated and computerized so that it was possible to identify well-suited habitats for the individual species. With the density of birds in the reference areas, the stock figures in the protection area was estimated for all species.

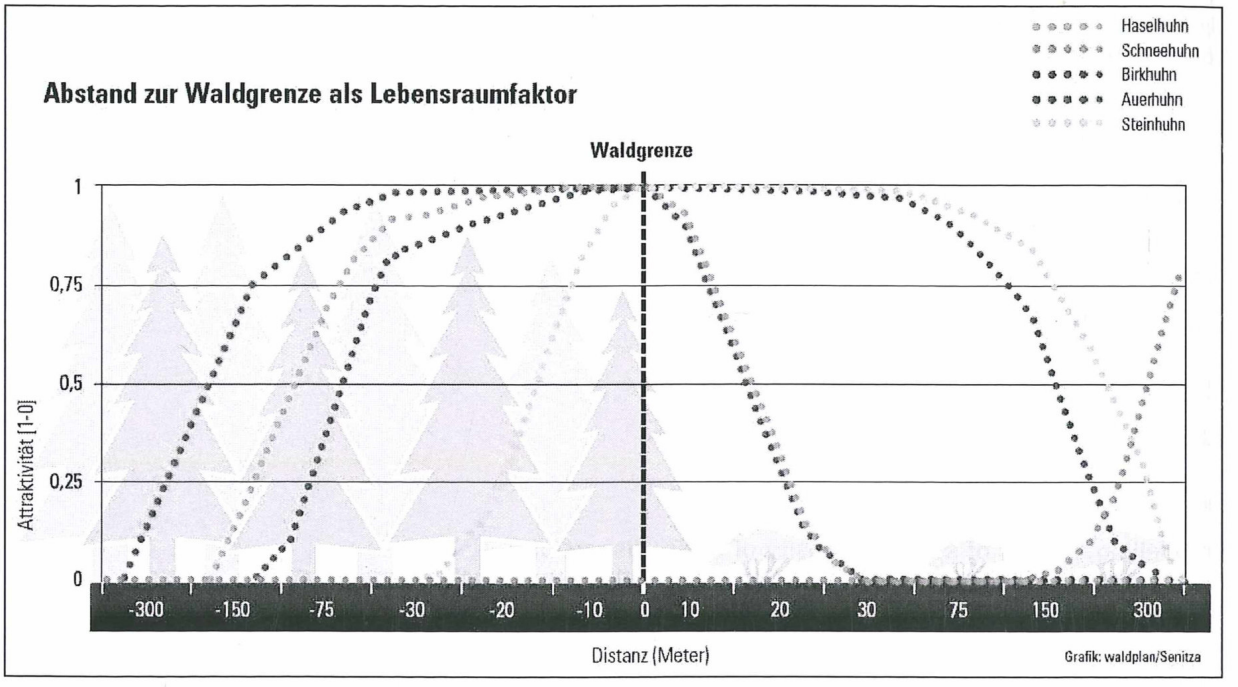

Figure 1: The distance to the timber line is an important factor of habitat for gallinaceans: Hazel and Wood Grouse are living as so called „Waldhühner" in closed forests. Black Grouse and Rock Partridge are mainly breeding on and just over the timber line. The habitat of the Snow Grouse begins above the last grove.

In the Tyrolean part of the Hohe Tauern National Park (611 sq. km) west of the Isel and Tauernbach - the following stock figures were estimated:

Wood Grouse:	3-5 individuals (population partially outside the National Park)
Black Grouse:	160-250 individuals
Snow Grouse:	480-600 breeding pairs
Hazel Grouse:	30-35 breeding pairs
Rock Partridge:	56-100 breeding pairs

The new results enable not only detailed stock figures to be made, but also contribute to the protection of these species. In the main distribution areas of the species measures for the preservation of the habitats und the protection of the individual species (visitor management) could be put into practice. The specific knowledge about the requirements of the habitats for each species is very important.

In 2009 and 2012 the rest of the Hohe Tauern National Park in Carinthia and Salzburg will also be researched.

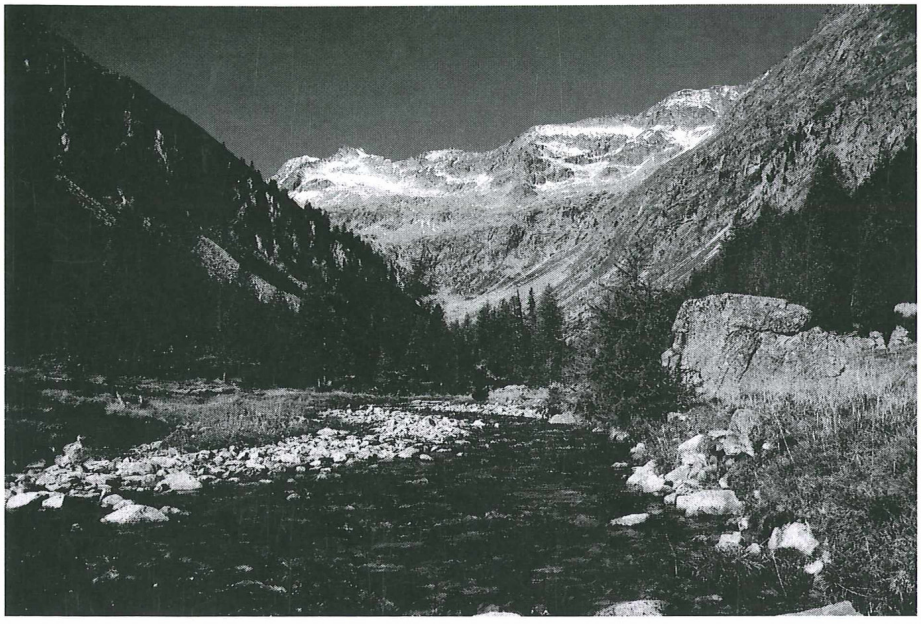

Figure 2: The „Patschalm", a tributary valley of the Defereggental, is characterized by a large variety on different habitats (Picture: Christian Ragger).

Figure 3: A Snow Grouse in the summer plumage (Picture: Christian Ragger)

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No sustainable conservation of biodiversity without connectivity.

ECONNECT as a project also aims at analysing the legal barriers and opportunities of the law for the creation of ecological networks across the Alps.

Celine Randier

The preservation of biodiversity by the creation of ecological networks is one of the recent steps in nature protection policies. *"Ecological corridors are linear connection elements allowing the passage of species between different living spaces, thus enabling genetic exchange between populations"*[1]. In the Alpine arc this strategy concerns especially the creation of ecological connectivity between protected areas. It means that measures have to be taken outside the protected areas. This new challenge is appearing step by step on the legal stage and affects not only the nature protection laws but also others fields like spatial planning and agriculture. This contribution presents the problems dealt with in the ECONNECT Project (European Territorial Cooperation Alpine Space Programme).

The concept of ecological corridors in law

In the International nature protection law, two kinds of networks can be distinguished: administrative networks[2] (administrative cooperation between protected areas), like for instance the network of the protected areas which are certified with the European Diploma, and the networks with an ecological connectivity between them. The concept of ecological corridor, as we understand it now, appeared in law with a Recommendation adopted in 1989[3] within the framework of the *Bern Convention*[4]. The basis of the *Emerald Network* was set up with the Recommendation n°3 adopted in September 1996, some months after the adoption of the *Pan-European Biological and Landscape Diversity Strategy*[5]. Currently most of the international conventions dealing with biodiversity conservation take into account, within the recently adopted documents, the need to improve ecological connectivity[6]. As regards the Alpine area, Article 12 of the Protocol Conservation of Nature and the Countryside of the **Alpine Convention** requires the creation of an **ecological network through the Alps** by the Contracting Parties. Article 12 also demands **cooperation between protected areas**. The harmonising of the management of cross-border protected areas is one of the steps for the realisation of ecological networks. Furthermore specifications supporting ecological connectivity can be found in the different protocols to the Alpine Convention (mountain farming, mountain forests, spatial planning and sustainable development, spatial planning, etc.). The ECONNECT Project aims at implementing Article 12 of the Protocol Conservation of Nature and the Countryside.

On the European level the EU Member States are obliged to create the Natura 2000 Network. The specifications regarding the Natura 2000 Network are interesting for this research as many of the Natura 2000 areas are already protected areas. This network is the sum of the areas protected under the Habitats Directive and those protected under the Birds Directive *but* it has also to be a *coherent ecological network*. For that purpose the Habitats Directive recommends in Article 10 to also take into account landscape features. Non-EU Member States, like Switzerland, participate (not a legal obligation) by realising the Emerald Network[7]

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[1] See in this volume the contribution of Thomas Scheurer Guido Plassmann, Yann Kohler and Marie-Odile Guth.

[2] Like for instance in the framework of the Ramsar Convention or in the framework of the World Heritage Convention.

[3] Recommendation No. 16 (1989) of the standing committee on areas of special conservation interest (Adopted by the Standing Committee on 9 June 1989).

[4] Convention on the Conservation of European Wildlife and Natural Habitats or Bern Convention, adopted in 1979.

[5] Pan-European Biological and Landscape Diversity Strategy adopted in 1995 at the Ministerial Conference "Environment for Europe" (Sofia, Bulgaria, 23-25 October 1995).

[6] See for instance the Guidelines on the management of the Ramsar areas adopted in 2002.

[7] There is no legal obligation for the Contracting Parties to the Bern Convention to create the Emerald Network because it was created by a Recommendation. This prescription is not integrated in the Bern Convention. There is also a coordination between these two ecological networks.

The integration of this concept of protected area networks in the national legal frameworks varies from State to State. This topic was explored in the National Assessments of the Legal Framework of Protected Areas produced for the first International Worksop organised within the scope of ECONNECT's Work Package 6. The assessments analysed the situation in the national nature protection laws as well as in the spatial planning legal acts.

A multisectoral and multilevel challenge

As Guido Plassman et al. stated: "*[many] nature protection measures can contribute to ecological networks, provided they are promoted and supported by policy-makers at local, regional, and national level in a coherent way*"[8]. From a legal point of view this corresponds to the problem of the integration of environmental requirements in others policies. The taking into account of the environment in other policies corresponds to one emerging legal principle: the principle of integration[9], which is also the cornerstone of the Alpine Convention Article 4 of the Protocol on Nature Protection to the Alpine Convention about "*[t]aking account of the objectives [of the Protocol] in other policies*" refers to this principle. In the ECONNECT Project the different policies of the Alpine States regarding biodiversity preservation (especially spatial planning, agriculture, landscape policy, etc.) will be analysed. For each Pilot region, an assessment will be carried out to identify those kinds of measures that already support or could support ecological connectivity.

Trans-border cooperation of protected areas as a contribution to ecological connectivity

The existing protected areas are especially important for the creation of ecological networks in the Alps since more than 25% of the Alpine area are protected. Some protected areas are located near State borders and a trans-border cooperation is essential for the creation of ecological networks. The **ECONNECT Project** thus aims at supporting trans-border cooperation by identifying the legal barriers and by proposing legal solutions to improve cooperation across borders. If cross-border cooperation between protected areas is already existing it needs to be institutionalised. The research will focus on different Pilot regions which bring together protected areas. The National Legal Framework of protected areas was analysed during the First International Workshop within the scope of Work Package 6. In a second step the differences between the National Frameworks will be analysed. It will also be evaluated in which manner a new European legal instrument – the European Grouping of Territorial Cooperation (EGTC)-, which aims at supporting the territorial cooperation between EU Member States, could improve the trans-border cooperation between protected areas. The Member States have to adopt national measures in order to implement the regulation. This emerging national legal framework will be investigated. One pilot area composed of the French National Park Mercantour and the Italian Natural Park Alpi Marittime is already on the way to set up such an alliance.

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[8] See in this volume the contribution of Thomas Scheurer Guido Plassmann, Yann Kohler and Marie-Odile Guth.
See for instance Nathalie Herve-Fournereau, "Le principe d'intégration", in Yves Petit (s. direc.), *Droit et politiques de l'environnement*, La Documentation française (Ed.), 2009.

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Integrated Sustainable Wildlife Management in the Biosphere Reserve Wienerwald – the step from sector-specific to cross-sectoral sustainability

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Summary

The project has developed tools and concepts for integrated, i.e. cross-sectorally harmonised assessment, management and monitoring of sustainable conservation and use of wild animals and wildlife habitats. Participatory research methods (expert interviews, land user surveys, stakeholder participation panel) have been applied to identify, analyse and evaluate key interfaces (antagonistic and synergistic interactions) between wildlife, hunting and other regional land uses. Main results include operational frameworks of principles, criteria and indicators (PCI-sets) for integrated sustainable wildlife management with practice-related user guidelines that are harmonised across land use sectors. The PCI-sets were designed as self-evaluation tools, and shall be applied by major regional land user groups (forestry, agriculture, hunting, recreation management) to evaluate their own respective influences on the conservation of wild animal species, habitats and sustainable hunting. The assessment set of each group also considers relevant sustainability requirements of other user groups. This new step from merely sector-specific towards sector-crossed (integrated) assessment of sustainable use has been taken for the first time, by focussing on the cross-cutting issue "wildlife management". In addition, recommendations for conflict management and for respective monitoring have been elaborated. Project results shall contribute to the avoidance, mitigation and resolution of wildlife - land use conflicts in the Biosphere Reserve and to the integration of wild animals and their habitat requirements into sustainable regional land use.

Keywords

Biosphere Reserve, integrated sustainability assessment, participatory research, sustainable hunting, sustainable use, wildlife management.

Project aims

The main objective of the project (ISWI-MAB, duration 2005-2008; Man and the Biosphere Programme, Austrian Academy of Sciences) was to develop tools, concepts and guidelines for the assessment, management and monitoring of sustainable wildlife management which are harmonised across the most wildlife-relevant regional land use activities. Derived sub-goals included:

- regional adjustment of existing principles, criteria and indicators of sustainable hunting (FORSTNER et al., 2001; 2006);
- identification and analysis of conflicts and potential synergies in the relationship between regional land user groups, wild animals, habitats, and sustainable hunting;
- development of principles, criteria and indicators of cross-sectorally integrated sustainable wildlife management for self-evaluation by land user groups that have strong impact on wild animals, habitats and sustainable hunting;
- elaboration of recommendations and guidelines for management and monitoring (Biosphere Reserve-wide and for core zones).

Study area

The Wienerwald Biosphere Reserve (WBR) was chosen as a model area because it is, on the one hand, a large-scale habitat for species-rich, native wildlife communities with high nature potential and conservation value and, on the other hand, a typical multiple-use cultural landscape in the immediate proximity of the urban agglomeration Vienna with a broad spectrum of use interests, high recreational use intensities, strong demand for hunting activities and related pressures on wildlife. This specific situation accounts for a variety of wildlife - land use conflicts that threaten sustainable development and accomplishment of the WBR conservation and management objectives.

Research questions

Wild animals (species, populations, individuals, habitats, genetic diversity) are exposed to multiple impacts caused by hunting and many other often overlapping and competing land use activities within the wildlife habitat. In particular in multiple-use landscapes such as the WBR, the resulting interactions between the habitat requirements of wild animals, hunting interests and other land use demands often lead to conflicts that can negatively affect sustainable conservation of native wild animal species and their habitats, the sustainability of involved forms of land use, and sustainable regional development at large. Stand-alone sectoral approaches to sustainable use are insufficient and often result in unintended adverse effects on both other land use sectors and the respective ecosystem. In contrast, sustainable wildlife management requires that all land user groups in the wildlife habitat are aware of and consider the effects of their activities on both wildlife resources and other user groups.

Over the last decades, concepts of sustainable use, including assessment approaches, have been developed for various land use sectors. A respective gap that existed in hunting and wildlife management for a long time has recently been filled by the development of criteria and indicators of sustainable hunting in Austria (FORSTNER et al., 2001, 2003, 2006; Umweltbundesamt, 2005). However, there still is an unsatisfied need for truly integrated approaches to cross-sectoral assessment of sustainability that consider the interactions, interdependencies and antagonistic effects that may arise between land use sectors and on the given ecosystem, often without the respective actors being aware of that risk. For example, the scope of action of hunting to be practiced in a sustainable way is often restricted by various impacts of other land user groups on wildlife resources and hunting management, and vice versa. However, sustainable use of wildlife is only achievable if all land user groups within the wildlife habitat are aware of the consequences of their actions on wildlife resources as well as on other user groups, and if sustainability requirements of other groups are considered in each group's practice of land use. With this in mind, the ISWI-MAB project has developed intersectorally harmonised approaches to sustainable use by the model of the common theme "wildlife and hunting" - a cross-cutting issue touched upon by many land use activities - and has operationalised them on a regional scale.

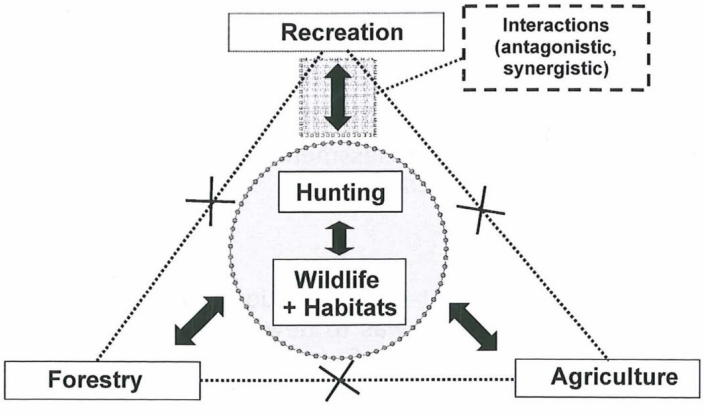

Figure 1: System definition for the development of indicators of integrated sustainable wildlife management (arrows: considered interactions; crosses: not directly considered interactions).

Methods

Embedded in a transdisciplinary process, a range of participatory research methods was applied to identify, discuss and evaluate wildlife-land use interactions, related conflict potentials, problem perceptions of stakeholder groups and preferences for management options. Covering the participation levels "information", "consultation" and "collaborative research", methods comprised qualitative expert interviews, broad land user and visitor surveys (on-site interviews, mail surveys)

with descriptive evaluation and explorative statistical analysis, a series of work sessions of an interdisciplinary stakeholder panel, and practical test applications by key stakeholders. The knowledge gained from involvement of stakeholders and the public was used to identify key fields of interaction between wildlife, hunting and other land use demands. These are defined as interactions involving three main system components: i) wildlife resources (native wild animals, species, populations, habitats), ii) hunting, and iii) other land use activities that impact upon wildlife resources and the sustainability of hunting (and are often influenced by them in return). At the centre of interest were those interactions that are relevant to sustainable development and that restrict or promote the clearance for sustainable use by other land user groups. That conceptualisation of "wildlife-land use interactions" is illustrated by figures 1 and 2.

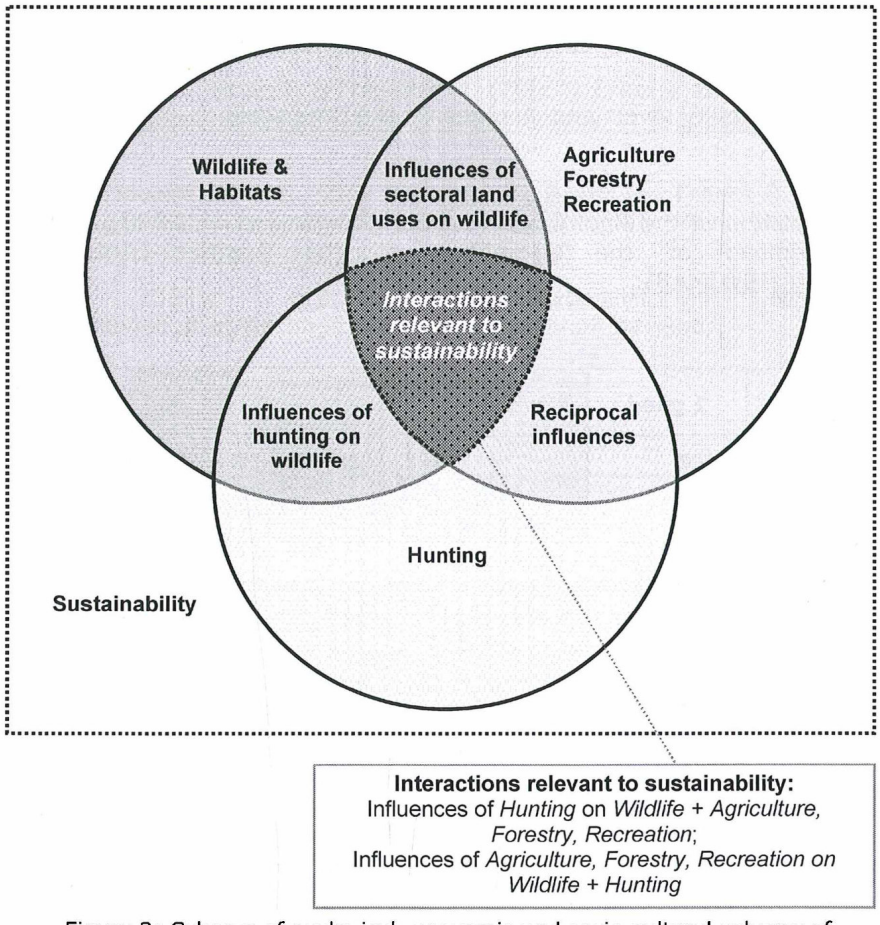

Figure 2: Scheme of ecological, economic and socio-cultural spheres of influence and interactions relevant to sustainability.

Results

Based on the interfaces identified, inter-sectoral assessment sets consisting of principles, criteria and indicators with performance scales and application guidelines have been developed for the four land user groups forestry, agriculture, recreation management, and hunting. To improve applicability and user-friendliness, each assessment set is also edited in a short version with selected priority indicators. Table 1 gives an overview of the number of principles, criteria and indicators per set. The range of application is indicated in table 2. Figures 3 and 4 illustrate the proposed evaluation scheme.

Table 1: Structure of the assessment sets with number of principles, criteria, and indicators with performance scales (point system); in brackets: number of indicators per short version.

Land use sector addressed (domain of action)	Principles (number)	Criteria (number)	Sub-criteria with indication and evaluation schemes (number)
Hunting	14	25	56 (30)
Forest Management	11	18	42 (21)
Agriculture	11	17	28 (15)
Recreation Management	9	17	36 (16)

Table 2: Fields of application of the assessment sets

Self-evaluation of the sustainability of land use activities of one's own group in relation to wild animals, habitats, hunting, and other land use demands
Analysis of individual strengths and weaknesses in terms of sustainability
Support in considering the impacts of one's own activities on wild animals, habitats and sustainable hunting
Decision-support and guidance in framing measures to optimise sustainability
Measuring effectiveness of measures and monitoring progress in implementation of sustainability
Stimulation for questioning of one's own practice of land use (awareness-raising, learning effect)
- Monitoring of sustainability levels and changes on the time scale

The full-length publication of the final project report (REIMOSER et al. 2008), including annexes, is available for download at the homepage of the Austrian Academy of Sciences (http://hw.oeaw.ac.at/ISWIMAB).

Ecology	**1 very good**	**2 good**	**3 average**	**4 bad**	**5 very bad**	**max. point score**	**min. point score**
	sustainable			not sustainable			
			47 % (28 points)			60	-63
Economy	**1 very good**	**2 good**	**3 average**	**4 bad**	**5 very bad**	**max. point score**	**min. point score**
	sustainable			not sustainable			
				23 % (6 points)		26	-14
Socio-cultural aspects	**1 very good**	**2 good**	**3 average**	**4 bad**	**5 very bad**	**max. point score**	**min. point score**
	Sustainable			not sustainable			
		62 % (18 points)				29	-37

Figure 3: Evaluation scheme, type 1 - Aggregation of assessment results within each major group of sustainability aspects (fictitious evaluation example for sector hunting). Additive aggregation of scored points, calculation in percentage of maximum number of points per group, allocation to one of 5 evaluation classes, verbal rating of intervals, sustainability performance scale with continuous transition between sustainable and unsustainable (grey). Maximum and minimum numbers of points are variable to allow for consideration of omitting of optional indicators.

Discussion and outlook

The assessment frameworks are mainly intended as decision-supporting and awareness-raising self-governance tools for land users and landholders. While any non-mandatory self-evaluation tool has natural limitations related to subjectivity, lack of bindingness, and trade-offs between scientific accuracy and practicability, nevertheless such "soft" approaches also have a number of specific strengths, e.g. higher acceptance, inclusion of qualitative, "observable" instead of merely measurable attributes, and high potential for learning effects (LEXER et al. 2005). The assessment sets are conceived as dynamic expert systems that are open to future improvements and adaptations to other regions and scales. In the WBR, key stakeholders seem to be willing to integrate the results into existing management rules.

Acknowledgements

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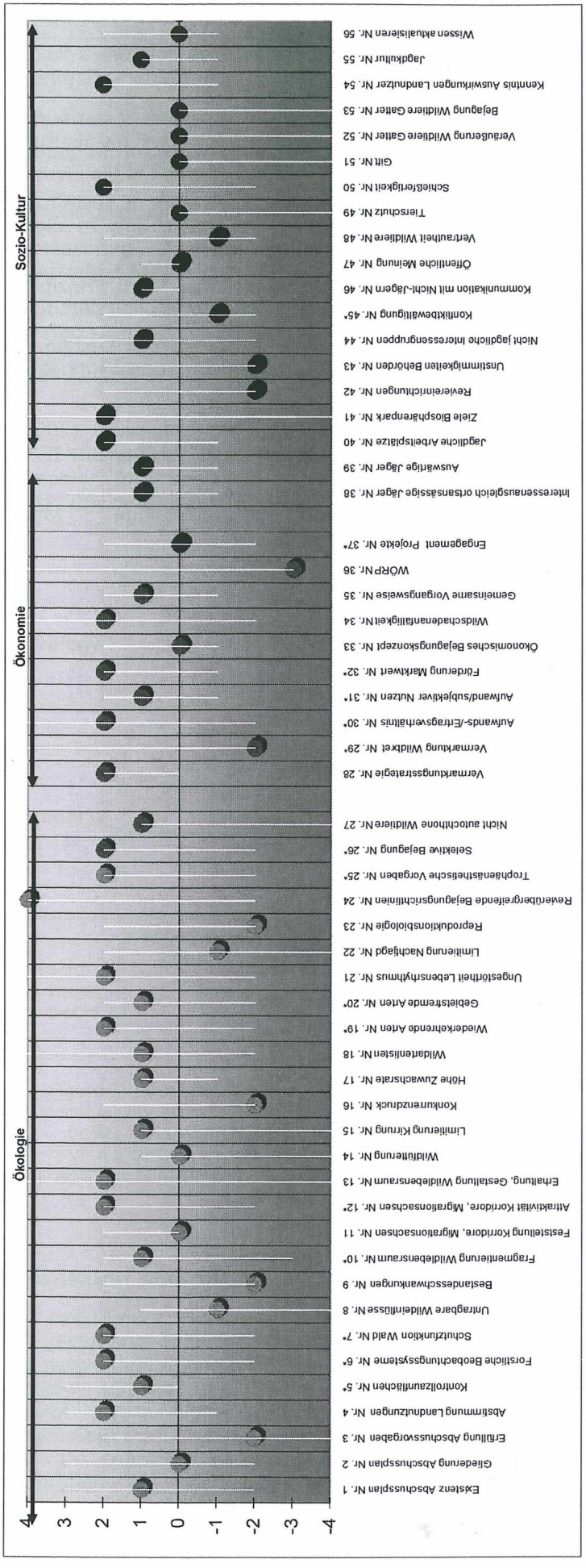

Figure 4: Evaluation scheme, type 2 - Assessment profile of one assessment unit (profiles of all individual indicators; fictitious evaluation example for sector hunting).

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How can PAs offer local people a chance to participate and benefit?

PA Management and participation as key factors for the acceptance and the sustainable implementation of the "PA idea" in different categories of PAs

PhD Research Project at the University of Innsbruck, Dep. of Geography (2007 to 2010), Supervisor Univ. Prof. Dr. M. Coy

Birgit Reutz-Hornsteiner

Summary

Protected areas (PAs) offer a high potential to involve the local population. The main objective of the research project is to find out how PAs can offer local people a chance to participate and benefit, including the topic of how the managements of PAs deal with the role and the intensity of involving the local population. The field research was undertaken in 4 categories of PAs with different cultural and management background with the objective to make a scientific comparison (Grosses Walsertal, Austria; Etna, Italy; Guadeloupe, France and Morne Trois Pitons, Dominica) in order to show similarities and to discuss how different PAs can learn from each other. This article shows the first results of the 72 interviews and the 3 future workshops.

Keywords

Participation, involvement of local people, governance, benefit, regional management instruments, sustainable development

Introduction

More than 113 700 PAs cover 19.6 millions square kilometres of the planet's surface – today over 12 percent of our planet is under protection (LOCKWOOD et al. 2006). PAs offer a high potential to involve the local population and to make them feel responsible for their area. The matter of sustainability plays an always more important role in PAs. A new focus of PAs concepts is to see them as regional management instruments (HAMMER 2002, JEKEL 1998, KALS 1997). Discussions about the successful implementation of PAs are becoming increasingly important. Particularly the interdisciplinary discussion between pure nature conservation and the interaction of man-nature in PAs as well as questions of sustainable development gain importance. In the sense of an "applied-geographical" perspective the analysis of implementation problems and the creation of PAs in the local-regional context are important research topics. Another focus of scientific research is the local populations' perception and acceptance of the idea of PAs.

Duration and aims

The project was started in 2007; the field research took place from 2007 to 2008. The project is planned to be finished in 2010. The main objective is to find out how PAs can offer local people a chance to participate and benefit and how the managements of PAs deal with the role and the level of participation. Expected outcomes are a scientific comparison of approaches of participatory decision-planning processes in different categories of PAs in different cultures as well as the review of their transferability.

Areas of study

The field work was undertaken in the following PAs: Grosses Walsertal (Austria) – Biosphere Reserve (BR) and pilot project; Etna (Italy) Regional Natural Park; Guadeloupe (France) – National Park, part of it being BR; Morne Trois Pitons (Dominica) National Park and UNESCO World Heritage Site.

Methods

The BR Grosses Walsertal in Austria served as pilot scheme for further steps and field work abroad. In addition to different socio-scientific qualitative research methods such as expert interviews (72 interviews), surveys, analysis of existing data the outcomes of workshop groups of the "future workshops" – a participatory approach to involve local stakeholders which were held in three PAs – were used for the interpretation of the results (3 workshops with a total of 73 participants). A stakeholder analysis was made in each case study to find experts for interviews and to gain additional information: the interview partners consisted of representatives of the PAs' managements, of people being involved in various projects in the territory as well as of members of NGO's and representatives of government and public authorities in order to guarantee a presentable stakeholder mix.

Research Questions

Answers to the following research questions in different categories and types of PAs should be found:

What is the general framework which determines participation in PAs?

What are the strengths and weaknesses of participatory planning and management processes?

Does participation – irrespective of category of the PA play a key role in the acceptance and the sustainable implementation of the protection idea?

How flexible are participatory processes – which general standards do exist, how must participatory processes be adapted to the local situation?

Which role does participation play in the examined case studies?

How is participation seen by the different players and stakeholders in the examined PAs?

What potential for participation can be found in the case studies, how do the local players engage in the projects, how far does "active participation" develop?

How should PAs be planned, so that they have the highest possible acceptance of the local people and the issues participation becomes important as a learning process for managers and involved people?

Can different participation methods, taking into account the needs of the local population be transferred and emulated successfully? How can a system of optimised "good governance" in management structures lead to participation as a valid working method?

First selected results of the expert interviews and future workshops

Implementation and management of PAs - lessons learnt

The interviewed people in all the case studies focused on the issue that "Everything you miss in the planning process – like involvement of local people – will then be a central problem and conflict source in the PA you want to establish". In the case of the BR Grosses Walsertal the local population was involved from the very beginning, even in the planning process for the BR. In the alpine pilot case study active participation took place in terms of that part of the local people developed a common concept for the planned PA. The other three case studies are PAs which were installed only by law and in the planning process without any participatory approach. So the management of the PAs Etna, Guadeloupe and Morne Trois Pitons nowadays are confronted with other problems than in the Grosses Walsertal. The BR Grosses Walsertal was established with the intention of giving an impetus to sustainable development whereas the other three case studies were installed mainly for protection goals where development and participation did not have a major importance. Another important issue for the interview partners in all the case studies was the importance of the development of a product (like nature tourism packages etc.) which should go parallel to the implementation of a PA. The tenor was that saleable products under the patronage of the PAs lead to higher identification with the territory. Further important topics mentioned in the interviews were the involvement of young people in planning and decision processes, communication and transparency, to offer possibilities for alternative livelihoods in case the PA creates new restrictions and to plan visible short term projects but also in a long term perspective.

Use of the PAs' label

In the pilot study Grosses Walsertal many initiatives and projects grew under the logo of the BR. The common label helps to organize money and makes people trust in the idea and the concept of the BR. Nevertheless also in the Grosses Walsertal only a few percentage use the label and do really count on the PA as a promoter for selling their products. In Dominica no labelling system exists, in Guadeloupe there is a label for partners in tourism and in the Etna Park a labelling system for local products is being established.

Is the PA seen as a benefit?

The interviews pointed out that if the PA is seen as a benefit only a few people realize the possible surplus value by the PA. Especially in Guadeloupe and in the Etna Park the PA is not seen as something which brings a benefit. In Dominica and in the Grosses Walsertal, where a lot of projects towards sustainable development take place in and around the PAs, some groups realize that they could intensify their cooperation with the park managements. It needs good practice examples and people who are convinced of the PA. This includes that the PA should be present in peoples' everyday's lives, which means to be at several occasions with information and so on.

Participation

Although the Grosses Walsertal can be seen as an example where participation takes place very successfully the interview partners emphasized that the general public is not reached yet. In Dominica participation takes place only in some pilot projects like COMPACT, environmental education and youth projects. In Guadeloupe and the Etna Park participation is very limited, according to the managements people are invited to participate, according to the other interview partners people feel excluded from projects and decisions.

Measures for success - support for participatory processes

The interview partners in all case studies pointed out that it is necessary to stay with active groups and to give them support and guidance to develop ownership and responsibility for the PA. When involving people it needs a Subject-Subject relationship, constant training and appreciation, a good and active management which coordinates and gives impetus where necessary, networking, time-limited participation and in general "to work on a local level but with effect on a regional level". It is essential to talk to the people in their language and to adapt concepts to the local level. Involving the local communities is essential; the Park must be part of the communities and visible. Also in PAs where the main focus is on protection it needs development opportunities – then the awareness for the strictly protected zones grows.

Discussion – Benefits of the research

As the expected outcomes of the research are a scientific comparison of approaches of participatory decision-planning processes in different categories of PAs in different cultures as well as the review of their transferability, specific recommendations and orientation guidelines for the managers of PAs can be given. In the BR Grosses Walsertal and in the Morne Trois Pitons National Park the Future Workshop held during the field research had a follow up.

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Contradictions and complementarities between nature conservation and economic development in Chilean Patagonia

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Summary

Chilean Patagonia is a Southern Hemisphere, high latitude temperate climate landscape, composed by a complex natural, and mostly pristine system, of ice fields, glaciers, mountains, rivers and streams, lakes, fjords, woodlands and grasslands. 90% of the land is considered like public land since it belongs to the State of the Republic of Chile. 50% of the regional land (near 50.000 Km^2) is under the legal status of nature conservation protected area (national parks, natural reserves, natural monuments and biodiversity protection priority sites). Most of these areas have remained isolated, due to the lack of connectivity either at the continental and archipelagic zones. As a consequence, many pristine landscapes can still be found everywhere. Until recently, regional strategic plans of development defined this area like *a life support system*, and facilitated the creation of many natural protection areas. However, given the accelerated Chilean economic growth, currently many economic investment projects such as hydropower installations, electricity transmission lines, salmon farms, roads construction, and tourist installations, are trying to be located in the region, threatening conservation purposes. It seems to be necessary to propose regional plans and policies aiming sustainable development, and which can harmonize as much as possible economic, social and environmental goals.

Keywords

Regional Sustainable Development, Conservation, Hydropower, Patagonia

Aims and duration of the Project

This research project, supported by the Chilean National Science and Technology Development Fund, has been prepared in the University of Chile to propose knowledge that can support an alternative Strategic Environmental Assessment for Chilean Patagonia. The idea has been to provide scientific information that can be confronted with the official Environmental Impact Assessment prepared by private national and foreign companies which are increasingly interested in the exploitation of regional natural resources. The project has been developed between 2007 and 2009.

Study area

The study area (fig.1) is one of the Chilean southernmost regions, corresponding to the Western or Pacific Ocean Patagonia. This area is located in the so called Aysen Region, one of the Chilean Administrative territories, situated between latitudes 44 and 49ºS, in the South American Southern Cone. The region is a more than 100.000 Km^2 of temperate rainforest distributed in the Western side, and semiarid steppes located in the Eastern side, which are inhabited by less than 100.000 people. Figure 1 shows the actual and proposed installation of several economic investments in the region: mainly salmon farms in the archipelagic and fjords situated at the northwestern section; urban settlements in the center and eastern parts, and hydropower constructions in the southern area. All the proposed economic installations are inserted, or around, currently nature conservation areas.

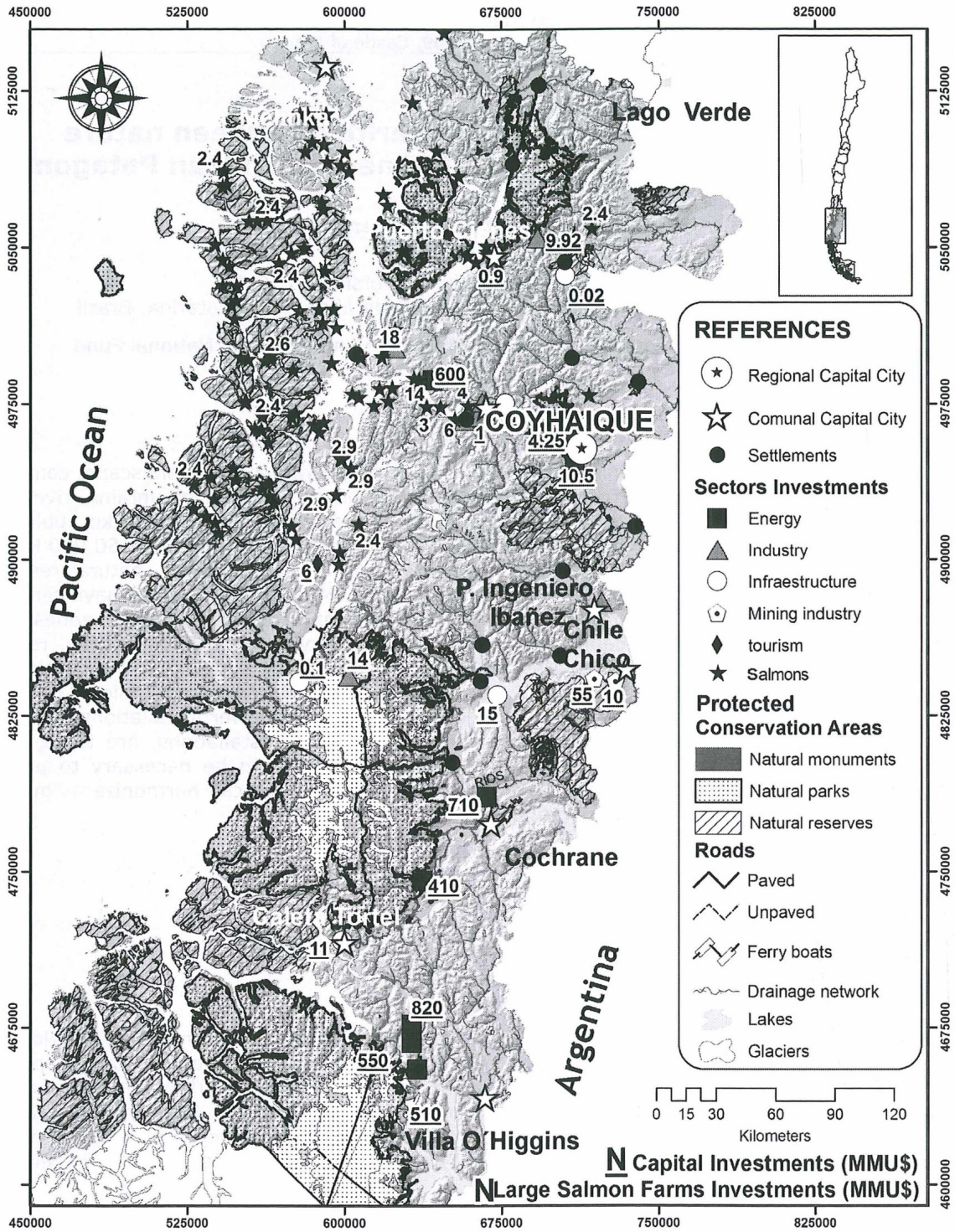

Figure 1: Nature Conservation Protected Areas and Economic Investments in Chilean Patagonia in year 2009

Methods

An inventory of economic investment projects, based on public information contained in Environmental Impact Assessments and information about economic development at regional scale, has been mapped. Land use and land cover maps have been prepared using remote sensing (satellite images and air photographs), and visiting the area for ground truth and interviews with local actors. Regional and watershed maps containing information about pristine environments and environmental sensible areas have been related with isolation, accessibility, and economic, social and cultural complementarities among human settlements. Surveys of public services capacities to attend nature protection areas and about conflict institutional maps have been drawn.

Results

Aquaculture, mining, touristic, infrastructure, and mainly hydropower installations are planned to be located in, or around natural conservancy areas, in Chilean Patagonia. New roads, urban developments, and decertification of national parks and nature reserves are taking place without a real participation of regional public authorities and local communities. Severe socio political conflicts are emerging everywhere, and a lack of environmental concern could be observed at national and regional scales.

Discussion

Much more scientific research, especially about ecological relations and models, environmental assessment of pristine areas, evaluation of natural landscape carrying capacities, local land uses and covers changes, and human settlements structure and functions, are needed to support decision making under an scenario of increasing pressures coming from foreign and national private companies which seems to be only interested on short-term and extractive economic growth.

Benefits of the research for the management of Past and/or further research

An increasing gap between available scientific knowledge and the demand of information for current and future decision making could be observed in Chilean Patagonia. An integrated scientific research about physical and socioeconomic environmental systems is necessary to support a Strategic Environmental Assessment process that could contribute to protect nature conservancy areas in front of many economic initiatives

Are the results of the research related to the stats of protection

Only in a partial way, since most of the protected areas -especially those located in isolated places and archipelagos-, are still inaccessible, and there is only few information about their environmental situation and the real state of their protection level.

The remarkable scientific achievements of the respective protected areas successfully anchor in the minds of the general public. The general public seems to be more interested in economic growth and availability of jobs, rather than environmental protection of nature conservation areas. One of the reasons is that, conservation areas have been exclusively established for preservation purposes, and are located far away from the places where local people live. As a result, local communities have not participated in their conservation and have been almost completely marginalized of any real benefit. However, most of the local and regional population wish to maintain as much as possible protected areas and to maintain the regional definition that Aysen region (Chilean Patagonia) is a real life support system.

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Local biodiversity should increase with climate change: case-study for ponds from the Swiss National Park

Véronique Rosset

Keywords

Small waterbodies, predictive models, protected area, climate warming, species richness, sentinel systems

Summary

Climate change is expected to have a significant impact on biodiversity worldwide (THOMAS et al. 2004). Many studies focus on responses to climate change at the regional level, such as species distribution shifts, and evidence that enrichment of regional biodiversity could happen in many areas of the world (HICKLING et al. 2006). Less is known, however, about the consequences of climate change on the species richness in ecosystems (local scale). Alpine areas are particularly sensitive to climate change (BENISTON 2003). Small waterbodies like ponds are abundant and widespread, and because of their small size they shelter simple communities, particularly at high altitude. Therefore, alpine ponds should play an important role as sentinel and early warning systems in the assessment of the future changes in local biodiversity. The Macun ponds of the Swiss National Park are part of a unique and exceptional area for such investigation and monitoring.

The aims of the present study are: (i) to present the observed species richness in the Macun ponds (2002 to 2008), and (ii) to predict the changes expected for 2100 (A2 IPCC emission scenario).

The Macun cirque was added to the Swiss National Park in 2000. This area is situated in the Alps (2'600 m. a.s.l.) in Graubünden, Switzerland. The climatic conditions are extreme, with extended ice cover (9 months).

The cirque covers 3.6 km^2 and includes a hydrographic system (Figure 1) composed of a stream network and more than 35 small waterbodies (area: 24–18,000 m^2).

As part of the National Park, the Macun cirque was identified in Europe as one of the Important Pond Areas of Europe (Minssieux in preparation). and a monitoring program has been put in place since 2002 (ROBINSON & OERTLI 2009). The ongoing research projects include monitoring of stream and pond diversity.

Macun pond diversity, as part of the monitoring project, has been assessed since 2002 with different rhythms according to the ponds. Macroinvertebrates are sampled in nine ponds with a standardized hand net, which is swept through the water intensively for 60 seconds per sample.

113 Swiss lowland to mountain ponds (including some of the Macun ponds), have been used to build predictive models for forecasting the potential impact of climate warming on freshwater biodiversity. Pond diversity was assessed once between 1996 and 2005 using the PLOCH standardized method (OERTLI et al. 2005), which measured the species richness for five taxonomic groups: aquatic vascular plants, aquatic Gastropoda, aquatic Coleoptera (larvae and adults), Odonata adults and Amphibia.

Predictive models were built using Generalized Additive Models (GAM) in order to model the relationship between 15 environmental variables (including mean annual air temperature) and measured species richness for each of the five taxonomic groups. To simulate climate warming, the future temperature increase predicted by the A2 IPCC emission scenario for 2090-2100, +3.4°C (IPCC 2007), was used.

In the Macun cirque, the monitoring between 2002 and 2008 showed that pond communities had presently a taxa richness between six and eleven taxa (Figure 2), values which fall within the range of observations from other alpine ponds but are particularly low compared to ponds from lower altitude (OERTLI et al. 2008). Coleoptera species richness was nevertheless particularly higher (two times higher) than what is usually observed at similar altitudes.

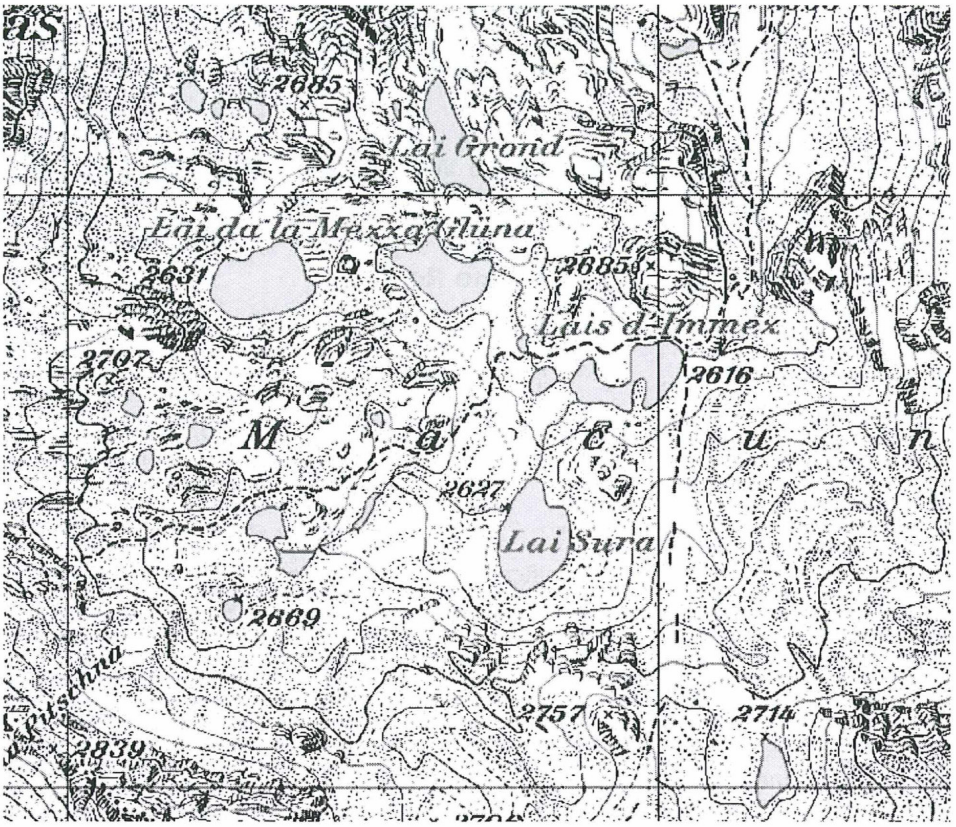

Figure 1: The hydrological system from Macun cirque (Swiss National Park).

For the Macun ponds (n=9), our predictions evidence that warming will lead to the apparition of taxa presently not observed at high altitude, such as Gastropoda, Odonata and Amphibia (Figure 3). A particularly marked increase in richness will occur for vascular plants. For Coleoptera, the slight decrease predicted is a bias due to the exceptional high richness of Macun ponds compared to alpine ponds with similar characteristics.

Analogous predictions for alpine ponds evidence that a temperature increase would enhance pond diversity for the five taxonomic groups: +139% for vascular plants, apparition of Gastropoda, +185% for Coleoptera, +454% for Odonata, and +56% for Amphibia.

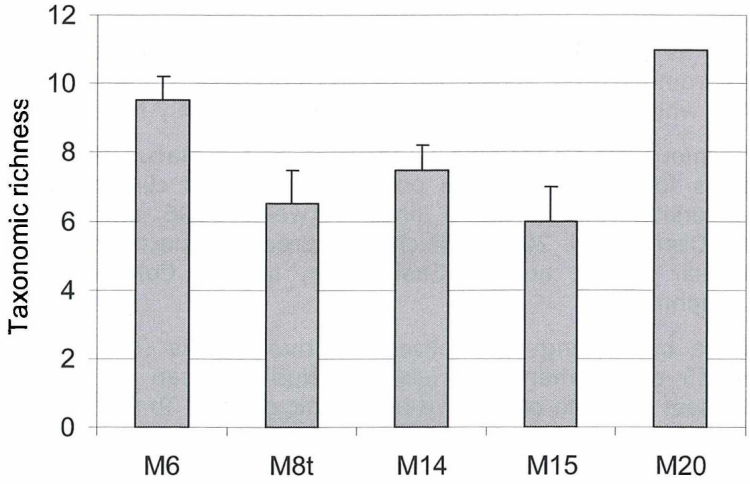

Figure 2: Taxa richness (species level, except for Diptera and Oligochaeta to family level and Chironomidae to subfamily) between 2002 and 2008 in five monitored ponds. Number of years sampled are two (M6, M14), three (M15, M20), or four (M8t).

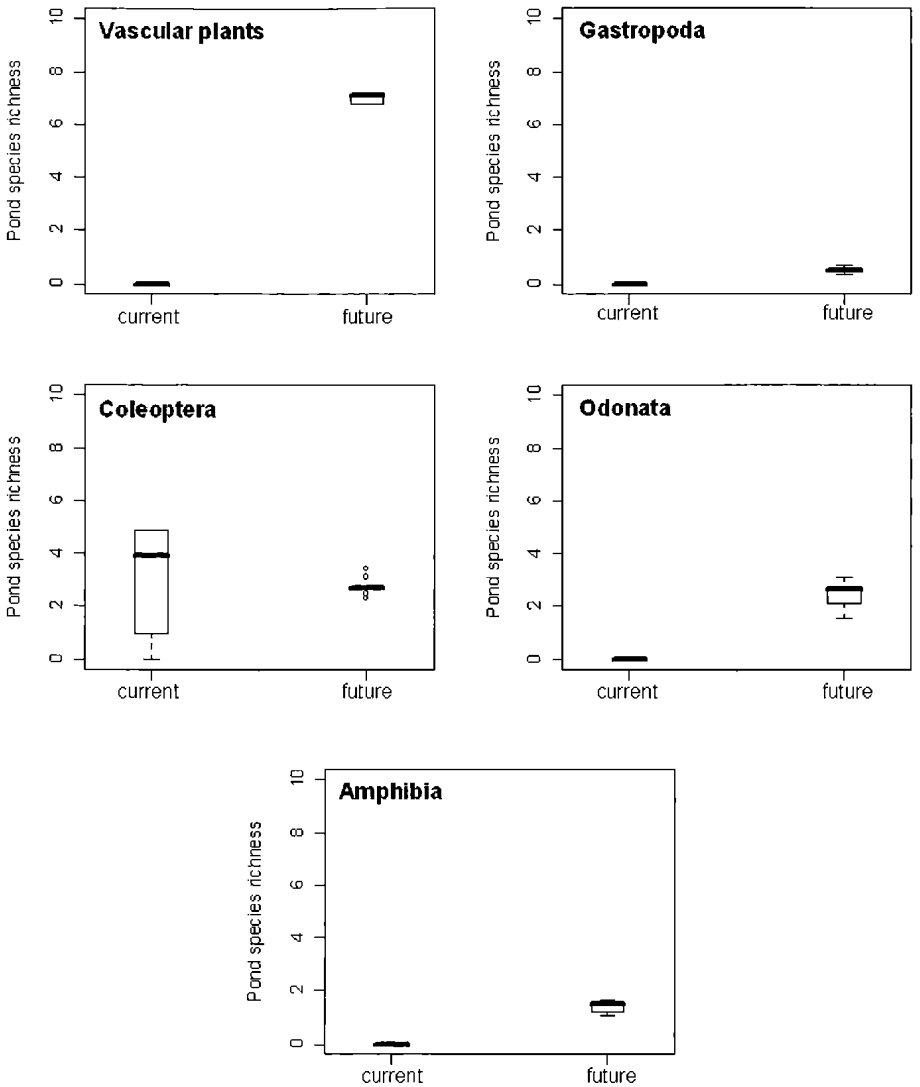

Figure 3: Current species richness ("current") and predicted species richness expected to occur in response to climate warming for 2100 ("future") for nine alpine ponds of the Macun cirque (Swiss National Park).

Alpine ponds located in the Macun cirque have the same range of species richness as other alpine ponds (with the exception of beetles). Because of their high connectivity and low disturbance by human activities, they are important to pond conservation and monitoring.

In Macun ponds, species enrichment is expected for the next century. Nevertheless, this enrichment would be in reality the result of a positive balance between numerous colonization events and sparse extinction events. Species currently inhabiting warmer locations will be able to migrate progressively to areas which are warming up. The majority of species (more than 90%) currently in the Swiss regional species pool are potential candidates for colonizing Macun ponds. Indeed, warming will lead to an apparition of vascular plants, Gastropoda, Odonata and Amphibia, species currently absent in these ponds. No cold stenothermal species, at risk of extinction, were detected from the five taxonomic groups used for predictions. Nevertheless, some other taxa inhabiting Macun ponds (Trichoptera for example) are at risk of extinction.

As the species enrichment predicted in this study represent the potential upper range of the expected changes, many important parameters not included in the predictions are believed to reduce this magnitude and should be considered and investigated in the future: species pools available for colonization, dispersal abilities of species, physical changes due to climate change and biological interactions. Future investigations should also focus on field evidence recorded by long-term monitoring programs. The use of alpine pond ecosystems seems particularly appropriate for such investigations, and this study demonstrates that they constitute an excellent sentinel ecosystem for predicting climate change effects at the local scale.

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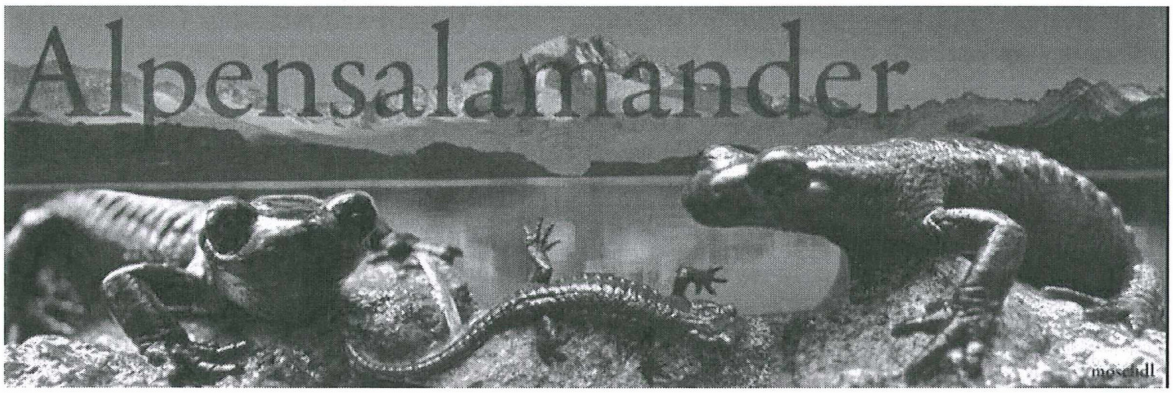
The Alpine Salamander

Wilfried Schwarzenbacher, Uschi Reinthaler, Magdalena Meikl, Kristina Bauch, Ulrike Berninger, Elke Zobl, Nicole Wopfner, Robert Schwarzenbacher



The Alpine Salamander (*Salamandra atra)* is a pitch black amphibian, that lives in Alpine regions at altitudes between 600-2400m. Males and females measures up to 144mm and 151mm, respectively and live up to fifteen years. It has a slightly elongated head, with two large kidney-shaped paratoid glands. The body has 11-13 costal grooves on either side. The tail is square in cross-section. Males have a slightly more pronounced cloaca than females. When threatened, they excrete a poisonous liquid from their skin glands. *S. atra* is a fully terrestrial species and can spend most of its time underground. It is a very cryptic and quite abundant amphibian, whose activity on the surface is highly related to climate, as it prefers humid conditions. This becomes evident after heavy rainfall, when the animals become active and leave their hideouts. Densities of 2380 individuals per hectar are known to occur. The typical habitats of the *S. atra* are humid alpine meadows and woodlands, where it lives in cracks, crevices or burrows, only to emerge at night or after rainfall. The species hibernates, depending on the altitude, for a period of 6-8 months (NOELLERT & NOELLERT 1992). The lowest known sites are at altitudes of 430m in Austria and Switzerland, although South of the Alps, the species is rarely found below 900m. The altitude records are 2430m in Switzerland, and 2800m Austria (GASC 1997).

Its specific adaption to the harsh alpine environment manifests its remarkable position as an ovoviviparous amphibian, which does not require an aquatic ecosystem for reproduction. Mating involves a ventral amplexus by the male, followed by the deposition of the spermatophore. One embryo develops in each of the two uteri. The developing young first feed on fertilized, and later on unfertilized ova in the uteri. Later in development, a zona trophica develops on the border between oviduct and uterus, which continuously provides the young with a cellular material that serves as food. The young develop extremely large external gills. Gestation takes 2 years between 650 and 1000m, and 3 years between 1400 and 1700m elevation. The terrestrial, fully metamorphosed young are 40-50mm total length upon birth.

S. atra is an endemic of the alpine arc with some isolated areas in the Dinaric Alps. The Country distribution includes Albania, Austria, Bosnia and Herzegovina, Croatia, France, Germany, Italy, Liechtenstein, Montenegro, Serbia, Slovenia and Switzerland. Only some isolated massifs in Bosnia, Montenegro and Albania (Dragobya) are colonized. Some parts of the Central Alps with a predominantly dry climate Valais and Engadine in Switzerland, Valtelline and Valle Venosta in Italy are avoided. In Italy exists a subspecies *Salamandra atra aurorae* with a bright coloration on the head, back, and dorsal side of the extremities. This coloration can consist of continuous patches or be spotted or blotched. It can vary in color from whitish or yellow to greenish or gray (BONATO 2005). The range of the subspecies *S. atra aurorae* is extremely small (less than 50 square kilometers) and situated at the southern border of the total area between Trento and Asiago in Italy. The habitat consists of mixed deciduous and coniferous forests on cretaceous limestone at altitudes between 1300 and 1800m. In 2005, Bonato and Steinfartz discovered a new partly yellow spotted subspecies of *S. atra* on Monte Pasubio in Italy, named *S. atra pasubiensis* (BONATO 2005).

Despite its central role in the Alpine ecosystem our actual academic record is embarrasingly small. In fact, we know close to nothing about its present distribution in the Austrian Alps, its habitat, and

most importantly its ecology. In order to resolve this shortcoming this project explores the population and distribution of the Alpine Salamander focusing on the Nationalpark Hohe Tauern and several other Natura2000 regions. The main goal is to map occurrence, population- size and development of the Alpine Salamander.

We have established the webportal www.alpensalamander.eu where local communities can register and report their salamander observations. This community based approach enables the combination of research, education and dissemination by interactive participation. We believe that protection of amphibians and their habitats is only possible by actively involving the population. Second, an oral history of Alpine Salamander observations in the past 50 years by conducting interviews in the local community, such as alpinists, farmers, national park staff, mineral collectors, and hunters to preserve their well-versed local knowledge of the Alpine Salamander. In addition, we will collaborate with national parks (Nationalpark Hohe Tauern) and museums (Haus der Natur) to effectively disseminate this project in schools, wildlife and mountaineering organizations.

In addition we will research the distribution of the alpine salamander and analyze its genetic structure. Here, we will focus on the entire distribution of *S. atra* to learn more about its evolutionary history, and highlight different lineages in a perspective of conservation. We will also analyze its distribution on a regional scale to quantify the gene flow between distinct populations and evaluate the influence of landscape features on it. Finally we will analyze the population level to study the relatedness between individuals in relation to their spatial position. Here we will develop a monitoring method to evaluate the emigration rates between the subterranean and surface populations and determine which parameters have an influence on it. For this monitoring project, we have selected locations in three geographically and geologically different Alpine areas. These areas will be monitored periodically, which will also include other amphibians like the Fire Salamander (*Salamandra salamandra)* to investigate the ecological relationship among these species.

The alpine salamander is on the red list of endangered animals in Austria (Kyek 2006) and strictly protected according to the European FFH guidelines. The subspecies *S. a. aurorae* is highly endangered in its very small range. Possible threats to the alpine salamander are the destruction of habitats through extensive road building, widespread use of pesticides by the forest industry, intensifying and expanding of agriculture and ski-tourism. Negative effects of climate change, air pollution, rain and soil acidification are likely though not proven (Gasc 1997).

Consequently, efforts to research its habitat and ecology, as well as measures for its conservation have highest priority.

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Research activities at the Sonnblick Observatory

overview of the results of more than 40 projects

Michael Staudinger

Abstract

Research at Sonnblick at 3100m altitude goes back for more than 120 years. During this period the focus has shifted several times, with meteorology and climatology being constantly in the centre and now a basis for all research on the effects of climate change. In the last decades glaciology and geology became an additional focus because of receding glaciers and the instability of rock masses.

Air chemistry takes advantage of the unique position of the observatory in the middle of the National Park, where no local emissions disturb the back ground measurements. Several projects deal with the basic constituents like sulphur and nitrat based pollutants, other projects focus on emissions of plants which acts as precursors of the ozon concentration in the lower troposphere.

Radiation orientated programs investigate the total ozon column, via GPS and GLONASS signals the total water vapour content of the atmosphere is measured. Additional to the chemical parameters radioactivity programs focus on gamma radiation and gamma spectroscopy. Biology became an important research field with programs on lichen and other basic forms of the flora and fauna of the high alpine environment.

Last but not least a couple of art projects showed the uniqueness of the location not only to science, but also the wider context we should perceive the world.

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Winter visitors' acceptance of the visitor management concept of the Gesäuse National Park

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Summary

One main challenge of protected area management is to combine nature protection and the provision of recreational opportunities for area visitors. In the Gesaeuse National Park in Styria/ Austria, one valley is very renowned for alpine ski touring, and the number of ski mountaineers is increasing year by year. Some of the alpine ski routes overlap with good habitats for grouse. Following the foundation of the National Park in 2002, a winter visitor management concept was developed for this area. Based on a habitat mapping of black grouse and capercaillie, two routes for alpine ski touring were relocated in coordination with local stakeholders. Focusing on positive visitor management measures, information, signposting and on-site rangers were used for implementing the concept. To evaluate the winter visitor management concept, mail-back questionnaires were distributed among alpine skiers. Results of the survey show that the management concept is known by 41% of the respondents and more than 70% of them see it as a useful management strategy. The acceptance of the visitor management concept is higher if visitors do not come from the National Park region.

Keywords

Ski touring, grouse, human-wildlife conflict, visitor management, national park.

Aims of this study

National Parks accredited by the IUCN (category II) focus on both, nature protection and the provision of nature-based recreational possibilities (IUCN 1994). Visitor management measures have to be implemented to guarantee that fauna, flora and habitats are not disturbed and deteriorated due to recreational use.

Within the Gesaeuse National Park, some areas are very intensively used for alpine ski touring. As areas that are well-suited for alpine ski touring are often at the same time good habitats for grouse and capercaillie, a habitat mapping of the relevant areas was undertaken (GRÜNSCHACHNER-BERGER & PFEIFER 2005). Results of this study showed that especially two ski routes within the valley of Johnsbach overlap with important habitats for grouse and capercaillie; consequently a visitor management concept was developed and accomplished. Two ski routes were relocated in order to bypass the sensitive habitats of black grouse and capercaillie. This shift of the routes was coordinated with local stakeholders, such as the land owner, the alpine associations, mountain guides, and the locals.

The visitor management concept mainly focuses on the so-called positive or indirect visitor management measures, i.e. signposting, information and voluntariness. Observations by rangers showed that the "new" alpine skiing routes were accepted by a great part of the users, but, nevertheless, some ski mountaineers were not willing to accept them. Therefore, the National Park administration decided to undertake a visitor monitoring of the ski mountaineers, using a mail-back questionnaire to get further information about the knowledge about and the acceptance of the visitor management measures.

Study area

The Gesäuse National Park is the most recent of the Austrian National Parks and, with an area of about 11,000 hectares, the third largest. It is situated in the north of Styria. Its landscape is characterised by rock, woodland and water. One small village, Johnsbach in Gesäuse, is well known for alpine ski touring since a long time, and the mountains around Johnsbach are intensively used by ski mountaineers in winter (www.nationalpark.co.at).

Methods

To gather information on winter visitors to the Gesäuse National Park as well as on their acceptance of the visitor management concept, a visitor survey was undertaken from December 2007 till March 2008. On weekends and holidays, mail-back questionnaires were distributed on parked cars at the main parking places in Johnsbach. These parking lots are at the same time the main starting points for the most relevant alpine ski routes of the area. In total 550 questionnaires were returned, resulting in a response rate of 25.8%. The questionnaire dealt with the following topics: visitor structure (e.g. socio-demographic data), visit-related data (e.g. means of arriving to the area, route taken), visitor motivations (ranging on a scale from 1=very important to 5=not important at all), attitudes toward ski touring, acceptance of visitor management measures, indicators of satisfaction, quality of recreation experience, and crowding perceptions. Data analysis was conducted with the statistical programme SPSS using descriptive and multivariate statistics.

The survey was conducted in winter 2007/2008 and will be repeated each five years to be able to observe developments in winter recreational use in the Gesaeuse as well as the acceptance of the visitor management.

Results

About 75% of the respondents were male; the main group size was two. Male visitors were older than women (46.5 years compared to 41 years). Almost all visitors arrived by car. The winter visitors are mainly day visitors, coming from Upper and Lower Austria and Styria; only 7% were locals. Nearly all respondents went alpine ski touring, only a few went snow shoe walking or siedding. The top three visiting motivations were "nature experience" (mean 1.2), "relaxing, recreation, quietness" (mean 1.5) and "sport experience" (mean 1.9). In general, winter visitors were (very) satisfied (95% of the interviewees) with the Gesaeuse in general, as well with their tour on the day of the survey (ARNBERGER et al. 2008).

The ski mountaineers carried out 20 tours in winter on average, and 4.8 of these tours were conducted in the Gesaeuse; this means that each 4th ski tour of the interviewees took place in the Gesaeuse. Nearly three fourth of the respondents believed that recreational activities, such as ski touring or hiking, should not be managed more intensively than they have already been managed.

About 40% of the ski mountaineers were aware of the winter visitor management concept for the National Park, and close to 70% see it as a positive strategy. Most of the proponents of the concept are not coming from the National Park region. Those not seeing any necessity for visitor management in this area were mainly concerned about the loss of freedom regarding their outdoor recreational activities. Nevertheless, only 11% perceived any restrictions of their recreational opportunities due to the established measures of the National Park; even 36% experienced no constraints at all. Visitors who were not aware of the negative influences of alpine ski touring on nature can be characterised as more elderly, male locals, who carry out more tours per year in general and in the Gesaeuse and see no need for a visitor management. In contrast, visitors who were aware of the negative influence of alpine ski touring on nature, do shorter (holiday) trips in the Gesaeuse, do less ski tours per year in general, are higher educated, were more satisfied with their visit to the Gesaeuse, and think that the visitor management concept is something positive.

Discussion

Following the results from the questionnaire – affirmed by the experiences of on-site rangers patrolling along the ski routes – the following conclusions can be derived:

The winter visitor management concept is known by only 40% of the ski mountaineers. Therefore, the National Park has to better inform its visitors about this concept and the reasons for it. Ski touring guide books, web sites and presentations for organised ski touring groups should inform the National Park visitors as early as possible.

Nevertheless, 70% of the interviewees experience the visitor management as a positive strategy. This is supported by the observations of the on-site rangers: most of the (foreign) visitors do accept the relocated ski routes and follow the signposts.

Locals and skiers visiting the Gesaeuse very often, are the more critical users of the ski routes. They see the visitor management concept more critically than foreign visitors. One important task in this context will be an intensified awareness rising campaign within the National Park region.

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Monitoring of glacier mass balance on Mullwitzkees Hohe Tauern

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Abstract

Since 2006, the Mullwitzkees, situated in the Venediger Massive within the core zone of the Hohe Tauern National Park, is subject to mass balance monitoring program. In contrast to other glaciers currently observed in monitoring programs, the glacier is located south of the main Alpine crest and also exposed to the south. The highest point of the glacier is Hoher Zaun (3450 m), the lowest part of the snout called Zettalunitzkees reaches down to an elevation of 2690 m. The mass balance of Mullwitzkees and the data of the Austrian glacier inventories allow gaining new insights in processes governing melt, hydrology and glacial recession for these types of glaciers. The monitoring network includes about 15 ablation stakes, several snow pits, a rain gauge and an automatic weather station. The mass balance of the glacier is measured using the direct glaciological method with fixed date. In the year 2006/07 the Mullwitzkees experienced a specific mass balance of -1447 mm. In the year 2007/08 the specific mass balance was -642 mm. In both years, therefore the mass loss was lower than the specific balance of the mass balance glaciers Hintereisferner (Ötztal) and Jamtalferner (Silvretta) although these are exposed to the north. The project is funded by the Hohe Tauern National Park and the Hydrological Service at the government of Tyrol.

Keywords

glacier, mass balance, Mullwitzkees, Venediger

Aims and duration of the project

The project aims at the measurement and interpretation of mass balance and climate data and the interpretation of the relationship of these measured parameters with respect to the current glacial recession and hydrology as well as for the development of future glacier scenarios for the both. The project is funded by the Hohe Tauern National Park and the Hydrological Service started in 2006 and is planned for five years at a first glance.

Area of study

The Mullwitzkees is situated in the Venediger Massive within the core zone of the Hohe Tauern National Park and is divided into the "innere" and "äußere" Mullwitzkees. Glacier fluctuations since the end of the Little Ice Age are summarised by PATZELT (1973). In the following only the "äußere" Mullwitzkees is regarded and therefore denoted as Mullwitzkees. The upper part of the glacier is exposed to the south and is confined by a ridge with the highest point Hohe Zaun at an elevation of 3450 m. The snout called Zettalunitzkees is exposed to the south-west and reaches down to an elevation of 2690 m. In 1998, Mullwitzkees (and Zettalunitzkees) covered an area of 3.24 km². The glacier area diminished to 3.08 km² in 2007. The glacier boundaries in Figure 1 and Figure 2 originate from the Austrian glacier inventory 1998. For 2007 the glacier boundaries were reduced on the basis of photos and inspections. Zettalunitzkees is also subject to measurements of glacier length by the glacier survey of the Austrian Alpine Club (e.g. PATZELT 2005, PATZELT, 2006). There are several glaciers along the alpine crest where mass balance measurements take place but the Mullwitzkees is the only one on the southern side of the main ridge of the Alps.

Method

To determine the mass balance of this glacier the direct glaciological method with fixed dates is used (HOINKES, 1970). Tough the mass gain and loss of the glacier within one year is detected. The year is divided into the accumulation period from the 1st of October to 30th of April were a mass gain of the glacier is expected and the ablation period from the 1st of May to 30th of September were the glacier experiences a mass loss.

Ablation is measured with ablation stakes in the ablation area. During the summer, the free ends of the stakes are measured several times. At the 30th of April multiple snow pits are dug to measure the height and density of the accumulated snow cover and at the 30th of September this work is repeated to determine the mass gain of the glacier within the hydrological year. The direct glaciological method is described in PATERSON (1994).

Results

In the year 2006/07 the Mullwitzkees experienced a mass loss of $4.46*10^6$ m³ w.e. (water equivalent) and a specific mass balance of -1447 mm. The AAR (accumulation area ratio) of 0.2 is low. Wind drift near the ridge causes the mass balance to be negative at high altitudes. Therefore the accumulation area is concentrated to mid-elevations of the glacier. The ELA (equilibrium line altitude) 2006/07 was 3160 m. In the year 2007/08 the mass loss devoted $1.98*10^6$ m³ w.e. and a specific mass balance of -642 mm, caused by high precipitation rates in winter, delaying the beginning of the ablation season. In Table 1 the characteristic numbers of the mass balance measurements on Mullwitzkees of both years are summarised and separated into terms of accumulation and ablation, as well as the AAR, the ELA and precipitation. The distribution of the mean specific mass balance on Mullwitzkees in centimeter water equivalent for the hydrological years 2006/07 and 2007/08 can be seen in Figure 1 and 2. The plot of specific mass balance (Figure 3) for HEF (Hintereisferner), KWF (Kesselwandfer), JAM (Jamtalferner), HSG (Hallstätter Gletscher) and MW (Mullwitzkees) shows that the mass balance tends to be less negative on Mullwitzkess compared to e.g. Hintereisferner, although it is exposed to the south. Further investigations are needed to prove these first results.

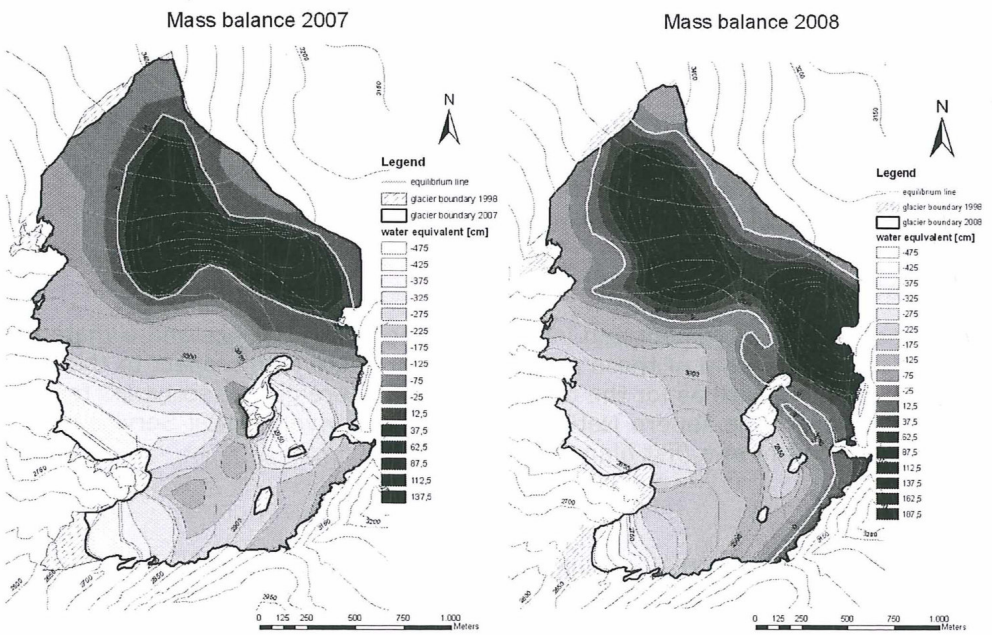

Figure 1 and 2: Distribution of the mean specific mass balance on Mullwitzkees in centimeter water equivalent for the hydrological years 2006/07 and 2007/08. The mass balance is colored gradually into 50 cm intervals within the ablation areas and into 25 cm intervals within the accumulation areas, the equilibrium line is plotted as a gray line.

Table 1: Characteristic numbers of the mass balance and climate observations on Mullwitzkees for the hydrological years 2006/07 and 2007/08, separated into terms of accumulation and ablation, as well as the accumulation area ratio, the equilibrium line altitude and precipitation.

	2006/07	2007/08	
Sc (accumulation area)	0.639	1.22	km^2
Bc (total accumulation)	0.44	0.93	$10^6 m^3$
bc (mean specific accumulation)	682	764	mm
Sa (ablation area)	2.444	1.864	km^2
Ba (total ablation)	-4.90	-2.91	$10^6 m^3$
ba (mean specific ablation)	-2004	-1562	mm
S (glacier area)	3.083	3.084	km^2
B (total mass balance)	-4.46	-1.98	$10^6 m^3$
b (mean specific mass balance)	-1447	-642	mm
AAR (accumulation area ratio)	0.207	0.396	
ELA (equilibrium line altitude)	3163	3115	m
P (precipitation)	1358	1553	mm

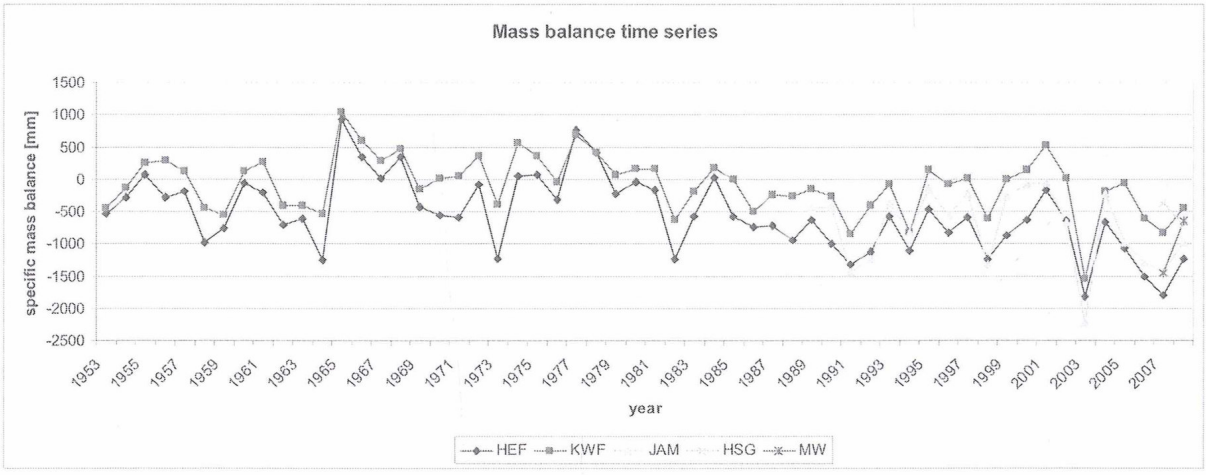

Figure 3: Time series (1953 – 2008) of the specific glacier mass balance in millimeter w.e. on HEF (Hintereisferner), KWF (Kesselwandferner), JAM (Jamtalferner), HSG (Hallstätter Gletscher) and MW (Mullwitzkees).

Discussion

Comparing the first two years of mass balance measurements on Mullwitzkees one of the most conspicuous results is the position of the accumulation area, which is displaced from the ridge to lower elevations due to wind drift during the winter. The ice thickness is decreasing at the highest elevations of this glacier (SPAN et. al., 2005, FISCHER et. al., 2007). A relationship between the local climate and the appearance of this glacier can be found at the earliest after five years.

These investigations do not relate to the status of protection but the Mullwitzkees is a glacier located in a protected area. Nevertheless mass balance measurements are the coherency between glacier and climate and therefore it is important to observe the actual conditions, to answer questions which are anchored in the minds of the general public, especially with regard to protected areas, as for example the questions how long the glaciers of the Hohe Tauern National Park tend to exist in different climate scenarios described in the IPCC Report 2007.

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Climate Change Effects on the Alpine Snow Cover

Ulrich Strasser

Summary

In this paper a stochastic weather generator is applied to provide long time series of consistent synthetical future climate data from measured historical records. The stochastic weather generator is applied to weekly episodes of a hourly meteorological dataset from a network of climate stations in the high alpine area of the Berchtesgaden National Park (Germany). The generated future climate scenario includes a temperature increase of 1.5 °C until 2050, and a corresponding up-to-10 % shift of precipitation from summer to the winter months. Then the energy balance snow cover model AMUNDSEN (Alpine Multiscale Numerical Distributed Simulation Engine) is applied using the generated future climate data time series to simulate the respective seasonal evolution of the snow cover in the National Park area. AMUNDSEN includes physical descriptions of specific alpine snow processes such as the complex interaction of topography and radiation, snow slides or canopy-snow interception and sublimation. The results reveal and spatial effects of the changing climatic conditions on the seasonal duration of the snow cover.

Keywords

Climate change, mountain snow cover, stochastic weather generator

Methods

We apply the ***Alpine MUltiscale Numerical Distributed Simulation ENgine*** AMUNDSEN (STRASSER 2008) for a reference period and a future scenario period to investigate the effect of a changing climate on the snow cover period duration in the area of the Berchtesgaden National Park (Germany, fig. 1). To drive the model, continuous recordings from an automatic network of meteorological stations are utilized (table 1); the latter also serve as data base for generating a future data series accounting for a changing climate by applying a stochastic weather generator. AMUNDSEN includes several interpolation routines for scattered meteorological measurements, rapid computation of topographic parameters from a digital elevation model, sophisticated simulation of short- and longwave radiative fluxes including consideration of shadows and cloudiness, parameterization of snow albedo, modelling of snow- or icemelt, modelling of forest snow processes and of gravitational snow slides, and a built-in stochastic weather generator to produce synthetic future meteorological data for climate change scenario simulations (STRASSER & MAUSER 2006). The latter produces data with the same temporal resolution as the input data, i.e. as is required by the snow model, and does not alter the physical relations between the meteorological parameters. Basic assumption of the method is that a climate storyline can be divided into time periods which are characterized by a certain temperature and precipitation, and these two variables are not independent from each other:

$$\overline{P} = f\left(\overline{T}\right)$$

with $\overline{P}$ being the mean precipitation of a certain time period, $\overline{T}$ its mean temperature and f their functional dependency. In our application the periods are weeks (fig. 2).

A typical annual course of the meteorological variables is constructed by computing mean temperature and total precipitation for the periods using all years of the measured historical dataset. This mean annual climate course is used to construct the future data period by period: first, the according temperature is modified with a random variation and the given trend. Then a corresponding precipitation is derived, considering the T/P relation and again a random variation. As a result, the week to construct is defined by a certain temperature and precipitation. In a last step, the period from the historical periods with the most similar T and P is selected applying the nearest neighbour criterion. Measured data of this period is then added to the future time series to be constructed. This procedure is repeated for all 52 weeks of the year, and all years of the future time series. For this study, the weather generator was applied to produce time series of hourly air temperature, precipitation, global radiation, relative humidity, and wind speed for the period 1 August 2006 to 31 July 2050, assuming a temperature increase and a shift of precipitation from

the summer season into the winter: a linearly increasing amount of mean weekly precipitation, up to a maximum difference of 10 % in 2050, is subtracted from the selection measure of all weeks between May and September and added to it for all weeks between November and April. Consequently, the weather generator selects weeks with more observed precipitation in winter, and weeks with less observed precipitation in summer to build up the scenario dataset.

Results

As one first indicator for the effect of a changing climate on the simulated snow cover, the mean future seasonal snow cover duration is analyzed. For this purpose, the obtained continuous hourly climate datasets for the reference period 1998–2006 and the scenario period 2042–2050 have been used to compute averages for the annual duration of the snow cover (e.g., number of days with snow on the ground). The results are spatially distributed and covering the entire area of the National Park.

The map of the mean annual differences in the duration of the snow-covered period between 2042–2050 under scenario conditions and the reference period 1998–2006 is characterized by a complex pattern. The following structures can be detected: (i) a general decrease in the duration of the snow-covered period in the valley regions from NE towards SW, (ii) a separation of the forested areas (substantial decrease in the number of snow days) from non-forested areas (moderate decrease in the number of snow days), (iii) the maximum reduction of the period of snow coverage in the snow slide deposition zones, and (iv) a moderate increase in the number of snow days in areas where snow is entrained and gravitationally transported by means of the snow slides model.

On the plateau of the Untersberg in the very North of the domain, the warming and increased precipitation in winter compensate for each other, whereas on the plateau of the Reiter Alm (in the same elevation), the change equals approximately -14 days (non-forested areas) to -18 days (forested areas). The yellow-reddish coloring for the valleys corresponds to -10 days, approximately.

In the forested areas, the reduction of the snow-covered period, amounts to values around 20 days. The sublimation of previously intercepted snow in the canopy is an efficient process remarkably reducing the duration of the period of snow coverage beneath the canopy. This process is strongly dependent on radiation input, and therefore considerably more efficient during the changed climate. A maximum reduction of the snow-covered period (35 days) can be detected in the snow slide deposition zones. Here, the effect of additional winter precipitation is compensated most efficiently by the higher temperature, additional increase of global radiation (+7.6 W m^{-2}), and reduced relative humidity (-1.9 %) during summer, all supporting a more efficient melting process.

Finally, the duration of the snow-covered period is moderately increased in the steep zones of entrainment and gravitational transport of snow. Whereas in other regions the mass balance of the snow cover is controlled by precipitation input and the energy balance in the transport zones it is mainly forced by precipitation input and consecutive gravitational removal of snow. As a consequence, snow is efficiently removed after each snowfall event, and the remaining snow layer quickly becomes thin enough to completely melt out the next time the energy balance becomes positive, even in mid winter. The absolute number of snow days in the transport zones is considerably smalier than in non-transport zones of the same elevation, clearly visible at the mountain ridges. Consequently, an increase in winter precipitation (mostly snowfall at these elevations) results in more days with snow coverage.

For the distributed patterns of snow cover duration it can be concluded from the simulations, that a general warming will lead to shorter snow-covered period, the effect being most pronounced in forested areas. On steep rock faces, snow might remain longer due to the more frequent precipitation events (with precipitation still falling as snow). If precipitation increases in winter, the increased air temperatures will be compensated for to a certain extent, and again the forested areas react most sensitive to the change.

The snow cover duration in the snow slide accumulation zones seems to depend more on the melt energy supply rather than on accumulation amount.

Conclusions

Applying the stochastic weather generator a future climate change scenario was constructed and used for a prognostic model run to estimate the potential seasonal evolution of the mountain snow cover under changed climatic conditions. For an assumed moderate trend towards higher temperatures and a shift of precipitation from summer to winter, the results show a rapid but spatially very differentiated decline of snow cover duration. Overall it becomes evident that although the increased winter precipitation still predominantly falls as snow, the additional accumulation of the snowpack is compensated for by the higher temperatures.

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Figures

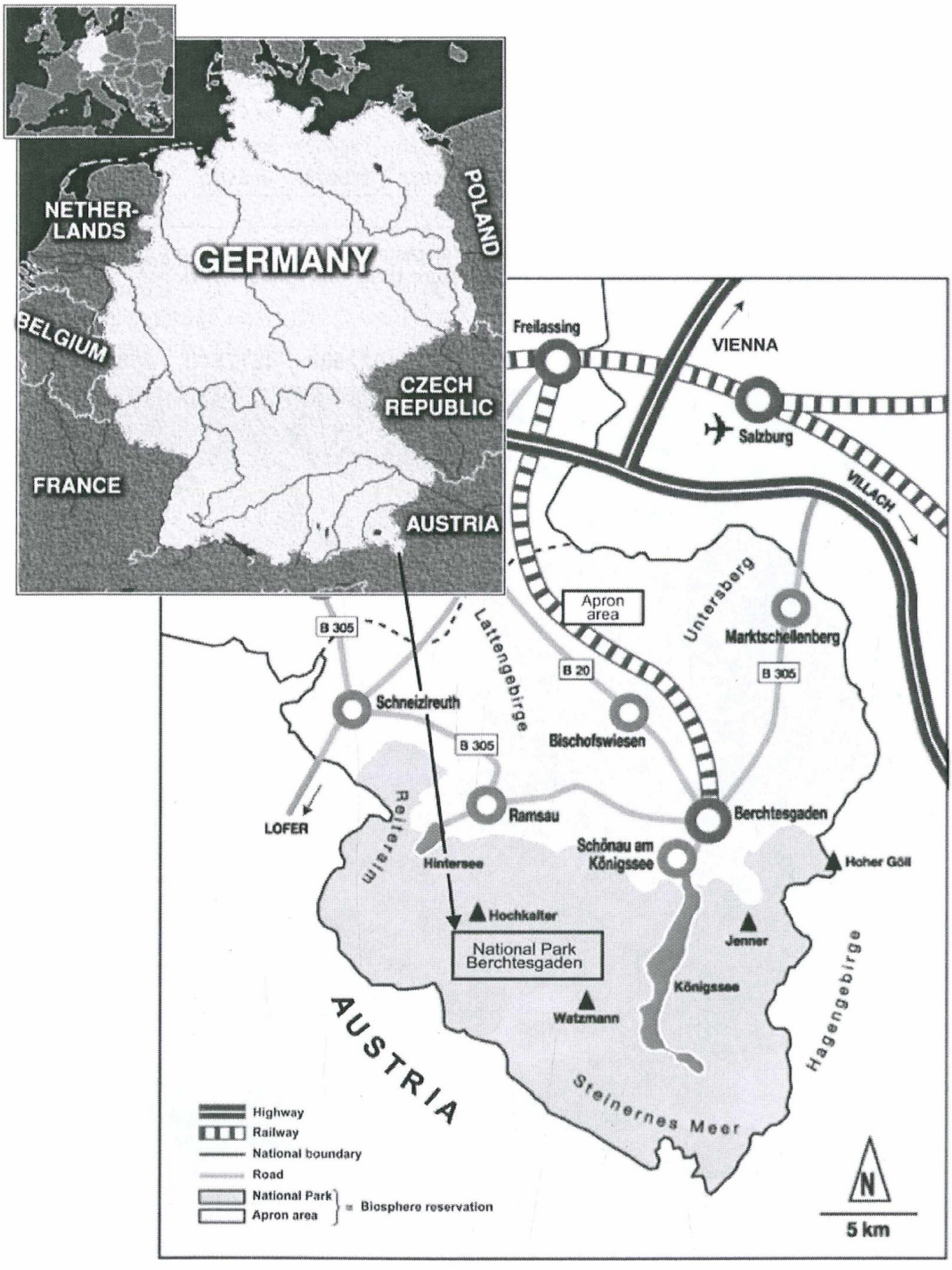

Figure 1: Location of the Berchtesgaden National Park (Germany).

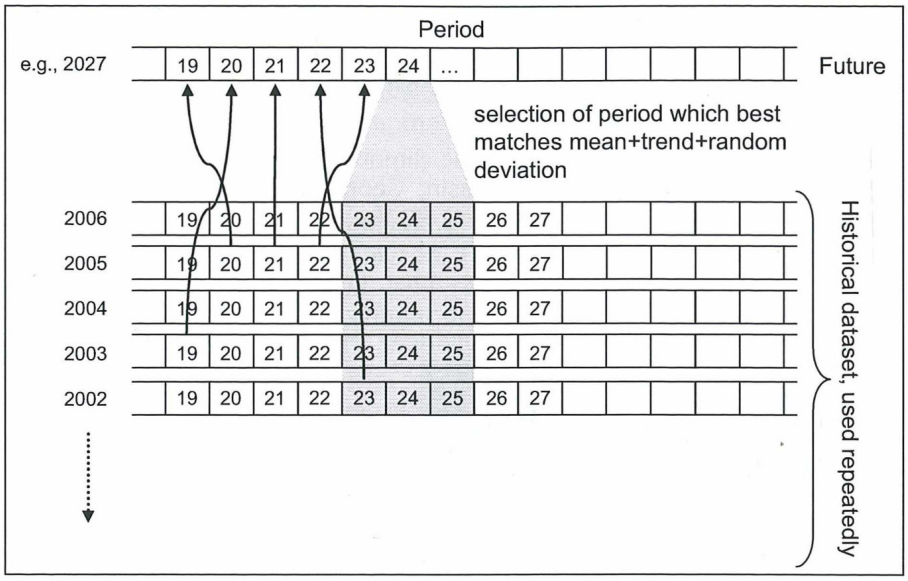

Figure 2: Principle of selecting periods of measured data to build up a future data time series with a certain temperature trend and random deviation.

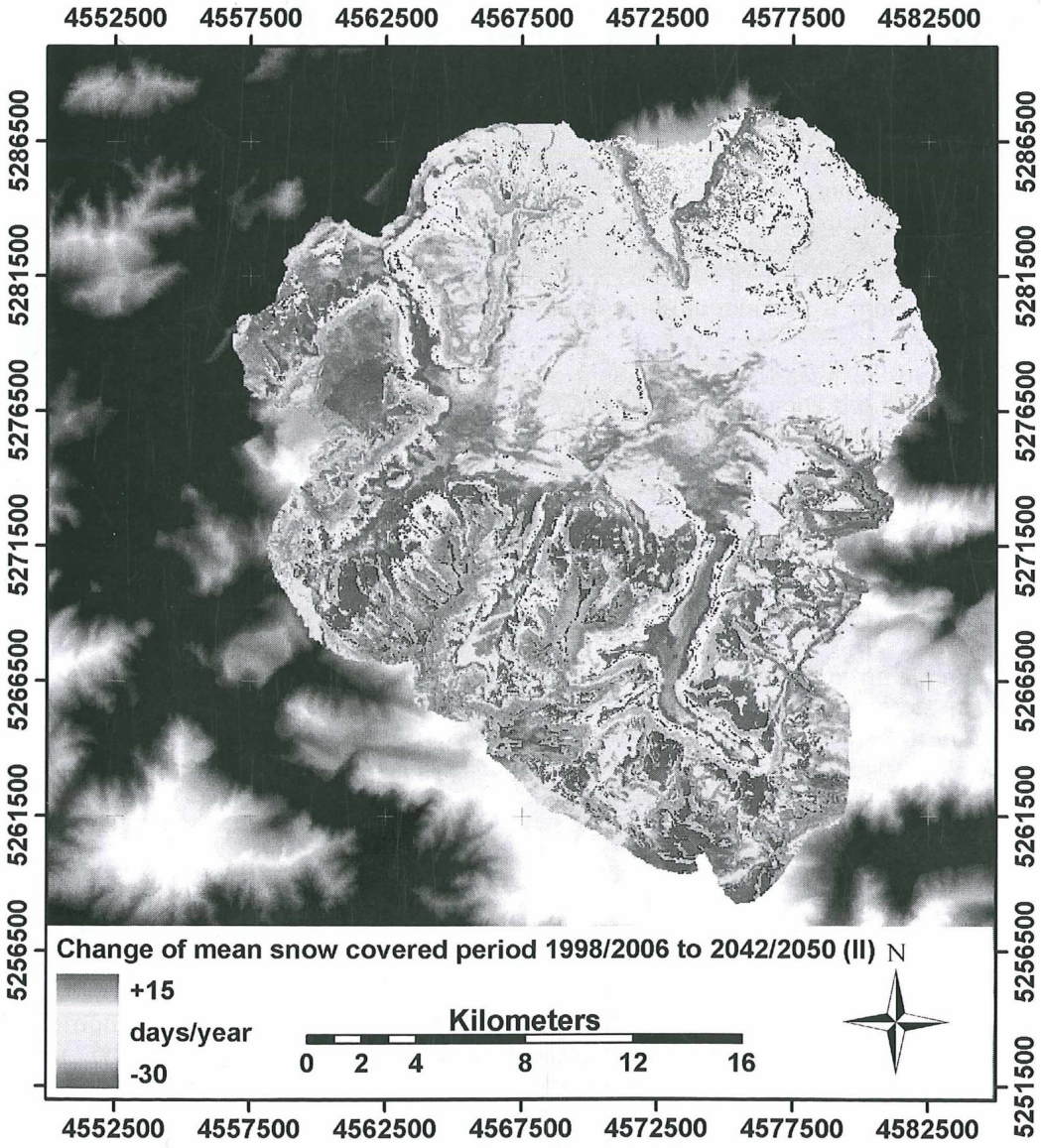

Figure 3: Mean annual difference in the duration of the snow-covered period between 2042–2050 under scenario conditions and the reference period 1998–2006.

Tables

Table 1: Meteorological stations and variables recorded in the Berchtesgaden National Park. The level of the temperature recordings is given with respect to the ground level.

Station	Elevation [a.s.l.]	Easting [m]	Northing [m]	Variables	Sampling rate
Reiter Alm I	1755 m	4560494	5279436	W, W_{max}, WD	10 min
Reiter Alm II	1670 m	4560835	5279235	T_a, T_s, T_{s20}, T_{s40}, T_{s60}, T_s, RH, H_s	10 min
Reiter Alm III	1615 m	4560950	5278982	T_a, RH, G, G_{ref}, P, H_s	10 min
Kühroint	1407 m	4572314	5270625	T_a, RH, G, G_{ref}, W, WD, P, H_s	10 min
Funtenseetauern	2445 m	4572939	5261755	T_a, RH, W, WD	10 min
Jenner I	1200 m	4576659	5272417	T_a, T_{s0}, T_{s20}, T_{s40}, T_s, RH, H_s	10 min
Jenner II	660 m	4575000	5273988	T_a, RH, P	10 min
Schönau	617 m	4573987	5275597	T_a, T_{a05}, RH, G, G_{dir}, SS, W, WD, P, p	10 min
Untersberg	1776 m	4575822	5287649	T_a, RH, W, W_{max}, WD, P	30 min

W = wind speed
W_{max} = maximum wind speed
WD = wind direction
T_a = air temperature (2 m)
T_{a05} = air temperature (0.05 m)
T_{s0} = snow temperature (0.0 m)
T_{s20} = snow temperature (0.2 m)
T_{s40} = snow temperature (0.4 m)
T_{s60} = snow temperature (0.6 m)
T_s = snow temperature (at the surface)
RH = relative humidity
H_s = snow height
SS = sunshine duration
G = global radiation
G_{dir} = direct radiation
G_{ref} = reflected radiation
P = precipitation
p = atmospheric pressure

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Climate change in alpine areas in central Austria between 1961 and 2006

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Summary

Monthly values of four different climatic elements (mean temperature, precipitation sum, sum of freshly fallen snow and maximum snow depth) from 44 meteorological stations were analysed for quantifying climatic trends over a 46 year period (1961-2006) at six high-altitude areas in the mountains of central Austria, partly located in the Hohe Tauern National Park. The trends of the four climatic elements were investigated by applying different statistical approaches. Our results indicate a significant temperature rise of mean annual temperatures of 1.3 to 1.4°C since 1961 in all six areas at the reference altitude of 2500 m a.s.l. The highest increase in temperature occurred during the summer season (JJA) with ~1.9°C. The trends of mean annual precipitation, sum of freshly fallen snow and maximum snow depth are not significant at all six sites. However, the annual precipitation sum seems to have decreased in two of the six areas (-75mm) whereas in one area it increased substantially (+160mm). The annual sum of freshly fallen snow decreased in five areas. The maximum snow depth decreased in all six areas. Our results clearly demonstrate that climatic conditions changed significantly within the last decades in central Austria.

Keywords

Temperature, Precipitation, Snow, Climatic trends, Hohe Tauern National Park.

Objectives and Study areas

The changing climate system affects high altitude regions by strong impacts on glaciers and permafrost (HAEBERLI & BURN 2002). Scientific research in Austria dealing with this topic is carried out in various projects and several studies have already been published (e.g. FORMAYER et. al. 2001). This study quantifies trends of four climatic parameters (mean temperature, precipitation sum, sum of freshly fallen snow and maximum snow depth) over a 46 year period (1961-2006) at six high-altitude areas in the mountains of central Austria (Fig. 1). These six areas (5 in the Hohe Tauern Range, 1 in the Niedere Tauern Range) are investigated by a project focussing on the effects of climate change on high mountain environments named "ALPCHANGE – Climate Change and Impacts in Southern Austrian Alpine Regions" (www.alpchange.at).

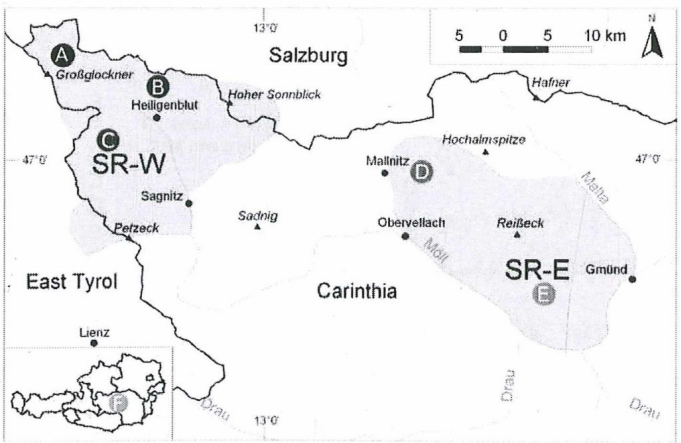

Figure 1: Location of the six selected ALPCHANGE study sites:
A=Pasterze Glacier
B=Schareck – Fallbichl
C=Central Schober Mountains
D=Dösen Valley
E=Hintereggen Valley
F=Hochreichart

Method and data base

The essential input for climate impact analysis is represented by the local data base which consisted in the framework of this study of monthly values from 44 observational meteorological stations (Table 1) nearby the six study sites depicted in Figure 1. Trends of the four climatic elements were investigated by applying different statistical approaches. Correlation analysis was used for filling data gaps, linear regression to calculate the conditions at reference altitude 2500 m a.s.l. and the overall linear trend. Mean differences of the two 23-year periods for mean temperature, precipitation sum and maximum snow depth (1961-83 vs. 1984-2006) as well as the two 18-year periods for the sum of freshly fallen snow and (1971-1988 vs. 1989-2006) were calculated. The statistical significance was tested with signal-to-noise ratios (Table 2) which are defined as the absolute trends divided by the standard deviations as well as Student´s t-tests (95% confidence limit).

Table 1: List of observational meteorological stations with altitude (m a.s.l.) used for the calculations of climatic elements at the six selected sites 1961-2006: A=Pasterze Glacier, B=Schareck - Fallbichl, C=Central Schober Mountains, D=Dösen Valley, E=Hintereggen Valley and F=Hochreichart.

name	altitude (m a.s.l.)	temperature	precipitation	fresh snow	snowdepth
Sonnblick	3105	A,B,C,D,E,F	A,B,C,D,E	A,B,C,D,E,F	A
TG4	3076		A,B,C		
PF3	2930				F
PF4	2893				C,D
PF2	2850				A
PF1	2800				B,D,E
Rudolfshütte	2304	A,B,C	A	A	A,B
Reisseckhütte	2256	D,E	E	D,E,F	D,E,F
Margaritze	2070	A,B,C			
Mooserboden	2036	A	A,B	A,B	A,B,F
Hochalm	2010		D		
Kölnbrein	1973	D	D		
Palik	1950		A,B,C		
Goldeck	1885	E	E	E	E
Zettersfeld	1820	C	C	C	C
Edelrautehütte	1725	F			
Gößkessel	1673		D,E		
Felbertauern	1650		A	A	A
Wastlbaueralm	1634		D		
Planneralm	1605	F		F	F
Schmelz	1560	F			F
Wöllatal	1550		D	D	D,E
Hochreichart	1500		F		
Obermillstätter Alpe	1450			E	E
Heiligenblut	1380		A,B,C	A,B	A,B
Kals	1347		C	C	C
Hohentauern	1265		F	F	F
Teuchl	1260		E	D,E	D,E
Iselsberg-Penzelsberg	1208		C	C	C
Mallnitz	1196		D	D	D
Innerfragant	1195		D	D	D
Döllach	1071		C	B,C	B
Matrei in Osttirol	1050			C	C
St.Johann am Tauern	1050		F	F	F
Oberzeiring	930		F	F	F
Wald am Schoberpass	890		F	F	F
Seckau	855		F		F
Ingering	850		F	F	F
Malta	830		E	E	F
Stall	820		D	C,D	D
St.Johann im Walde	750			C	C
Kleindorf	742			D	D
Mautern	735		F	F	F
Kraubath an der Mur	605	-	F	F	F

Table 2: Significance criteria used in this study (after Rapp & Schönwiese 1996)

significance	signal to noise ratio (SNR)	confidence limit (CL)
not significant	SNR ≤ 1.645	CL ≤ 90%
weak significant	1.645 < SNR ≤ 1.960	90% < CL ≤ 95%
significant	1.960 < SNR ≤ 2.576	95% < CL ≤ 99%
strong significant	2.576 < SNR	99% < CL

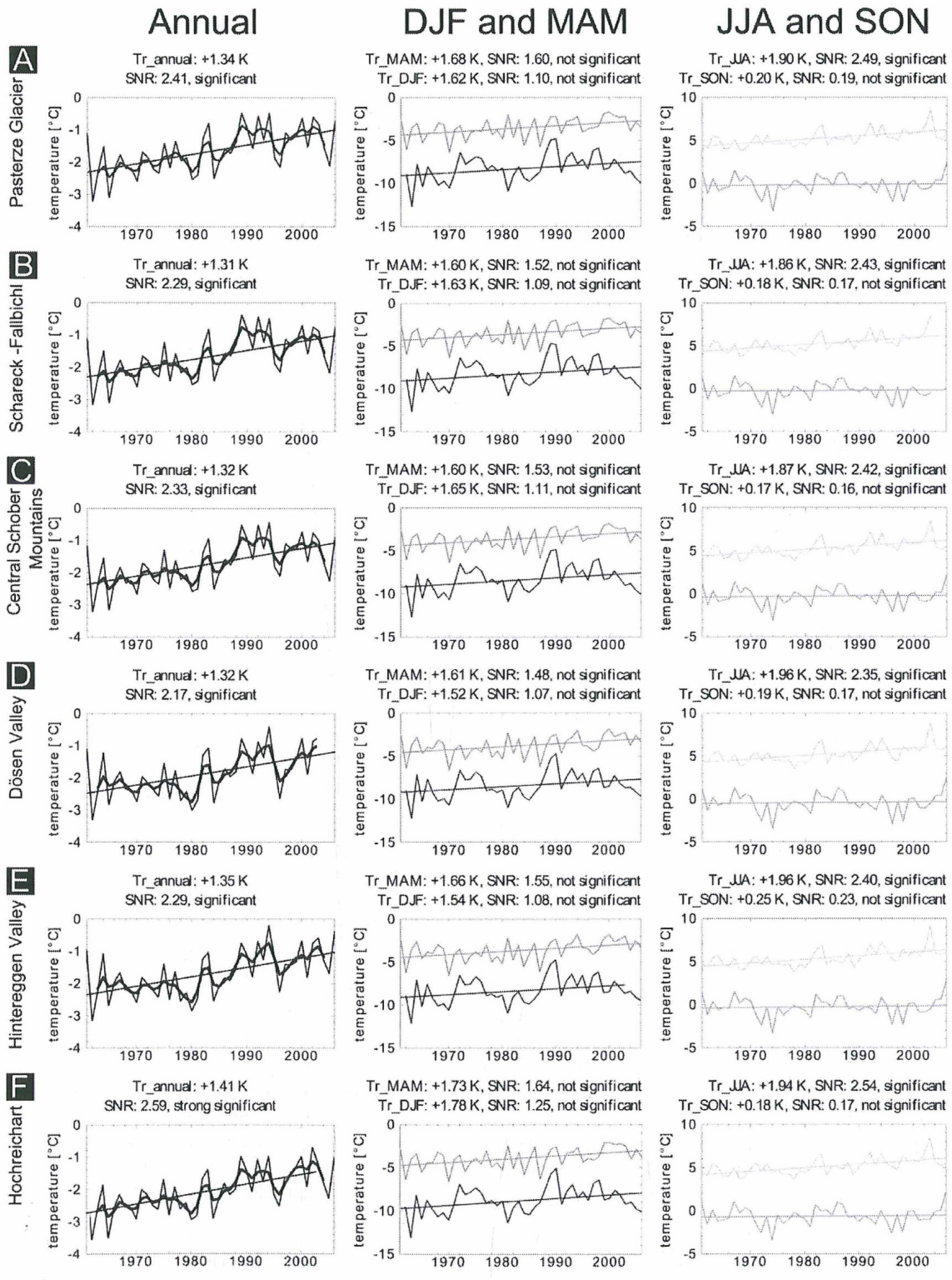

Figure 2: Mean annual (incl. moving 5-year means with gauss filter) and seasonal temperatures and absolute trends including signal-to-noise ratio (SNR) at the six selected sites in 2500 m a.s.l. 1961-2006: A=Pasterze Glacier, B=Schareck - Fallbichl, C=Central Schober Mountains, D=Dösen Valley, E=Hintereggen Valley and F=Hochreichart.

Results

Our results indicate a significant temperature rise of mean annual temperatures of 1.3 to 1.4°C since 1961 in all six areas. The highest increase in temperature occurred during the summer season (JJA) with ~1.9°C. May experienced the highest warming of all months with values of up to 2.4°C (Figs. 2. & 3).

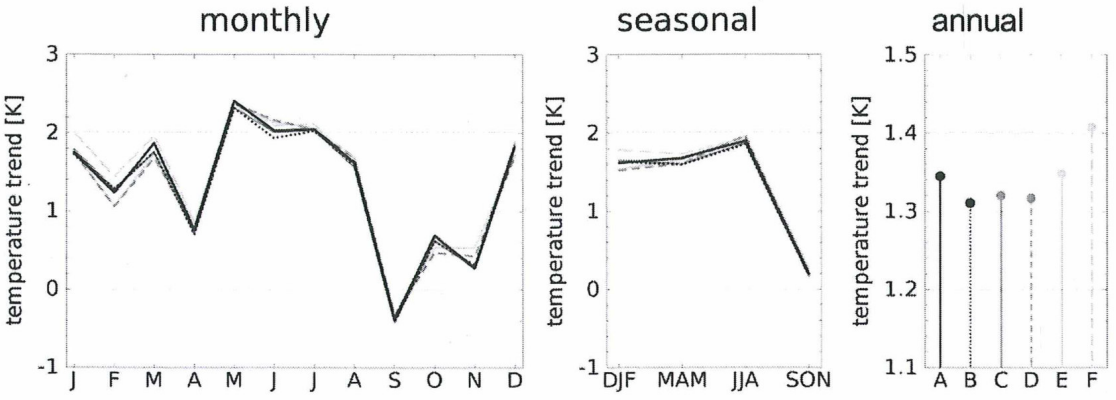

Figure 3: Monthly, seasonal and annual absolute temperature trends at the six selected sites in 2500m a.s.l. 1961-2006: A=Pasterze Glacier (black line), B=Schareck - Fallbichl (black dots), C=Central Schober Mountains (grey line), D=Dösen Valley (grey broken), E=Hintereggen Valley (light grey) and F=Hochreichart (light grey broken).

Mean annual precipitation trends are not significant at all six sites. However, the annual precipitation sum seem to have decreased in two of the six areas (-75mm) whereas in one area it increased substantially (+160mm). Only the autumn season (SON) reveal an increase in precipitation at all sites (Fig. 4).

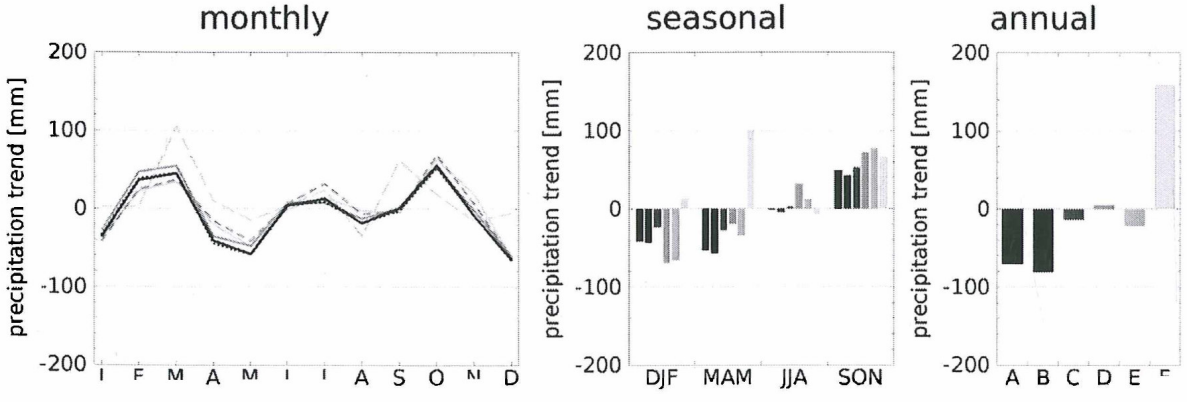

Figure 4: Monthly, seasonal and annual absolute precipitation trends at the six selected sites in 2500m a.s.l. 1961-2006: A=Pasterze Glacier (black line), B=Schareck - Fallbichl (black dots), C=Central Schober Mountains (grey line), D=Dösen Valley (grey broken), E=Hintereggen Valley (light grey) and F=Hochreichart (light grey broken). Note greyscale application for seasonal and annual values.

The trends of the annual sum of freshly fallen snow as well as the maximum snow depth reveal no statistical significance. Despite this fact the annual sum of freshly fallen snow decreased in all areas at the Hohe Tauern Range sites by 80 to 130 cm (Fig. 5). Increasing sums are revealed at the five sites located in the Hohe Tauern Range (A-E) in autumn and at the Niedere Tauern Range site (F) in winter. The annual maximum snow depth decreased in all areas by 40 to 210 cm, which is principally based on the reduction of summer values of up to 180 cm (Fig. 6).

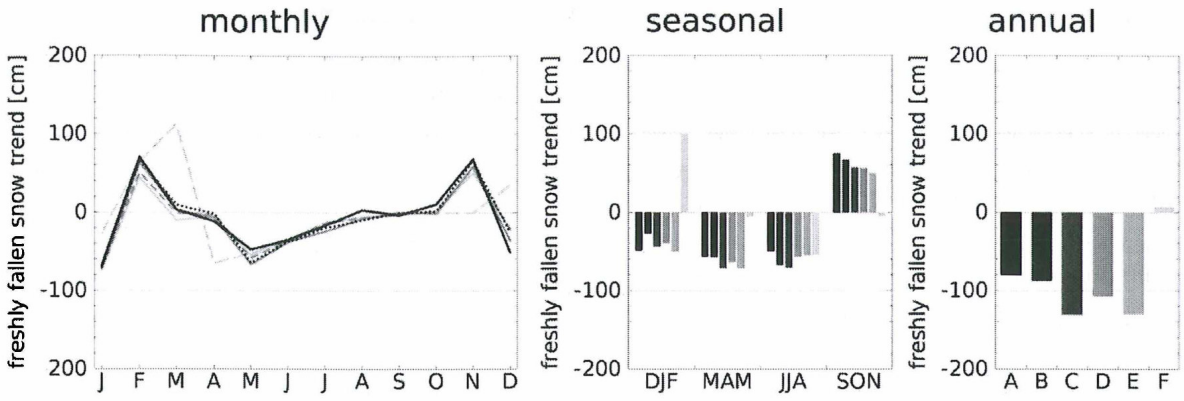

Figure 5: Monthly, seasonal and annual absolute trends in freshly fallen snow at the six selected sites in 2500m a.s.l. 1971-2006: A=Pasterze Glacier (black line), B=Schareck - Fallbichl (black dots), C=Central Schober Mountains (grey line), D=Dösen Valley (grey broken), E=Hintereggen Valley (light grey) and F=Hochreichart (light grey broken). Note greyscale application for seasonal and annual values.

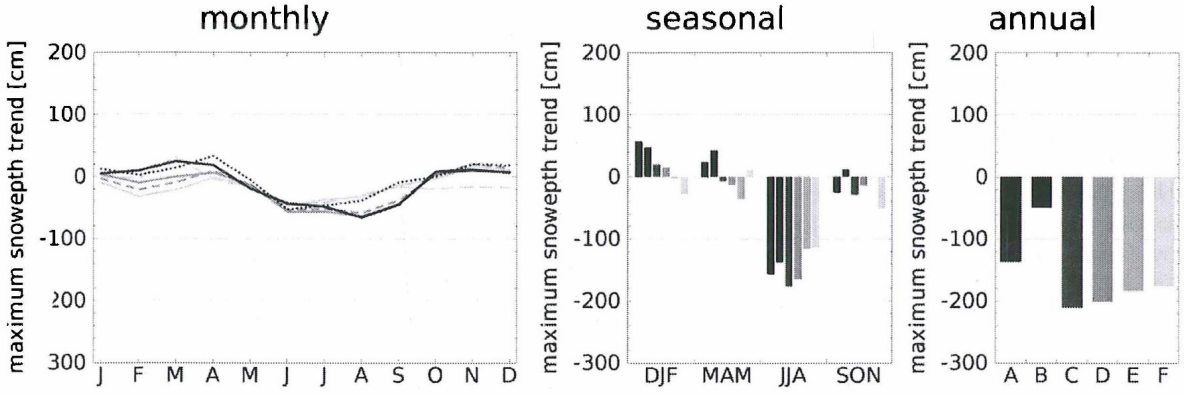

Figure 6: Monthly, seasonal and annual absolute maximum snow depth trends at the six selected sites in 2500m a.s.l. 1961-2006: A=Pasterze Glacier (black line), B=Schareck - Fallbichl (black dots), C=Central Schober Mountains (grey line), D=Dösen Valley (grey broken), E=Hintereggen Valley (light grey) and F=Hochreichart (light grey broken). Note greyscale application for seasonal and annual values.

In general, the overall linear trends for all four parameters were confirmed by the mean difference of the two 23-year (temperature, precipitation sum and maximum snow depth) and, respectively, 18-year periods (sum of freshly fallen). Furthermore, some differences of freshly fallen snow and maximum snowdepth are significant particularly in summer even though the trends are not significant.

Discussion and Conclusion

Observed atmospheric warming in the European Alps is much higher compared to the global average. Based on IPCC (2007) the global linear warming trend over the studied 46-year period is in the range of 0.46-0.74°C. Based on our study the warming in the high mountains of central Austria (reference altitude 2500 m a.s.l.) is 1.3 to 1.4°C and hence two to three times higher compared to the global average confirming previous studies (Böhm et al. 2007). Amongst other environmental effects, this significant warming caused substantial glacier retreat and perennial snow field reduction at all six sites strongly affecting their hydrological systems.

Acknowledgements

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The last 125 years in the Josenwald. Formerly exploited, today a forest reserve

C. Temperli

Abstract

Forest structure was sampled in the Josenwald reserve in northern Switzerland. The reserve, which is under protected status since 1970, is 85 ha large and located on a steep south-facing slope ranging from 420 to 1300 m a.s.l. above the Walensee lake. In this inventory, the forest was assessed on 87 concentric plots of 200 and 500 m^2 size.

The inventory showed a high naturalness of the Josenwald with respect to tree species composition and dead wood volume. *Fagus sylvatica* is the most frequent tree species in the reserve, followed by *Tilia cordata*, *Fraxinus excelsior* and *Quercus spec*. The volume of standing and lying dead wood amounts to 98.1 m^3/ha in the *Fagus* stratum and 62.4 m^3/ha in the *Tilia-Quercus* stratum, similar to values found on similar sites in old-growth forests in the western Carpathians. In contrast, the growing stock still only amounts to 253 m^3/ha in the *Fagus* forest stratum and 235 m^3/ha in the *Tilia-Quercus* stratum. Around 1880, it was even clearly below 100 m^3/ha due to severe timber cutting.

In total, 119 habitat structures per ha were found in the *Fagus* stratum, and 60 in the *Tilia-Quercus* stratum. Root plates were the most frequent habitat structure, followed by cavities with a mulm body, stem cavities and snags with a dbh of at least 36 cm as well as crown dead wood. Trees with dbh≥80 cm were very scarce. Twenty-six percent of all living trees with dbh≥36 cm had at least one habitat structure, and 26% of all trees with habitat structures had more than one.

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Natural environments management: which sustainability for Walloon agriculture?

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Summary

Eighteen farmers, for whom the management of high ecological value grasslands represents a meaningful part of their agricultural activity, took part to this study undertaken to characterise them and to establish the farmers' motivations for starting this activity and the possible curbs on its development. The sustainability of this diversification was analysed using two approaches: (1) the economic dimension was characterised through a comparative analysis of the income and (2) the social dimension focused on the working time and on their social involvement. This study has shown that natural habitat management is a good complementary activity, but does not allow a farmer's main activity.

Keywords

management of high ecological value grasslands, income, working time, social involvement.

Introduction

In recent years European Union environmental policy has worked towards preserving the habitats of endangered species. In this context, farmers are playing a growing role in the management of open spaces, whether their own land or within nature reserves. However, they have to adapt to the specific features of such environments by altering their practices, learning new skills and, when the grazing land is very poor or rough, by breeding hardier breeds suited to the terrain, such as Roux ardennais (local race) or Mergelland sheep, Highland or Galloway cattle and Fjord ponies.

This study aims to assess the profitability of this activity and the working time input required.

Methodology

An inventory was made of farmers managing 15 ha or more of areas of biological interest for whom these areas make up at least 30% of the utilised agricultural area (UAA). To supplement the inventory, farmers with a UAA of 15 ha or more and more than 75% areas of ecological interest were also included. The project focuses on farmers who mainly use grazing as a natural environment management tool.

The farms are studied according to two approaches, one social and the other economic. The first approach concentrates on the working time and the involvement of the farmers at local level (direct sales, investment in local associations, etc.). Interviews were conducted to characterise the farms and establish the farmers' motives for diversifying in this way, and also the possible curbs on development. At economic level, the income generated by this activity was analysed. This was done by subtracting the costs of management (feed, care, machinery, etc.) from the revenue received (subsidies, increase in value of animals, etc.).

Results and discussion

In total, fewer than 30 farmers met the selection criteria. Of these, 18 agreed to take part in the project. One-third of the latter only manage natural environments. The others have livestock farming as their main activity (dairy and beef cattle or sheep). These farmers have an average UAA of 80 ha. Most of them hold organic certification. This is no doubt due to the fact that the requirements of managing this land are at least equal to the organic specifications, and to the possibility of obtaining financial support for organic farming as well as aid granted in the context of agri-environmental measures.

Hardy breeds are recommended for maintaining such environments. On average, a farmer uses two animal species to manage parcels of high biological value. It was noted that 60% of farmers use cattle (principally Highland) and 55% use sheep (mainly the Roux ardennais). Some farmers use horses (28%) or goats (22%), but these are generally used along with another species.

These "managers" are principally motivated by their passion for nature and for conservation. However, the specific nature of these environments creates various difficulties, such as the

accessibility of the parcels of land, maintaining fencing and moving herds. This activity takes 23 hours' work per week on average (or 23 h/ha/year). The time varies considerably according to the method of management (fixed or mobile fencing, big parcels or alternate grazing of small parcels, mowing some parcels, etc.) and according to the farmer's investment in the activity. In terms of social involvement, 60% of farmers belong to at least one association and 80% pool their equipment and help one another when necessary. As a general rule the farmers are very satisfied with their quality of life and would not change it.

At economic level, this activity is entirely dependent on subsidies, in other words agri-environmental measures, subsidies for organic farming, single payment entitlement or subsidies for depressed areas. These may make up more than 80% of the income from this activity (Figure 1). The remaining 20% breaks down between increasing the herd and selling animals. Using hardy breeds has the attendant problem of finding outlets for the carcases, which do not meet conventional marketing criteria. Farmers therefore have to look for other sources of enhanced value (organic sector, direct sales, selling to breeders, etc.), but such initiatives are still limited in scope. This dependence on subsidies makes it very difficult to develop long-term visions for these farms.

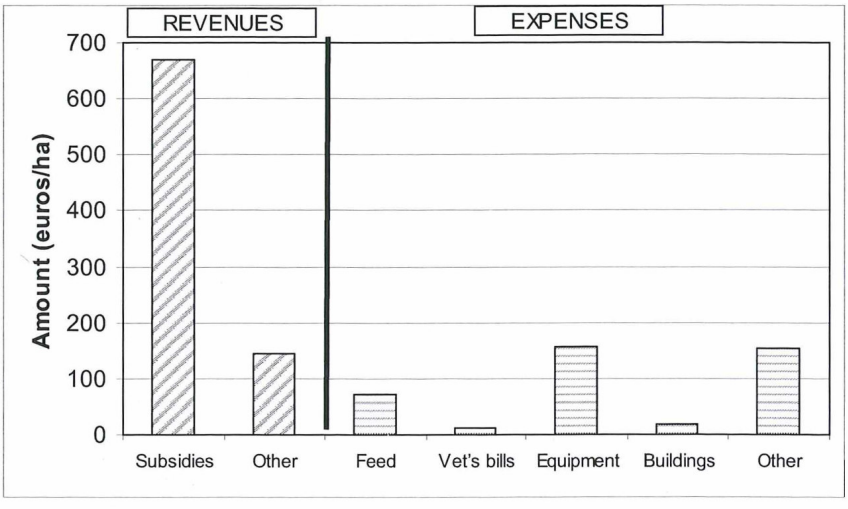

Figure 1: Management Revenue and Expenses

As regards the costs of diversification, using hardy breeds is advantageous as they need less in the way of specific expenses (feed, veterinary treatments, etc.) than conventional breeds. Moreover, the start-up investment for this diversification is relatively low compared with more "traditional" farming. As these animals can remain outdoors all year round, some farmers can in fact avoid the expenses of buildings. Only sheep farmers have a sheep-fold. Furthermore, the equipment required is generally no more than an all-terrain vehicle, a tractor, a livestock vehicle and, possibly, forage harvesting equipment. Both the expenses and the revenue associated with managing natural environments are low. The average income from this activity is therefore relatively low (413 €/ha). On the other hand, in relation to working hours, these farmers have a perceptibly better average hourly wage (18 €/h).

Conclusions

Management of natural environments does not provide sufficient income to be a farmer's main activity. However, as the hourly wage is relatively high for an agricultural activity, it may be a good diversification option for a farmer.

The study results will give farmers information about the costs and profits associated with this type of management. They will also provide the authorities with a basis for considering the appropriateness of the aid offered to farmers for their contribution to the landscape maintenance.

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The Evolution of the Planning of National Parks and Protected Areas in Romania

Constantin Vert

Summary

The value of the natural capital of Romania has imposed early measures of protection, whose evolution can be grouped around the following steps:

1928-1944 – period in which 36 territories are being protected through the "Journals of the Council of Ministers" as natural reservations, national park, monument of nature, reaching 15 000 ha. However, due to the efforts specific of the beginnings, the focus was only on the creation of a legal and institutional incipient frame and on the construction of a limited number of protected areas and almost no attention was given to the administration of the constituted protected areas.

1944-1989 – period in which the measures of protection of the nature were based on the institutional efforts made before the war by renown scientists as Al. Borza or Emil Racovita. In 1972 the number of constituted protected areas reached 190 objectives, with a total of almost 100.000 ha. Unfortunately, the protection measures were resumed only to the declaration of protected areas and almost nothing about their administration.

1990 until today – once the communist era was over, an opening and a bigger efficiency were expected in relation to the creation of a national network of protected areas which would cover the whole diversity of national ecosystems but also concrete legal and institutional measures which would ensure an efficient management of protected areas. But the results proved that these expectations are very difficult to meet.

Keywords

national parks, protected areas, Romania

It is mainly national recognized that Romania has a great and diversified natural potential. This statement is based on the Romanian natural settings which include: mountains, hills, plains, rivers, wet areas and one of the largest delta systems in Europe, The Danube Delta. Due to its geographical position, flora and fauna species interfere bringing northern European elements, subtropical in the south and south-west, dry from the east and oceanic from the west.

Traditional life style of population especially in forestry, agriculture and the lower level of economic development than in other European countries determined a lower exploitation of resources.

Subsequently, this is reflected in keeping the fauna and flora diversity, expressed by large wolves, bears, lynxes chamois populations among other areas of Europe and obviously in the preservation of forest and alpine habitats specif to the Carpathians. Thus, the Romania's natural capital value imposes cross history measurements of protection for its natural heritage.

The diachronic analysis of all measurements and instruments of protection and conservation through the protected area reveals the following stages:

– stage 1928-1944 is characterized by the first formal measures for conservation and protected areas setting up in Romania. During this period, 36 sites, covering almost 15,000 ha, were declared and partially managed as natural reserves, national parks and natural monuments. But, due to the efforts which characterized every starting point, it was focused firstly on the regulations' framework and institutions, on a limited number of protected areas and more or less upon their management.

– stage 1944-1989 –when the former laws for environment protection formulated by scientists as Al. Borza or Emil Racoviţă played a key role. Thus, in 1972, the total number of protected sites or elements increased to 190, covering an area about 100,000 ha. Unfortunately, they remained on a

declarative level and less applied into practice, that spoiled and threatened them as vulnerable and fragile sites. Investments for their planning, guarding, conservation and protection missed or were at a very low level. Even though statistics show an increasing in area, the ratio of protected space was only by 0.0042 % from the Romania's total surface, which was insufficient for preservation of the entirely diversity of landscapes or ecosystems of the country.

There were several attempts to setting up of great protected areas- national parks in Apuseni, Călimani, Ceahlău, Bucegi, Piatra Craiului, Cozia, Valea Cernei, Cheile Bicazului, Rodna Mountains, but without results. Meanwhile, small natural reserves were created by the counties authorities, followed by local legislative acts. In many cases, local initiatives for protected areas hadn't a scientific support or studies, they acted just to meet a central request of the communist government or as a local patriotism feeling. They never benefited by a proper management, the aim was to be not to function.

In 1973, the Law no 9 (Environment Law) was adopted. It stipulated the general legal framework for natural monuments and reserves, but nothing for the protected areas management, administration regulations as Poland or Czechoslovakia had at that time.

During this period, the large esteem protected area of Romania were internationally recognized; the reference year was 1979, when Retezat and Pietrosul Rodnei were designated as Biosphere reserves under UNESCO Man and Biosphere (MAB) Program. Although this fact could improve their state they remained out of any proper administration.

– after 1990s stage – the communist collapse opened a new era for a real protection which emphases new laws configuration, new types of management and a national network for conservation able to satisfy all specific environment needs of the natural Romanian heritage. The aims were difficult to be achieved and the positive results are still expected. One of the main diffculty was related to the misunderstanding and misinterpretation of measurements required in conservation by institutional actors and mainly by The Waters, Forests and Environment Ministry. Thus, only in 1997 was sett up a Department for Biodiversity Conservation which main mission was that to coordinate and manage of all activities about conservation in protected areas.

The natural capital value of Romania was once again international recognized by the Danube Delta inclusion (over 50% of its area) as Ramsar Site in the World Natural Heritage, in 1991.In 1992, it was named Biosphere Reserve. It is a paradox here, meanwhile at the international level it represents a large space for protection, inside country several wet areas benefit of real conservation program.

As a result that Romania has adhered and ratified the Convention for Biological Diversity (at Rio), in 1996, with the financial support of the World Bank was realized "The national strategy and action plan for biodiversity conservation and sustainable utilization of its components in Romania" which plans on the short, medium and long terms all activities to fulfill the Rio de Janeiro Convention. In 1995 the Environment Law (no 137) was adopted, a law which also includes regulations for nature conservation, protected areas and recognizes all previous protected sites without exception of acts, law, decision's stipulations etc.

Thus, today, the Protected Areas Network includes 579 protected sites (besides 13 national parks) which represents 4.8% in Romania surface (1.140.590 ha). Three of them in the UNESCO MAB program were declared as Biosphere Reserves: Retezat, Pietrosul Rodnei and the Danube Delta. The last one belongs to the World Heritage and as Ramsar site – wet zone of international importance.

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Conceptualizing protected area research in a transdisciplinary mode

Ulli Vilsmaier

Summary

The search for transdisciplinary forms of knowledge production is currently intensively discussed and experimented in research processes. This contribution aims at outlining different understandings of transdisciplinarity and explores possibilities to conceptualize protected area research (in the following PA research) in a transdisciplinary way. This will be achieved by analyzing different types of PA research and by distinguishing different aim horizons of area protection. The contribution refers to PAs with a legal status and it is based on a survey of research profiles of National Parks[10].

Keywords

understandings of transdisciplinarity, knowledge integration, problem framing, aim dimensions of protected areas, types of protected area research.

Introduction

The discussion on transdisciplinary research as new mode of knowledge production has increased enormously since the 1990s (KUEFFER et al. 2007). It originates from a lack of success in problem solving in particular in fields of human interaction with natural systems (THOMSON KLEIN 2004: 517). Because of its growing complexity and interdependency, disciplinary oriented knowledge production does not have the potential to face the types of problems we are dealing with at the beginning of the 21st century. And even interdisciplinary approaches often do not meet the challenges. As a consequence, the debate on transdisciplinarity disclosed new perspectives on the potential of science and its role in society, exploring new modes of research oriented towards societal problems. Research targets, the architecture of research processes, sources of knowledge and contributing institutions and individuals are conceptualized and integrated in a new way. The debate on and practice of transdisciplinary research is still very young and to some extent unclear (JAHN 2005; POHL & HIRSCH HADORN 2006; ZIERHOFER & BURGER 2007), somehow even contradictory. Therefore, a short overview of understandings of transdisciplinarity will be given, before exploring possibilities and potentials of transdisciplinarity in PA-research.

Understandings of transdisciplinarity

The idea of transdisciplinarity originates from a change of perspective. Research questions within the field of human interaction with the biosphere should no longer arise out of a disciplinary viewpoint but should be derived from actual situations with need for change. Research questions should not be generated primarily out of disciplinary research traditions but out of the 'life-world'. According to HIRSCH HADORN et al. (2008: 30), "there is a need for transdisciplinary research when knowledge about societally relevant problem fields is uncertain, when the concrete nature of problems is disputed, and when there is a great deal at stake for those concerned by problems and involved in dealing with them." Transdisciplinary approaches aim at capturing the complexity of problems, taking into account the diversity of life-world and scientific perceptions, linking abstract and case specific knowledge and constituting knowledge and practices that are capable of solving societal problems (ibid.: 30).

The main difference in the debate relates to the question of how this can be achieved. Some authors consider it a task to be solved within academia. Transdisciplinarity would therefore require a reorganisation of internal structures within science, being identical with 'true interdisciplinarity' that goes beyond temporary cooperation (MITTELSTRAß 2003: 9). It is regarded as an integrative concept that searches to overcome disciplinary isolations on a higher methodological level. On the

[10]Sources: Documentations on scientific research in national parks 2005/2006, 2004, 2002, 2000 of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management; Research concepts of Austrian National Parks and the SNP; Database on Research in European mountain protected areas of the Alpine Network of Protected Areas: http://4dweb.proclim.ch/4dcgi/ProtAreas/en/BuildSearch_ProtArea.

other hand, many authors do not only question the internal structure but also the system of knowledge production as a whole (e.g. GIBBONS et al. 1994; SCHOLZ 2000; THOMSON KLEIN et al. 2001; ZIERHOFER & BURGER 2007). They question the exclusive academic form of research and advocate the integration of non-scientific perspectives and experiences by integrating stakeholders to research processes. Scientific knowledge production is regarded as one specific form and perspective to frame and analyze a phenomena or problem. Complementary dimensions should be integrated as well to get a more complete understanding and create more useful solutions through mutual learning (THOMPSON KLEIN et al. 2001, STOLL-KLEEMANN & WELP 2008). To many scientists, participatory research has become synonymous to transdisciplinarity. But even if stakeholder integration turns out to be of high importance, it would be a reduction of the potential that the discourse on transdisciplinarity is opening up, reducing transdisciplinarity to participation of stakeholders.

Both, the reorganisation within science as well as contributions of stakeholders will turn out to be necessary instruments in transdisciplinary research. But the key for reorganizing research in a transdisciplinary mode is the (re)formulation of research questions and the relation of research activities to different horizons of purposes. Again, the change of perspective enforces structural changes of research processes and the role of science in society. MAX-NEEF (2005), and earlier JANTSCH (1972, see: POHL & HIRSCH HADORN 2006: 76ff) suggest to organize transdisciplinary research by combining different horizons of questions related to an actual situation. These questions are: What exists? (empirical level); What are we capable of doing? (pragmatic level); What is it what we want to do? (normative level); and: What should we do? or: How should we do what we want to do? (value level).

If we deal with actual situations against the background of the dimensions these questions refer to, research turns out to be more than scientific knowledge production. It is then a democratic learning process, where roles are distributed according to the abilities and experience of the involved groups of society. The research process itself forms part of the required transformation and does not only provide knowledge for others to implement. This approach allows for an overall transdisciplinary research frame, including disciplinary and interdisciplinary research by ordering different horizons of purposes and dimensions of problems. Further, it offers a structure for framing the research field and process, including not only phenomena or attributes of concern but also sources of knowledge (institutions) and contributors (people).

Conceptualizing transdisciplinary PA-research

In order to conceptualize PA research in a transdisciplinary mode, the overall research horizon has to be oriented towards the overall aim of area protection, which is, very generally spoken, a balanced relation of man and biosphere. Viewing the overall aim opens up a frame for integrating particular aims of area protection, even contradictory ones. And it allows for integrating not only empirical questions into the research process, but also pragmatic, normative and value oriented questions. By relating research activities to different aim horizons of area protection more visibility of the importance of PA research activities can be achieved. This can be useful not only for communicating the PA idea in public, but also for participatory approaches in research by making the meaning of stakeholders' contributions to research processes clearer. Further, it has the potential to transform or complement disciplinary or interdisciplinary research. The contextualization of particular research activities to the PA idea by researchers can be strengthened by research-coordinators of PAs. It is one reason among many others why a coordinative process for research activities in PAs is crucial. The outlining of cross sectional issues in research concepts is a constructive step towards the establishment of a transdisciplinary perspective in particular research activities.

This very basic step of framing PA-research according to different aim horizons for developing a transdisciplinary research perspective can be deepened by differentiating types of PA research and exploring their potential for transdisciplinary foundation. Apart from distinguishing between rationalities and organizational forms of research (science/humanities; discipline/inter- or transdiscipline), PA research also differs according to its relation to PAs, being either research *in* PAs, *on* PAs, *for* PAs or context-related research.

Research *in* PAs is generally empirical basic research to investigate the biosphere under no or reduced human impact. The relation to the overall aim consists mainly in providing knowledge on the biosphere for a better understanding of natural phenomena. If participatory approaches are applied, they are primarily context related, aiming at information collection on human impacts for interpretation of research results. Research *for* PAs is oriented towards management tasks. It is based on empirical research results and addresses the pragmatic dimension of area protection. It is linked to the territorial related aims of PAs such as conservation, investigation, recreation and education, addresses clearly defined purposes and provides information for realization. If participatory approaches are applied, they are primarily oriented towards the realization of predefined aims. Research *on* PAs refers to the concept and the project as a whole and studies the

societal and ecological impact of PAs, the realization of the objectives of PAs and critically reflects the conception and realization of area protection. It is an integrative perspective that has the potential to relate research according to all different aim horizons and integrates the empirical, pragmatic, normative and value level. By reflecting on area protection as a societal project that pursues adequate solutions for the man and biosphere relation, the integration of scientific research results, different societal perspectives, experiences and interests is necessary. Thus, research *on* PAs requires transdisciplinary approaches.

For all steps of transdisciplinary research (problem framing, integration of knowledge and perspectives, implementation of research results) a manifold structural embeddedness of PAs is crucial, in particular on a regional level. Furthermore, it allows for incorporating empirically gained knowledge and management purposes to a wider societal field, including (public) discourses, administrative structures and political institutions. If a constant communication and information exchange is given, transdisciplinary research activities can build on them. Since PAs have an institutional body including the role of research coordination, transdisciplinary research approaches can be advanced through strengthening these structures and roles. Individual researchers or research groups can contribute by stronger contextualizing particular disciplinary or interdisciplinary research activities in PAs, relating them to different levels of purposes of the PA idea. However, the foundation for successfully establishing transdisciplinary research is to respect and to explore the diversity of perspectives, regarding diversity as an advantage, not as a handicap (Pohl et al. 2008). And it requires to sometimes leave predefined paths, to search for mutual understanding on different organizational levels (terminology, theoretical foundation, methodology of research, values and norms), and to establish frames for integration.

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Local knowledge in National Park Hohe Tauern and adjacent areas in Eastern Tyrol (Austria) about wild gathered plant species for phytotherapy as a basis for organic animal husbandry

Christian R. Vogl, Brigitte Vogl-Lukasser, Susanne Grasser

Summary

The FAO claims that agricultural lands falling under categories V and VI of IUCN protected areas should be encouraged to convert to organic management. One element of organic farming is the restriction for the use of allopathic medicine, and the explicit legal statement to favour phytotherapy (EC-Regulation 2092/91). In the years 2004 and 2005, 144 respondents were interviewed in Eastern Tyrol in the Nationalpark Hohe Tauern (and adjacent communities) about the use of gathered plant species in folk veterinary phytotherapy. All 144 respondents reported 98 plant species (52 out of them were gathered) and other ingredients, used alone or in combination in home made remedies. In total 1,328 home made remedies (multiple answers possible) were reported. 1,085 home made remedies have at least one plant based ingredient. Local knowledge about the use of plant species in folk veterinary medicine is disappearing rapidly and urgent activities have to be undertaken to safeguard this knowledge. The diversity of home made remedies including the knowledge about gathered wild species used by farmers can be a basis for sustainable approaches to animal disease control in protected areas. Promoting the utilization of gathered species should always go hand in hand with measures to ensure sustainable harvest and introduction of selected species into cultivation.

Keywords

ethnobotany, ethnoveterinary medicine, local knowledge, gathered wild plant species, phytotherapy, home made remedies, organic farming

Duration of the project

12/2003-03/2006

Area of study

Eastern Tyrol (Lienz district) incl. villages of the Nationalpark Hohe Tauern in Eastern Tyrol, Austria

Introduction

While several agricultural approaches make sustainability claims, organic farming is the only well-defined agricultural management system, including restricted practices that aim at environmental protection and food safety. Therefore the FAO claims that agricultural lands falling under categories V and VI of IUCN protected areas should be encouraged to convert to organic management.

Gathering of wild plant species is a typical and important activity of many people in rural communities worldwide also in protected areas. It is also an activity done frequently by farmers, including organic farmers e.g. in villages in and adjacent to the National Park Hohe Tauern. The species gathered by farmers are used usually as food, teas, ornamentals, but also as fodder or for human or veterinary medicinal purposes.

Due to the restrictions for the use of allopathic medicine in organic farming, and an explicit legal statement to favour phytotherapy (EC-Regulation 2092/91), the local knowledge of farmers about phytotherapy based on gathered plant species is of importance for the organic farming movement.

Local knowledge about folk veterinary practices is usually studied under the disciplinary context of ethnobotany (MARTIN 1995, ALEXIADES et al. 1996) and ethnoveterinary medicine (MC CORKLE et al. 1996, MARTIN et al. 2001) or veterinary anthropology (MC CORKLE 1989).

Methods

In Eastern Tyrol, i.e., Lienz district in Austria, gathering is a practice widespread among farmers (CHRISTANELL et al. 2009).

In the years 2004 and 2005 as part of a research project (VOGL-LUKASSER et al. 2006, VOGL-LUKASSER et al. 2007, VOGL & VOGL-LUKASSER 2003), 144 respondents were interviewed in Eastern Tyrol about the use of gathered plant species in folk veterinary medicine. Methods used for data collection included freelists, semistructured interviews, structured interviews as well as non-participant and participant observation (BERNARD 2002). Collected data was analyzed according to ranks, frequencies and parameters of social network analysis (WELLER & ROMNEY 1988; BERNARD 2002).

Results

In Eastern Tyrol, all 144 respondents reported 98 plant species (52 out of them were gathered) and other ingredients, used alone or in combination in home made remedies. The 20 most frequently mentioned plant species (*=gathered) were: *Achillea millefolium**, *Allium cepa*, *Arnica montana**, *Artemisia absinthium**, *Avena sativa*, *Brassica rapa* ssp. *rapa*, *Calendula officinalis*, *Camellia sinensis*, *Cetraria islandica**, *Cinnamomum camphora*, *Coffea arabica*, *Gentiana lutea**, *Hordeum vulgare*, *Juniperus communis**, *Larix decidua**, *Linum usitatissimum*, *Matricaria chamomilla**, *Picea abies**, *Sambucus nigra** and *Secale cereale.*

In total 1,328 home made remedies (multiple answers possible) were reported. 1,085 home made remedies have at least one plant based ingredient. Most home made remedies are known from "earlier times" only and are not used any more.

The social network of the respondents and the persons recommended by the respondents as to be an "expert" can be characterized as i) highly fragmented (e.g. only few recommendations of persons in other villages and other valleys; no recommendations of persons outside the district), ii) uncertain about experts on the topic (e.g. many persons with high outdegree but no persons with high indegree) iii) and missing of persons that might be described from an outside perspective as knowledgeable about the topic. Respondents also report that veterinary doctors of the study area do not recommend plant based remedies.

Conclusion

A remarkable high amount of knowledge about plant based remedies is held not by single folk experts, but dispersed over a large diversity of respondents, who mostly do not practice this knowledge any more. Local knowledge about the use of plant species in folk veterinary medicine is disappearing rapidly and urgent activities have to be undertaken to safeguard this knowledge.

The diversity of homemade remedies used by farmers can be a basis for sustainable approaches to disease control, but further efforts have to be made by veterinary science to test them, by veterinary doctors to be trained in their use and by advisory agents to make explicit their importance in organic farming.

Local knowledge of (organic) farmers about plant based home made remedies maintaining animal's health or curing animal's diseases might be a starting point for the further development of sustainable animal health care programmes in protected areas and adjacent regions. Promoting organic farming and implicitly the utilization of gathered species should always go hand in hand with measures to ensure sustainable harvest and introduction of selected species into cultivation. Further efforts have to be made for the sustainable use of wild gathered plant resources.

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The link between protected areas and agrobiodiversity conservation – The case of traditional crops and their local varieties in National Park Hohe Tauern and adjacent areas in Eastern Tyrol

Brigitte Vogl-Lukasser, Christian R. Vogl and Peter Blauensteiner

Summary

According to the IUCN, protected areas should protect not only biological diversity but also associated cultural resources (biocultural diversity). One integral part of biocultural diversity is agro-biodiversity and the related local knowledge. In 2004 and 2005 structured and semi-structured interviews were carried out in Eastern Tyrol in the Nationalpark Hohe Tauern and adjacent communities with 39 persons, who still save local varieties of crops. From 18 traditional crop species with 81 accessions the broad bean (*Vicia faba*, with 22 accessions in Eastern Tyrol, 13 accessions in NP Hohe Tauern communities) and the turnip (*Brassica rapa* ssp. *rapa*, with 19 accessions in Eastern Tyrol, 7 accessions in NP Hohe Tauern) are most widely distributed. These crop species have been very important in the Alps for centuries. The survival of these species and the local varieties is closely related to local people's high appreciation of the specific taste for some dishes whereas the various uses and different stories belonging to the cultural context are in danger of disappearing. The promotion of the conservation of crop genetic diversity and the related local knowledge within existing protected areas could play an important role in conserving plant genetic diversity.

Keywords

agro-biodiversity, ethnobotany, local knowledge, crop genetic diversity, local varieties, memory banking

Duration of the project

12/2003-03/2006

Area of study

Eastern Tyrol: Nationalpark Hohe Tauern (and adjacent communities), Austria

Introduction

According to the IUCN, protected areas should protect not only biological diversity but also associated cultural resources (biocultural diversity). One integral part of biocultural diversity is agro-biodiversity (THRUPP 1998, COLLINS & QUALSET 1999) and the related local knowledge. A threatened global agro-biodiversity resource is the reservoir of genetic diversity found in cultivated crops. The FAO estimates that about 75% of the genetic diversity of crops has been lost in the last century. As claimed by the WWF (STOLTON et al. 2006), the role of protected areas in conserving crop genetic diversity could be greatly increased by better understanding of this issue within protected area organisations.

Methods

This paper is based on a research project (VOGL-LUKASSER et al. 2006a, VOGL-LUKASSER et al. 2006b) documenting this local knowledge, and arguing for the conservation of the germ plasma and the related local knowledge (memory banking, NAZAREA 1998).

In 2004 and 2005 structured and semi-structured interviews were carried out in Eastern Tyrol in the Nationalpark Hohe Tauern and adjacent Eastern-Tyrolean communities with 39 persons, who still save local varieties of crops. The interviews covered agronomy, processing and trade, as well as the cultural context of these crops. Additionally, participatory observation deepened a qualitative

understanding for the cultural and historical context in which the cultivation of traditional crops is embedded (BERNARD 2002, VOGL et al. 2004). Previous projects in the region (e.g. VOGL-LUKASSER et al. 2002, VOGL-LUKASSER et al. 2007) served as background for the study.

Where possible, local varieties were also sampled by the authors and stored by the "Abt. Landw. Versuchswesen, Boden- und Pflanzenschutz" of the government of Tyrol.

Results

From 18 traditional crop species with 81 accessions the broad bean (*Vicia faba*, with 22 accessions in Eastern Tyrol, 13 accessions in Eastern Tyrolean communities of the NP Hohe Tauern) and the turnip (*Brassica rapa* ssp. *rapa*, with 19 accessions in Eastern Tyrol, 7 accessions Eastern Tyrolean communities of the NP Hohe Tauern) are most widely distributed. These two crop species have been very important in the Alps for centuries and almost every farmer not only grew these species but propagated the seeds.

For the elderly generation, turnips (*Brassica rapa* ssp. *rapa*) were highly important as a seasonal vegetable and versatile utilized species with basic foodstuff character. In spite of the decrease of cultivation of turnips during recent decades, consumption of fermented turnip (*Rübenkraut*) is still widespread throughout the region, usually consumed during winter time. Some farmers have recognised the economic potential in commercializing *Rübenkraut*. These farmers still hold knowledge not only about cultivation, harvest and processing of turnips but also about propagation of seeds from these local varieties.

In the case of the broad been (*Vicia faba*), mountain farmers appreciated this crop species because it provides secure harvest also at high altitudes in mountain areas. Various *old* uses and recipes show the wide range of applications for this species. Not only the fundamental contribution to every day live but also the important role in social events were remarkable. Bean festivities were held throughout the whole region. Some farmers in *Bobojach* (part of Virgen which is a community of the NP Hohe Tauern) reintroduced the *Pühnhohlgunggl* (*Pühnhohl* = legume of the bean; *Gunggl* = festivity) only a few years ago. At this festivity the green legumes of the beans are cooked in big outdoor steaming pots and served with wine complemented by music and dancing.

The survival of these species and local varieties is closely related to local people's high appreciation of the specific taste and the related dishes, whereas the various uses and different stories belonging to the cultural context are in danger of disappearing.

Conclusion

The promotion of the *in situ* conservation of agricultural genetic diversity and the related local knowledge within existing protected areas could play an important role in conserving crop genetic diversity, which represents a vital source of genes that can ensure future food security. Further steps are necessary recognising the biocultural heritage of traditional crops/varieties in the NP Hohe Tauern and other protected areas. By explicitly addressing the biocultural heritage of protected areas, protected area managers could improve the participation of local people in conservation efforts, raise the profile of the protected area and support also the social and economic benefits of protected areas.

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SHARE
- Stations at High Altitude for Research in the Environment - an integrated project for monitoring and environmental research in mountain regions

Elisa Vuillermoz, Andrea Lami, Gianni Tartari, Beth Schommer, Roberta Toffolon, Paolo Bonasoni

Summary

Ev-K2-CNR/SHARE Project contributes to the study of climate change and its related impacts and adaptation in mountain regions, providing information on atmospheric composition and climate, energy and water cycle, glaciology, limnology, biodiversity and natural resources, environmental medicine. This ultimately provides important benefits to governments, international agencies and international scientific community.

SHARE represents an international point of reference about integrated and multi-disciplinary studies at high altitude, aimed at strengthening systemic approaches to sustainable ecosystem management in sensitive areas.

Keywords

Mountain ecosystem, Protected Areas, environmental research, monitoring station, climate change.

Aims of the Project

The role of mountains as primary indicators of climate change was stated by the UN General Assembly that recognized mountains as ideal and representative locations for the study of climate change, promoting the enhancement of research efforts in these areas. Mountains represent 24% of the Earth surface and to protect these areas, environmental monitoring is essential. In this context, SHARE (Stations at High Altitude for Research in the Environment) Project intends to contribute to the study of impacts and adaptation to climate change, with special attention to water resources safeguard, conservation of biodiversity and fragile ecosystems and food security.

This Project aims at the implementation of long-term environmental programs in high mountain locations, to produce observations and high quality measurements, within the framework of relevant international research programs.

SHARE activities include: i) Scientific Research and Climate; ii) Technological Research and Climate; iii) Information System; iv) Capacity building. It provides a feasible framework of adaptation and mitigation strategies to improve understanding of climate change effects on agriculture, biodiversity, health, water resources, and livelihoods, supporting environmental management and decision-making policies especially in developing countries, in agreement with UNEP – Bali Strategic Plan.

Area of Study

SHARE focused its network in Asia (Himalaya and Karakorum, Nepal and Pakistan), in Africa (Ruwenzori, Uganda) and Europe (Apennines and Alps, Italy), with expansion to South America (Cordillera Real, Bolivia) in the planning stages.

Considering the role of mountains as extraordinary platform for monitoring climate change and early effects on Earth system, results achieved by the SHARE could be representative on a global perspective.

Methods

Data are collected through the 16 mountain sites listed in the SHARE network table. SHARE data archive is based at the Ev-K2-CNR Committee headquarters in Italy. Data from most SHARE Automatic Weather Stations (AWS) are available on WCRP/GEWEX/CEOP website, atmospheric composition data from the Nepal Climate Observatory – Pyramid (NCO-P) are available at the UNEP-ABC Data and Information Service Center (ABC-Disc) whereas trace gas data from NCO-P and Mt. Cimone station (Italy) at WMO-GAW-WDCGG archive. AOD data are visible at NASA/Aeronet website and limnological data at ILTER website.

SHARE Technological Research is developing a system to monitor atmospheric composition and climate in extreme environmental conditions of mountain regions. This innovative, integrated station, modular and flexible, would only use renewable energy, ensuring a low environmental impact.

SHARE Electronic Information System will collect information on ongoing monitoring activities in mountain environments. Data will be organized in a synergic and integrated archive, accessible to scientific community, concerned stakeholders, general public.

Results

Some of the recent results achieved in the framework of SHARE Project are summarized below:

Atmospheric and climate

SHARE Project is depository of longer climate monitoring record (15 years) at 5,000 m asl in the Southern side of Mt. Everest area. Since March 2006, continuous measurements of atmospheric composition are carried out at the NCO-P station, the highest observatory of UNEP-ABC monitoring program. These measurements allow to characterize atmospheric composition at a high Himalayan PA site: it may be influenced by air masses from high troposphere and stratosphere, as well as from pollutants transported at the local, regional, and continental scales while a high percentage of carbonaceous particles have been found.

Within the framework of CEOP, part of GEWEX of WMO's WCRP Programme, Ev-K2-CNR led the CEOP-High Elevations (CEOP-HE) working group aimed at improving the understanding of multi-scale variability and change in hydrological and energy cycles in high elevation regions.

Glaciology

Studies have been performed on the Changri Nup glacier in Nepal, Mt. Everest region and on the Baltoro and Liligo glaciers in Pakistan, K2 region to help the understanding of relationship between climate and debris-covered glaciers and to forecast glacier response to climate change on a decadal scale and impacts on runoff in high mountain regions. To quantify recent and ongoing fluctuations of ice mass, historical maps and photographs were analyzed together with the processing of satellite images. Field measurements were performed to validate remote-sensing data and to investigate variability and magnitude of surface ablation on the glacier tongues. Overall, preliminary results indicate that response of debris-covered glaciers to the current warming climate is a long-term negative mass balance.

Limnology

Limnological survey of lakes located between 4,500 and 5,500 m a.s.l. have been performed since 1992 in the Khumbu Valley, Nepal. Lake hydrochemistry reveals a constant increase of ionic content, probably related to glacier retreat. Analysis of benthic fauna shows shifts in species composition as response to the recent warming. Paleolimnological reconstructions could potentially provide proxy data of past climatic changes. Most striking result is the presence of Little Ice Age (LIA) and Medieval Warmer Period (MWP). Along time span covered by the core several episodes of climatic variation are observed; multi-proxies approach indicates an alternating stage of warmer/wetter and cooler/drier period.

In future lakes and wetland regions at a catchment scale will be integrated to focus on key drivers of aquatic system change and their interactions with global drivers at different time scales. A unified system of ecological indicators for monitoring freshwater, and new methods for defining reference conditions and restoration strategies will also be developed.

Discussion

Climate change effects and improper use of resources in mountain areas must be taken into account at political and administrative level. It is therefore necessary to strengthen the capacity for integrating climate change responses within national and international development process.

Main activities carried out in the framework of SHARE are developed in Protected Areas. In the Hindu-Kush-Himalaya-Karakorum, the two Natural heritages of Sagarmatha National Park and Central Karakorum National Park, and in Uganda, the Ruwenzori National Park, are key-areas to understand processes through which climate change could affect vegetation, herbivore and carnivore altitudinal distributions and their inter-relationships. SHARE project could concretely contribute to the development of interventions devoted to mountain ecosystems and PAs managements, improving environmental conservation and increasing national and local capacities. Therefore, benefits of this Project are to understand how climate change could affect mountains and learning how to manage and mitigate any adverse effects.

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Managing a World Heritage Site – Potentials and Limitations of Transdisciplinary Approaches

Astrid Wallner, Ursula Schüpbach, Urs Wiesmann

Summary

Management of the World Heritage Site Swiss Alps Jungfrau-Aletsch is challenged by the interplay of conservation and economic development. This is a situation where a knowledge-based solution is sought for a complex societal problem. This sets the frame for transdisciplinary research where the problem is defined and solved cooperatively by actors from science and the life-world. The transdisciplinary setting in the case of the WHS Jungfrau-Aletsch constructs a situation of mutual learning among stakeholders from different levels and backgrounds. However, the positive effects of mutual learning are continuously challenged by the power play inherent in participatory approaches.

Keywords

transdisciplinarity; multi-stakeholder participatory process; protected areas; World Heritage Site; integrated management; Switzerland

Aims of the project

In order to protect the environment with its inherent natural beauty without preventing regional development we need to integrate knowledge from various scientific disciplines as well as from other societal fields. This takes us to transdisciplinary research, which is defined as 'research that includes cooperation within the scientific community and a debate between research and the society at large' (WIESMANN et al. 2008).

In the region of the WHS Jungfrau-Aletsch a multi-stakeholder participatory process was initiated in order to negotiate concrete objectives for this area. In this way persistent conflicting expectations should be overcome and ownership and common responsibility for the region enhanced. The discussions in the forefront of the nomination of the WHS as well as the multi-stakeholder participatory process itself have been analysed in various studies (AERNI 2005; WIESMANN et al. 2005; LIECHTI et al. 2008; WALLNER et al. 2008). In this presentation we re-examine the findings of these studies against the background of transdisciplinary research. Thereby we detect key issues prevalent in transdisciplinary research settings as well as tackling upon potentials and limitations of transdisciplinary approaches. The methods used in these studies include semi-structured interviews with participants of the participatory process, standardized questionnaires filled in by the participants of the participatory process as well as analysis of newspaper articles published in the forefront of the democratic decision-making.

Area of study: Unesco World Heritage Swiss Alps Jungfrau-Aletsch

The protected area of the WHS Jungfrau-Aletsch – designated by UNESCO World Heritage Committee in 2001 – concentrates on the uninhabited high alpine zone. This area is positioned in a region containing settlements and small-scale cultural landscapes. The region composed of the protected area and the surrounding settlements constitutes a world wide known tourist attraction as well as an important economic basis for the local residents (35000 people living in the area).

The scientific advisory group of the management centre suggested implementing a multi-stakeholder participatory process in order to concretize the WHS by negotiating and prioritising overall goals, specific objectives, necessary measures and concrete projects for the region. Thereby contradictions between acceptance and expectations should be overcome and the management could work on the basis of broad acceptance.

Results and Discussion

Analysis of the studies related to the WHS Jungfrau-Aletsch revealed three key issues, which are crucial when trying to find a local based pathway to sustainable regional development and nature conservation.

The issue of integration into participation

The selection and integration of stakeholders into the process is a very sensitive procedure. Some participants were interview in order to assess their perception of the process. Most of them regarded the process of selecting the participants as positively in regard of broad involvement. Some of the participants were directly approached by the WHS Management Centre to participate, while others joined the process based on calls placed in the regional newspapers. Nevertheless, it was mentioned that it is extremely difficult to integrate persons who feel less concerned as well as people who are not linked or organised very well and who cannot formulate a common interest regarding the WHS. Furthermore, stakeholders range from the local level to the regional and even sub-regional and national level. These are all stakeholders from other societal fields than science and their perception of nature and economic development can be even more differentiating amongst each other than the perceptions from various scientific disciplines.

The issue of perceptions and positions

Our perception of nature influences the position we take regarding nature protection. In the case of the WHS Jungfrau-Aletsch different perceptions of nature and landscape were found to be an underlying current in the multi-stakeholder participatory process. Three main visions could be differentiated: a vision of pristine nature including aspects of wilderness and a wide range of conservation issues; a vision of nature as being related to humankind and manifested as cultural landscape; and a vision dominated by utility of nature focussing on economically relevant natural resources.

Different and especially conflicting perceptions influence negotiations and therefore have to be addressed by creating an atmosphere of mutual learning. In the case presented here, enabling a situation of mutual learning was essential for developing broad ownership of the problems at hand and thereby detecting common values hidden behind differing perceptions.

The issue of negotiability

In the area of the WHS Jungfrau-Aletsch, many persisting conflicts among stakeholder groups stem from the fact that there are existing legal norms which can not be negotiated by the involved stakeholders, because they are defined by the state government. In this situation they represent a kind of 'non-negotiable' feature in the participatory process. Nevertheless, these legal norms are often very important for the local population and therefore are always mentioned in negotiations.

Mutual learning and power play

The process launched in the area of the WHS Jungfrau-Aletsch in order to define objectives and activities in order to reach those objectives enabled mutual learning on different levels:

between the different local stakeholder groups;

between stakeholders from the local, regional and national level;

between society and science.

This extensive situation of mutual learning made it possible for all involved stakeholders to detect common values despite conflicting interests. This is a decisive step in enhancing local people's sense of ownership and thereby also responsibility for the region. From this point of view we can conclude that there is great potential in transdisciplinary approaches for the management of protected areas.

However, power play is also a critical issue in participatory processes: Power play becomes evident

in the decision who should participate;

in different perceptions;

by putting 'non-negotiable' features into the centre of negotiations;

when assessing the success of implementation.

Power play is a key issue in the management of protected areas. The situation of mutual learning created by applying transdisciplinary approaches is continuously challenged by the underlying power play. Furthermore, local ownership and common responsibility for an area can be built through participatory processes but their survival might be threatened by prolonged discussions on financial support for concrete actions. These arguments illustrate that participatory processes hold enormous potential for management of protected areas but the limitations of theses approaches must also be seriously considered.

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VISIMAN
Development of a Flexible Visitor Management Tool for National Parks and Regional Natural Parks

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Summary

The main goal of the project VISIMAN is the development of a new IT-based tool for visitor management in national parks and regional natural parks. The product consists of a system-based management platform with interfaces to the four functional units; visitor monitoring, visitor information, data management and expert information. The IT tool can easily be extended with further functional units and applications. A visitor monitoring is implemented in all four project areas, which increases the precision of the gathered visitor numbers.

Keywords

IT management tool, visitor monitoring, visitor management

Introduction

Nature parks are in conflict between nature protection and tourist attraction. On one hand nature parks are very attractive tourism destinations with increasing visitor numbers (REINIUS & FREDMAN 2007); on the other hand protection is a crucial task of nature parks. The park management needs to find its way in between these differing interests (BORSDORF & KÖCK 2009). IT systems can efficiently support decision making and help to prepare and provide the needed information. Unfortunately, only few broad IT tools are currently available on the market. Therefore, an interdisciplinary project was launched to develop an IT tool that stores, processes and provides data, which are relevant to park management issues. The IT tool will be developed in collaboration with four project areas in Switzerland: the Swiss National Park, Wilderness Park Zurich, Regional Nature Park Pfyn-Finges and nature reserve Tanzboden.

Project Purpose

In the project regions there is a significant demand for visitor monitoring data and information for managers as well as for visitors. Therefore, visitor monitoring was launched or extended. The aim of the project is to design and develop an IT system that can be adapted to the specific requirements of the using parks. The IT tool provides quick access to visitor monitoring data, actual research results and provides detailed information for visitors. Fig. 1 gives a schematic overview of the IT tool's different work steps.

Project Design

Interviews with the project partners were performed in order to assess the exact requirements for park management software. Different workshops with park managers enabled the evaluation of the needs and possibilities. A number of options were analysed before choosing the best suiting IT system. The software is built iteratively using the feedback of the customer.

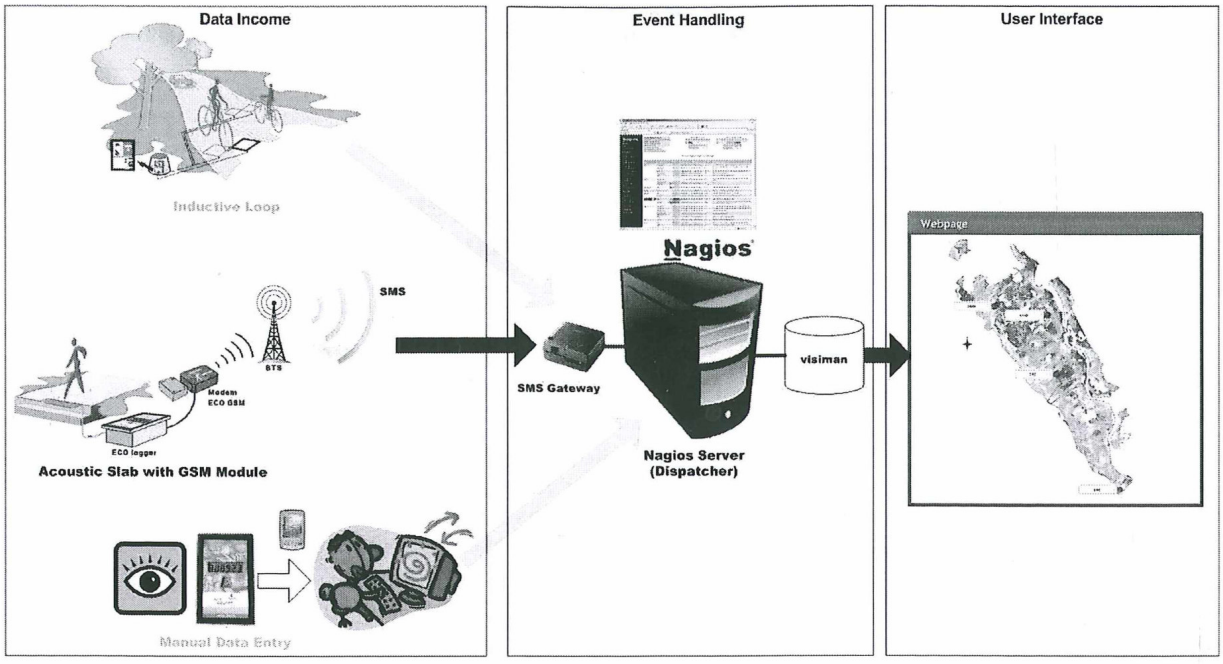

Figure 1: Operation scheme of the VISIMAN IT tool (modified from www.eco-compteur.com)

A visitor monitoring had to be designed for the remaining project areas, since it had already started and was methodologically improved in the Swiss National Park (Rupf et al. 2008) and in the nature reserve Tanzboden (Iten & Siegrist 2006). An overview of monitoring methods is given in Cessford & Muhar (2003). As automatic counting turned out to be less accurate than expected, special attention was paid to improve these methods (Rupf et al. 2006). Furthermore, external data like parking revenue, turnover of hotel and restaurant industry, public transport data etc. are also integrated into the monitoring.

Expected Results

The IT system is composed of different application modules and central data storage in order to keep the system extendable and adaptable. The central element of the system is constituted of the open source dispatcher system NAGIOS, distributed under the GPL license. The open code allows adaptation to special requirements. The central management platform is designed with open interfaces to the different modules, which are data management, visitor monitoring, expert information and visitor information. All incoming data is dispatched by the NAGIOS system and stored in a database and directly committed to the evaluation procedures (see Fig. 1). The user interface is built by using web-based technologies and can be run by any web browser. The system can therefore be used easily without further knowledge or costly training.

Visitor monitoring turned out to be the most important information for the project partners so far. Firstly, monitoring concepts are developed. Secondly, different monitoring methods, such as automatic counting, manual counting as well as indirectly collected data are applied with respect to the previously defined monitoring goals. Automatic counting has been optimized in the Swiss National Park (Rupf et al. 2008) and will be used in the other parks as well. In Parks with a complex path network, a visitor flow model, mainly based on manual counting needs to be developed. In combination with automatic counting methods, which provide continuous data over the entire measuring period, the visitor flow model can estimate the number of visitors and the visitor distribution at any time. By using data transfer on mobile technology, real time visitor numbers as well as crowding alarms can be submitted to the correspondent information centres.

Various park managers confirmed the need of visitor information in order to fulfil their missions of nature protection and education, as well as for tourism reasons. Therefore, a communication concept, which determines target groups, communication channels and content, needs to be developed. However, the need of visitor information in the partner regions is quite different. The Swiss National Park for instance offers plenty of visitor information, while other partners like the Regional Nature Park Pfyn-Finges and the Wilderness Park Zurich are still developing their information systems and contents.

The need for variegated information for different experts such as park managers, public relations responsibles or researchers is obvious. Different information systems in related fields already exist, e.g. ProClim-Info System or meta-meta-database. The main problem of these systems is their research oriented approach and the missing knowledge transfer to park management. This problem is faced by the deployment of a wiki system, which makes research results more exploitable for decision makers.

Aknowledgements

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Destination choice in alpine summer tourism: heterogeneity of preferences and the role of protected areas

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Summary

Several place specific studies indicate that protected areas are one important attraction for tourists (e.g. JOB et al. 2005, BRAU & CAO 2005), but no such research has been undertaken with tourists and potential tourists in the areas of origin. So this study aims to assess how various categories of protection influence the choice of a summer tourism destination in the Alps. In a stated choice survey, respondents had to make repeated choices between two hypothetical alpine destinations which were disguised as web sites with changing characteristics and landscape features. To account for heterogeneity a latent class segmentation has been applied. Results show that the preferences for protected areas vary between the segments. National Parks are a significant attraction factor for one segment of 31% of the respondents. Also expectations, profile, and socio-demographic characteristics, past travel behaviour, and reaction on possible effects of climate change are assessed for this segment. The findings of this study will provide additional insights for managers of protected areas on interested visitors segments and on suitable marketing strategies.

Keywords

Protected areas, destination choice, Alps, discrete choice experiment

Aims of the study

Throughout the Alps, natural integrity and the outstanding landscape beauty are key elements of the tourism product, and influence the choice of destinations. Several place specific studies indicate that protected areas are one important attraction for tourists (e.g. JOB et al. 2005, BRAU & CAO 2005). However, no such research has been undertaken with tourists and potential tourists in the areas of origin. The goal of this study is to assess how various categories of protection influence the choice of a summer tourism destination in the Alps. Firstly, it is assumed that protected areas have an influence on the destination choice in the Alps. Secondly, it is assumed that the importance varies for different protection categories and different segments.

Methods

The study is based on an online representative random sample of German tourists, who constitute the major source of visitors to Austria during summer (Statistik Austria 2007). An online survey, investigating the choice for summer vacations in the Alps was conducted in February and March 2008 with an online panel. The survey consisted of 34 questions for respondents with interest in the Alps, and reduced to 24 questions for non-alpine interested persons. With a return rate of 54% a total of 1,153 completed questionnaires were obtained.

The core element of the survey was a stated choice survey in which respondents had to make repeated choices between two hypothetical alpine destinations. To make the choice task more realistic, the alternatives were disguised as web sites with changing characteristics and landscape features (see Fig. 1). Attributes described various alpine landscapes in images, various types of protected areas, different village sizes and various activity and cultural offers.

For the analysis Latent Gold Choice 4.0 (VERMUNT & MAGIDSON 2005) was used, which produces a regular multinomial logit model, as well as a latent class segmentation (TRAIN 2002, BOXALL & ADAMOWICZ 2002). Latent classes are characterized by maximizing homogeneity within classes and maximizing differences between classes and will be described below.

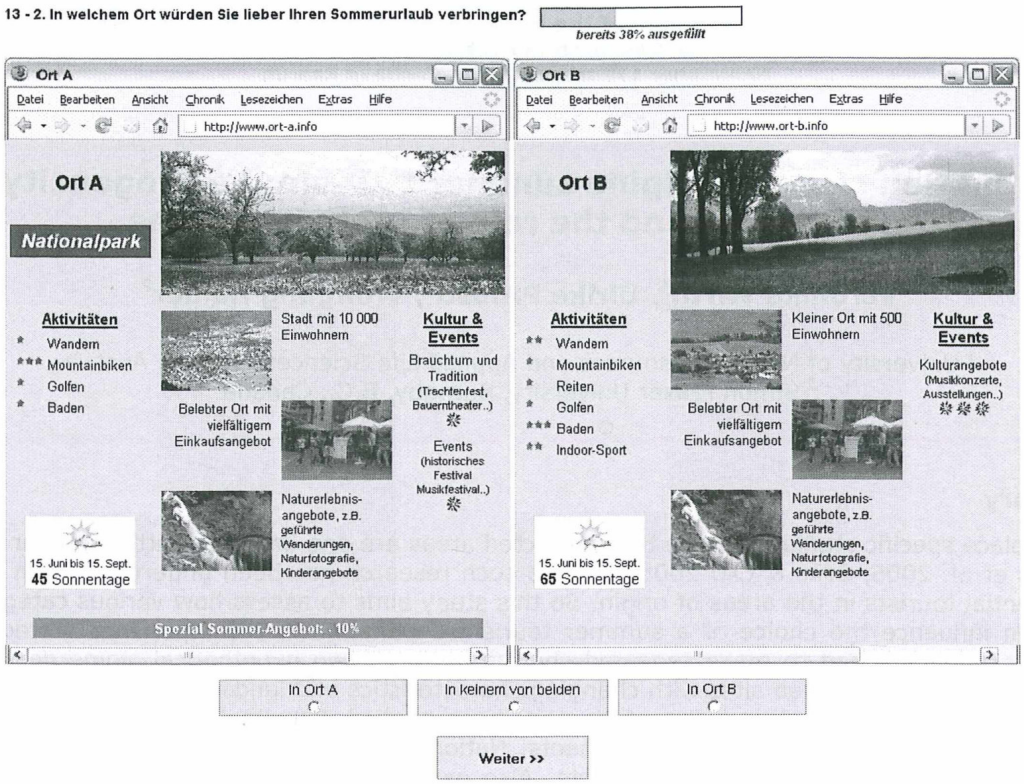

Figure 2: Design of one choice set

Results

In a rating task of motivations, the most important items for spending summer holidays in the Alps were "resting and relaxing" and "experiencing nature and landscape". Protected areas were also rated among the 10 most important attributes and offers of an alpine destination.

In the choice experiment all characteristics and offers of the destination are evaluated at once, and only the protection category National Parks had a positive significant influence in the destination choice for one segment.

To account for heterogeneity, three segments have been identified by latent class segmentation:

Social and activity oriented tourists (55%),

Nature oriented tourists (31%) and

Relaxing oriented tourists (14%).

The parameter estimates for each of the activity related variables are presented in Fig. 2-5, where the y-axis shows the part-worth utility and the x-axis the characteristics of the respective attribute.

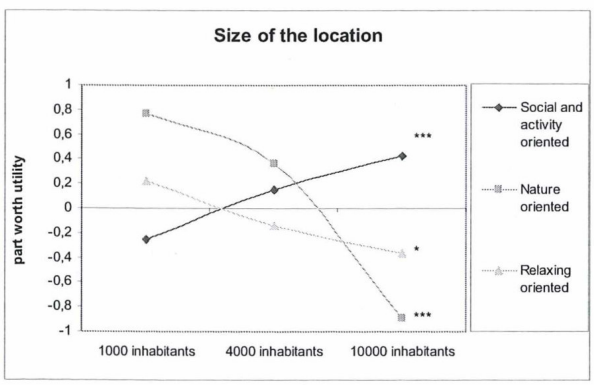

Figure 3: Part worth utility of the size of the location in the destination choice in the Alps (n=1006), ***p<0,001,** p<0,01, * p<0,05

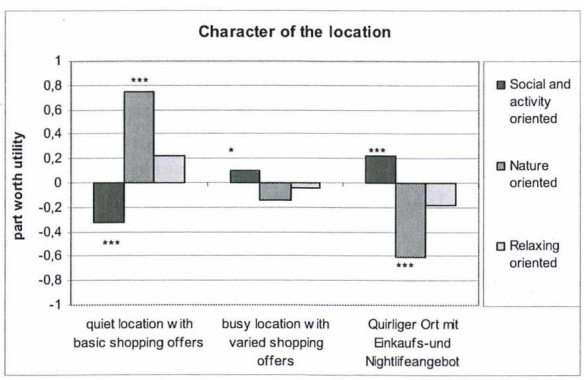

Figure 3: Part worth utility of the character of the location in the destination choice in the Alps (n=1006), ***p<0,001,** p<0,01, * p<0,05

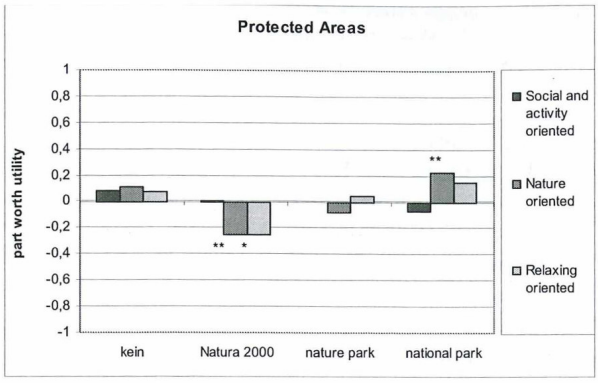

Figure 4: Part worth utility of the protection status in the destination choice in the Alps (n=1006), ***p<0,001,** p<0,01, * p<0,05

Figure 5: Part worth utility of the nature experience offers in the destination choice in the Alps (n=1006), ***p<0,001,** p<0,01, * p<0,05

The random sample of German tourists shows large heterogeneity in their preferences for a summer holiday destination in the Alps. Especially preferences for size and character of the holiday location point in opposite directions for the different segments.

The group of social and activity oriented tourists is the youngest segment. Members of this segment prefer location with larger size and animation (see Fig. 2 and 3). Protected areas are not relevant for them, but nature experience offers are attractive.

The relaxing oriented tourists are composed of mostly older tourists. This group prefers smaller and quieter locations. Protected areas and nature experience offers are not relevant; the category "Natura 2000" actually evokes a negative influence.

In the segment of nature oriented tourists a positive influence of national parks can be observed. This group constitutes the oldest segment. For members of this group it is important to experience nature, solitude, regional characteristics and cuisine. They have above average knowledge of protected areas, and a special interest the Alps. They prefer smaller and more quiet locations, and destination communities with 10,000 inhabitants are clearly rejected. The protection category "National Park" is a significant attraction factor for the segment, however, the category "Natura 2000" has negative influence. Further salient attributes for this segment are sports offers such as hiking and swimming, as well as traditional cultural offers.

These nature oriented tourists show some significant differences with regards to their expectations, profile, and past travel behaviour compared to other segments: Their most important motivational factor is experiencing nature and regional characteristics, while experiencing conviviality and fun is far less important. This group uses significantly more frequently regional information and booking options. Four and five star hotels are less preferred, whereas accommodation on farms are more preferred. They also significantly prefer destinations which offer intact nature and landscape, good quality and fair price of accommodation and gastronomy, hiking and mountaineering opportunities as well as protected areas in the region; other sport options, entertainment and nightlife offers are not important – as confirmed by the DCE. They also have a significant more positive image of protected areas.

Discussion and Outlook

Hypotheses of this study have been confirmed only partly: Regarding the role of protected areas in this destination choice there is a clear difference regarding the status of protection.

National parks proved to be the only relevant protection category in the destination choice for alpine summer holidays. Nature parks turned out to be regarded as indifferent and Natura 2000 sites even as negative.

This study primarily assumed also an influence of nature parks albeit to a lesser degree than national parks as well as potential for the European network "Natura 2000". One probable reason for these findings might be a generally low knowledge about protected areas among the general public, and the categories "Naturschutzgebiet" and "National Park" are known much more widely, while the categories "Nature Park" and "Natura 2000" are known less or hardly known at all. Other studies report also an influence of nature parks on the destination choice (e.g. WEIXLBAUMER et al. 2007; JOB et al. 2005); but in contrast to this study these were place specific studies asking visitors of nature parks that had already made their choice of destination and were most probably better informed about the protection status.

The findings of this study go along with results of other studies that report the unclear position of nature parks in the mind of the general public (JOB 2005:82, MEHNEN & MOSE 2007:2) and studies that report merely an influence of national parks on the destination choice (REINIUS & FREDMAN 2007, BUCKLEY 2004).

Of particular importance for management are the significant differences between the segments: for a segment of 31% national parks were a significant attribute in the destination choice. This segment might seem rather large at first glance, as protected area tourism in the Alps is so far rather a niche market. But these finding go along with studies that suggest a market of potentially sensitized tourists for nature and landscape based offers including around a third of the German population (SCHERHORN 1997 quoted by SIEGRIST 2000:110, StFE 2005:66-67).

For marketing and management purposes these results highlight the different expectations and demands of different tourist segments. The group described as "nature oriented tourists" are a suitable target group for tourism in regions with protected areas and include both visitors to the Alps and new visitors that are interested in the Alps. This group prefers an authentic experience with core alpine offers and high quality of the offer.

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The idea of German-Austrian Alpine National Parks – Motives and Settings

Ronald Würflinger

Until today the *Verein Naturschutzpark* (German Association of Nature Conservation Park) has property within the Hohe Tauern National Park in Salzburg. The 3.500 hectares present a 100 year history of protected areas in Austria and Germany and stand for common efforts of the creation of the Hohe Tauern national parks in particular until 1945. This paper outlines those efforts and the first steps to the Hohe Tauern National Park until the Second World War. The different nature conservation and homeland preservation movements in Germany and Austria and their approach to the conservation tool national park are emphasized.[11]

On October 23 in 1909 the *Verein Naturschutzpark* was founded in Munich. Te creation of three nature parks in Austria and Germany was defined as the main objective: One in northern Germany, one in the low mountain range and one in the Alps. The work of this association, the date of the foundation and their first work program is a significant act in the history of protected areas in Germany and Austria and in nature conservation in general.

German and Austrian nature conservation movements continuously gained strength in the second half of the 19th century. The straight concept of protection of species dominated the beginning of nature conservation activities. Networks, clubs and associations like the *Wiener Tierschutzverein* (Viennese Society for the Prevention of Cruelty to Animals, 1846) or the *Deutscher Bund für Vogelschutz* (German Conservation Union for Bird Protection, 1899) were founded.

At the end of the nineteenth century the view of nature conservation changed in a remarkable way and obtained amplification. In Germany the *Deutscher Bund Heimatschutz* (German League of Homeland Preservation) was formed by Ernst Rudorff in 1904. Rudorff elevated the romantic perception of a mythical rural Germany to the ideal state of affairs. Rudorff´s movement aimed to preserve the existing social order and cultural heritage and criticised the development of the upcoming mass society, in detail capitalism, Americanism, proletarization and urbanization. The main focus was the preservation of traditional "German landscapes" which included a concept of nature conservation and "German wilderness". Even the word nature conservation has been attributed to Rudorff. Since the epoch of German Romanticism a nationalised discourse about nature and wilderness and their meaning for the German culture and value for the German society have existed – similar to the United States where "...wilderness became part of the national identity".[12]

The first public department of nature conservation in Europe was installed 1906 in Prussia – *Staatliche Stelle für Naturdenkmalpflege* (State Agency for the Care of Natural Monuments). From the beginning the agency focused on identifying, researching and monitoring natural monuments. The state agency adopted the methods that have been applied in the preservation of historical monuments and sites. Natural monuments were defined as objects of cultural value and as national treasures. Under the direction of the founder Hugo Conwentz the agency took over a leading role in the nature conservation policy in Austria and Germany. Conwentz´ perception of nature was concentrated on a small scale conservation policy. In 1905 an inventory of Austrian natural monuments was started and initialised an extensive designation of natural monuments especially in Vienna.[13]

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[11]A chronicle overview of the establishment of the Hohe Tauern National Park wrote: Anton Draxl, *Der Nationalpark Hohe Tauern. Eine österreichische Geschichte*, Band 1 (Innsbruck, Österreichischer Alpenverein, 1996).

[12]Karl Ditt, Naturschutz zwischen Zivilisationskritik, Tourismusförderung und Umweltschutz. USA, England und Deutschland 1860-1970. 518, in: Matthias Frese, Michael Prinz (ed.), *Politische Zäsuren und gesellschaftlicher Wandel im 20. Jahrhundert. Regionale und vergleichende Perspektiven* (Paderborn, Schöningh, 1996), 499-534.

[13] Alexander Mrkvicka, Petra Schneider, „Grüne Wende"? Naturschutz im Jahrhundertwende-Wien. 338, in: Karl Brunner, Petra Schneider (ed.), *Umwelt Stadt. Geschichte des Natur- und Lebensraumes Wien* (Wien, Böhlau, 2005), 331-339.

In 1898 the Prussian deputy Wilhelm Wetekamp hold a speech in the Prussian Congress and demanded national parks for Germany – he directly referred to national parks in the United States. But both, the *Deutscher Bund Heimatschutz* and the state agencies for the care of natural monuments in Prussia and Austria have not focused on protected areas. The "Yellowstone Park Act" and the formation of the Yellowstone National Park in the United States in 1872 influenced the European nature conservation movement. Alongside the formation of departments of nature conservation and the strengthening of homeland and landscape preservation movements the idea of the establishment of protected areas became an important role in the discourse about nature conservation. This movement on one hand admired the United States for their national park program and despised their society for the lack of history and culture and their capitalism on the other hand.

Hugo Conwentz, the rational head of the Prussian department of natural monuments criticised the ideas of big protected areas in Germany.[14] He denied the existence of suitable regions. The homeland conservationists adopted the concept of protected areas more optimistically. Other leading persons in Austria like Karl Gianonni, a representative of the homeland preservationists, and Günther Schlesinger, the founder of *Naturschutzbund* (Austrian League of Nature Conservation), supported the idea of nature parks.[15]

In 1909 an interest group founded the *Verein Naturschutzpark* (Association for Nature Conservation Parks) in Munich. First members were for example Hermann Hesse, Heinz Reclam, Arthur Krupp and Lina Hähnle from Germany and Maria von Ebner-Eschenbach, Bertha von Suttner or Koloman Moser from Austria. From the beginning the implementation of a program of strictly applied nature conservation and a philosophy of non-interaction was discussed. The Association tried to distinguish itself from the United States and their focus on leisure activities and outdoor recreation in the national parks. The choice of the term "nature park" and not "national park" exemplifies this position. Member Curt Floericke wrote in 1910: "There should be no shot in our park and no blow of an axe but everything should be controlled by wild nature itself."[16]

The strict emphasis on nature conservation was given up in the first hour. In the first publication of the *Verein Naturschutzpark* in 1910 nature parks were defined as instruments for strengthening the tourism in peripheral and rural regions.[17] The topics tourism and outdoor recreation in the parks became a crucial role within the association.

With the Lüneburger Heide (a heathland in northern Germany) the *Verein Naturschutzpark* acquired its first target area and purchased its first properties there in 1910. Already in 1912 the association received the right to expropriate. The association had the right to prohibit hunting and forestry. In 1912 the Austrian members founded their own branch of the *Verein Naturschutzpark*. Initiator and leader was forester Adolf Ritter von Gutenberg. This alliance was still part of the German association and remitted two thirds of the membership fees to Germany. In 1913 Gutenberg declared the establishment of an alpine nature park as the main objective. Opposition against new hydro power plants and the damming of rivers was a crucial topic for the Austrian branch.[18] As in Germany the Austrian association was a pool of homeland and landscape preservationists and of nature conservationists. Gutenberg also emphasized the touristic significance of nature parks for rural areas. The Austrian branch is to be considered as the first effective association of nature conservation in Austria. [19]

In 1913 the Austrian branch rented land in the Niederen Tauern in Styria to establish the first alpine nature park. Conflicts about the rent and contract details put an end to those efforts. In the same year the association started to concentrate on the Stubachtal in the region of the Hohen Tauern. Until 1924 more land was bought in the region – around 4.500 hectares. In 1924 the Austrian branch was converted into the *Österreichischer Naturschutzbund* (Austrian League of Nature Conservation). The German branch of the association *Naturschutzpark* retained the

[14]Later he changed his mind but refused tourism and leisure activities in the parks.

[15] Karl Giannoni, Naturschutzbestrebungen in Österreich, in: Verein zur Verbreitung naturwissenschaftlicher Kenntnisse (ed.), *Vorträge des Vereines zur Verbreitung naturwissenschaftlicher Kenntnisse in Wien*, (Wien, Eigenverlag, 58. Jahrgang, Heft 2), 1-35.

[16] (Authors translation) Curt Floericke, Entwicklung, Stand und Aussichten der Naturschutzparkbewegung. 15, in: Verein Naturschutzpark (ed.), *Naturschutzparke in Deutschland und Österreich, Ein Mahnwort an das deutsche und österreichische Volk* (Stuttgart, Frank´sche Verlagshandlung, 1910), 7-18.

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[19] Harald Payer, Helga Zangerl-Weisz, Naturschutzziele im Wandel der Zeiten. Historische Entwicklung des Naturschutzes, 72, in: *Wissenschaft und Umwelt Interdisziplinär*, Band 9 (Wien, 2005), 69-80.

responsibility of the properties in the Hohe Tauern. The newly founded *Naturschutzbund* put its focus on the lake Neusiedl south of Vienna. The Austrian efforts to establish a national park became a more intense and diverted discourse through the *Naturschutzbund*.

Beside the German-Austrian *Verein Naturschutzpark* the *Deutsch-Österreichischer Alpenverein* (German-Austrian Alpine Association)[20] obtained land in the Hohe Tauern. The *Alpenverein* purchased more than 33.000 hectares including the Großglockner and its glacier. In 1936 the associations demanded a nature protection area for their properties. Even during the Second World War both purchased more land. The *Alpenverein* developed the paper *Naturschutzgebiet Nationalpark Hohe Tauern* (Nature Protection Area Hohe Tauern National Park). In the Third Reich this idea haven't been realized.

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[20] From 1873-1945 the German and Austrian brunches of the alpine associations were united. Between 1938 1945 only the German Alpine Association existed.

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Census and monitoring of bird species in the National Park Gesäuse, Austria

Lisbeth Zechner, Kerstin Hammer, Katharina Hirschenhauser, Monika Pfeifer, Veronika Grünschachner-Berger

Summary

Since 2004 the National Park Gesäuse GmbH runs extensive surveys of (a) species that depend on old forests or deadwood as indicators for habitat management and (b) indicator species for optimising visitor management.

Keywords

birds, monitoring, visitor management, habitat management, tetraonids, woodpeckers, golden eagle, Natura 2000, indicator species, stress hormones

Aims of the study

The Gesäuse is designated as both IUCN category II National Park and Natura 2000 site. These protection categories pursue different objectives and priorities concerning species protection, habitat management and leisure time activities. Therefore, data on the distribution, abundance and habitat requirements of indicator species are essential for management measures.

Area of study

The National Park Gesäuse with an area of 11,054 hectares is located in the Ennstaler Alpen, which are part of the North eastern Limestone Alps in Austria. 86 % is designated 'Protection Zone', where the virgin landscape is subject to nature protection. The rest is the so-called 'Management Zone'.

Methods

Species that depend on old forests or deadwood as indicators for habitat management

In 2004 and 2005 surveys of capercaillie (*Tetrao urogallus*) were conducted in 3 areas according to the habitat suitability index (STORCH 1999, HAUBENWALLNER 2006). Since 2006 woodpeckers have been surveyed within a LIFE project using stimulation by tape recorded songs.

Indicator species for optimising visitor management

Due to strongly increasing numbers of winter visitors in the last years additional winter surveys of capercaillie and black grouse (*T. tetrix*) and estimations of habitat suitability in context with skiing activities were realized (GRÜNSCHACHNER-BERGER & PFEIFER 2005, 2006).

As a pilot-project we attempted to estimate the influence of human disturbance by measuring stress hormone (corticosterone) metabolites (CORT) from capercaillie droppings (THIEL et al. 2005, 2008, HIRSCHENHAUSER & GRÜNSCHACHNER-BERGER 2008). Droppings were collected in February 2008 in the National Park and in 4 control areas. To avoid type I error due to pooling fallacy we determined individual genotypes from each dropping (SEGELBACHER et al. 2008).

During summer the Gesäuse is frequently used for climbing, which may interfere with golden eagle (*Aquila chryaetos*) breeding activities. Yearly controls of golden eagle pairs in the National Park and in the adjacent regions have been continued since 2005 in collaboration with Slovakian specialists.

Human summer activities are also concentrated around the river, e.g. rafting. Since 2003 abundance and success of common sandpiper (*Actitis hypoleucos*) breeding pairs have been surveyed along the river Enns. In 2006 we collected detailed observations of behaviour and breeding activities using standard protocols (HAMMER 2006).

Results

Species that depend on old forests or deadwood as indicators for habitat management

Within the park two areas allowed a comparison of habitat suitability for capercaillie. The habitat suitability index (HSI) showed a low suitability for capercaillie in the northern part in Gstatterboden (year = 0.3), mainly caused by the structure of forests with a high portion of artificial, young spruce forests and the lack of blueberry (*Vaccinium myrtillus*). In comparision, Johnsbach in the south with natural acidophilous spruce forest and high canopy density of blueberry shows better HSIs (year = 0.5).

6 woodpecker species could be found in Gstatterboden (700 ha), but density is also very low, due to these monotone spruce forests, e.g. three-toed woodpecker (*Picoides tridactylus*) is found only with 1 - 2 pairs. First changes may be observed in the increasing number of white-backed woodpecker (*Dendrocopos leucotos*) with 3 territories in 2009, which benefits from windbreakings in beech forest patches near the tree-line.

Indicator species for optimising visitor management

In the southern part of the National Park at Gscheideggkogel capercaillie habitats of good to very good quality are frequently used by ski mountaineering (*#Figure 1*). The area around the top was also classified as very good habitat for black grouse. Also in Zirbengarten an overlapping of very good habitat for black grouse and intensive skiing activities is found over 100 ha. This fact carries potential conflicts with much disturbance for both species.

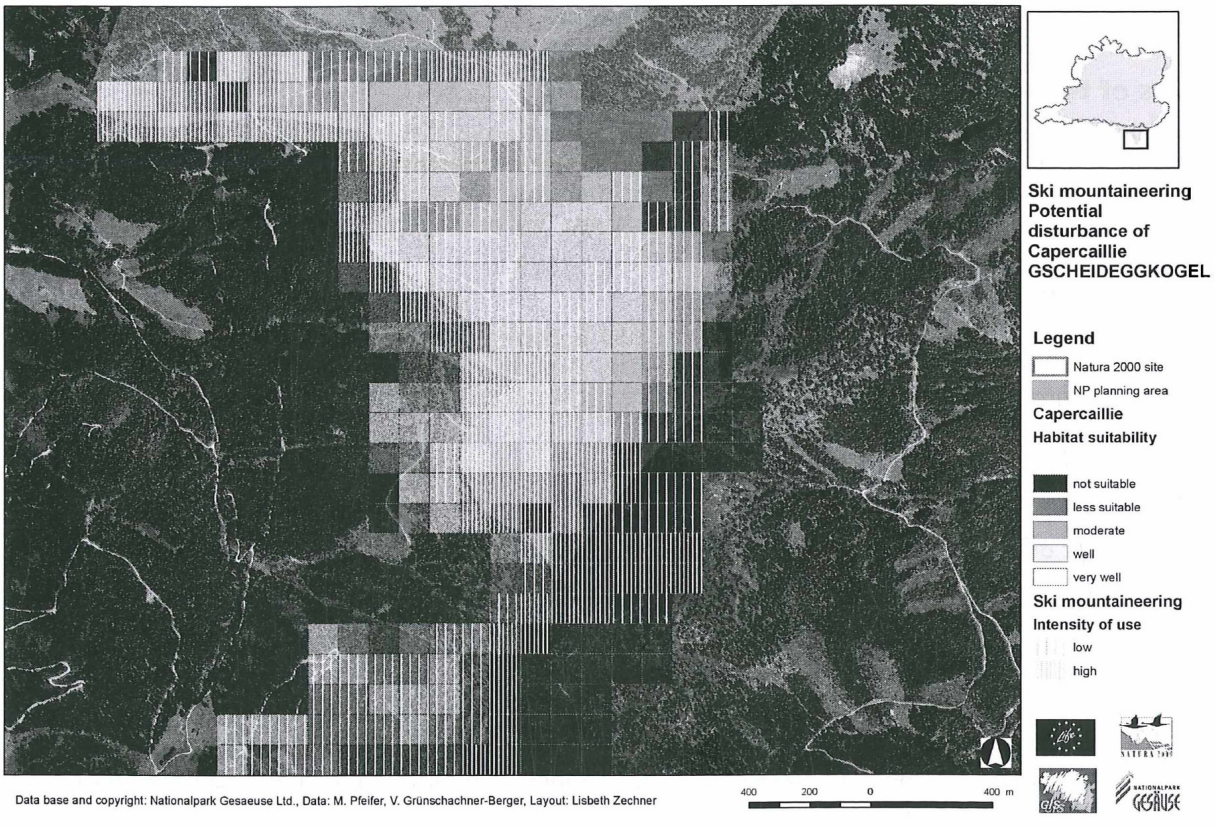

Figure 1: Habitat quality for capercaillie and intensity of ski mountaineering at the Gscheideggkogel

However, the analysis of excreted stress hormone metabolites resulted in unexpected patterns: lowest CORT levels were found in droppings from the most disturbed study area in the National Park. A number of potential parameters may explain this result and new questions have come up. For example, do capercaillie habituate to predictable or frequent disturbances (*#Figure 2*), and how much of this variation is explained by food and snow cover?

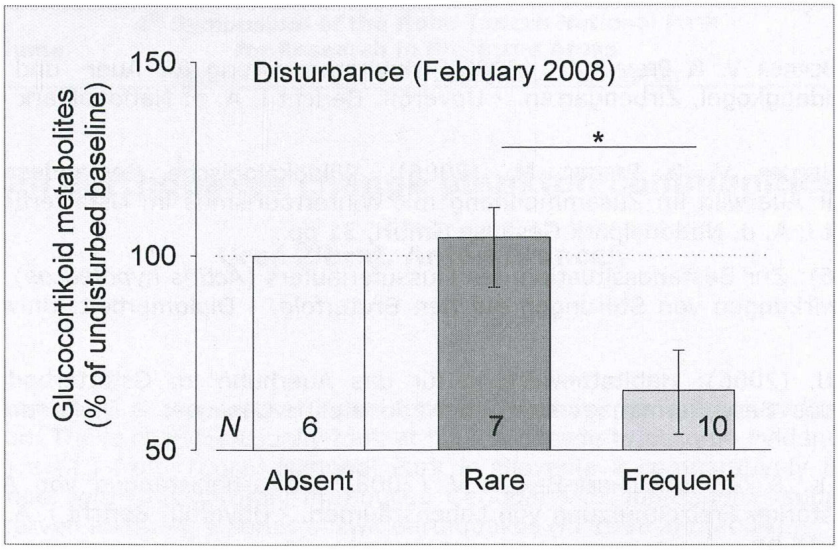

Figure 2: Stress hormone metabolites from droppings of male capercaillie in areas with different degrees of human disturbance: undisturbed ('Absent'), occasional wood works ('Rare') and ski trail at Gscheidegg ('Frequent')

During summer, disturbances may be more severe for golden eagles. Breeding success of the 3 pairs in the National Park was quite low. 2005 – 2009 only 2 juveniles fledged successfully (mean reproduction rate 0.13 juveniles/pair and year). In 2008 one juvenile (observed by an installed camera) died just some days before fledging because of bad conditions with cold, rainy weather and lack of prey. Disturbance by helicopter flights might be an additional problem for one pair.

A similar situation was observed for common sandpiper. We could only reconfirm 2 – 4 breeding pairs in the National Park and 1 2 additional pairs in adjacent sections of the Enns. The pairs are distributed in the broader sections of the river with shallow banks. Closed high canopy vegetation (median 50 %) mainly of bushes and trees < 5 m is typical. In 2004 we registered 382 boats. Common sandpipers were more disturbed by noisy visitors than by silent ones. Also the distance between birds and boats was elementary. In one case a breeding pair abandoned their nest assumingly due to frequent human disturbances.

Discussion

All monitoring activities in the National Park are related to concrete management activities, i.e. aiming at the optimisation of visitor and habitat management measures. For cliff breeding species (i.e. golden eagle) nest protection zones with restrictions were defined within the Natura 2000 site. Along the river Enns first consequences comprise marked entry and exit sites for rafters, information panels and folders, annual training of rafting guides and ranger guardians. At the starting points of ski mountaineering routes information panels have been installed to reduce negative impact of skiing activities in the core areas of capercaillie and black grouse. The routes and trails have been marked in sensitive areas and an alternative route was found to calm the Zirbengarten. Additionally, a folder with recommended routes was printed. Unfortunately, acceptance of these actions by visitors and locals is not satisfying.

First actions were taken within the forest management to improve the habitat quality for capercaillie. The habitat quality for woodpeckers, owls and red-breasted flycatcher (*Ficedula parva*) may be ameliorated by enhancement of deciduous forests and of natural succession with more dead wood and older stands. In fact, measures taken to avoid bark beetle calamities are counterproductive to enforce these processes.

Using long-term census of selected bird species we demonstrate that continuity and improvement of monitoring activities are important to estimate habitat quality, particularly the impact of habitat and visitor management. Our aim is the adjustment of these surveys with Natura 2000 monitoring guidelines, and the cooperation with other protected areas to standardise methods and compare the resulting directives for wildlife management.

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Can earthquakes change plankton communities?

Uroš Žibrat, Anton Brancelj

Abstract

Zooplankton community changes have been described before, be it from sediment analysis or direct observation. These changes usually took at least a decade to become evident. In lake Krnsko jezero (1383 m a.s.l.) from Triglav National Park in Slovenia a comparatively fast zooplankton community change, with the naturaly introduced *Ceriodaphnia quadrangula* supplanting *Cyclops vicinus*, was observed following a series of two earthquakes (in 1998 and 2004).

Zooplankton community structure, basic physical and chemical parameters of the lake have been studied since 1994. Before 1998 the lake was dominated by a predatory cold-water copepod *Cyclops vicinus*. After an earthquake in 1998 (EMS= 5.6) the filtrating thermophilic cladoceran *Ceriodaphia quadrangula* appeared and soon became the dominant species. After the second earthquake in 2004 (EMS= 4.0) *C. vicinus* almost completely disappeared from the lake.

Principal component analysis showed decreasing nutrient loadings and Chl-a concentrations, while Secchi depth was increasing. Significant changes in zooplankton biomass and a slight increase in average surface water temperatures were also recorded. These results were supported by Canonical Correspondence Analysis, where the thermophilic nature of *C. quadrangula* and its colonization of the lake after the year 1998 were confirmed.

We argue that the combination of two earthquakes, increased surface water temperatures and natural introduction of a new Cladocera species induced a comparatively fast change in zooplankton community structure in lake Krnsko jezero.

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Redesigning of Biosphere Reserves in the Lake Neusiedl / Fertö Region – the view of stakeholders

Karen Ziener, Lajos Puskás

Summary

In the Lake Neusiedl / Fertö region already in the late 1970ies long before the Seville Strategy came up two Biosphere Reserves were established. In Austria this old biosphere reserve should be transformed in a biosphere reserve according to the Seville Strategy and the Austrian National Criteria for Biosphere Reserves. In the MAB-Project "Redesigning the Biosphere Reserve Lake Neusiedl", which combines an ecological perspective to natural and cultural landscape, nature conservation and protected areas and a socio-economic perspective to regional identity and regional development, fundamentals for the restructuring process of an enlarged biosphere reserve are developed. This means that information about the perceptions and ideas of regional stakeholders has to be collected and to be initiated a first participatory process. In Addition within a cross-border cooperation project with colleagues from Hungary the conditions of the implementation of modern biosphere reserve concepts in Hungary were explored and in-depth interviews with regional experts were conducted. The presentation will compare some results of these qualitative interviews in Austria and Hungary and point out some conclusions for the redesigning process of the biosphere reserves.

Keywords

biosphere reserve, participatory process, cross-border cooperation, Lake Neusiedl / Fertö region

Project duration, aims and investigation area

The presented results of stakeholder interviews in the transboundary Lake Neusiedl / Fertö region were obtained in the framework of two research projects. The Project "Redesigning the Biosphere Reserve Lake Neusiedl" (2006-2009, financed by MAB-Programme of Austrian Academy of Science) combined an ecological perspective to natural and cultural landscape, nature conservation and protected areas with a socio-economic perspective to regional identity and regional development. Founded in 1977 and consisting of the lake and the broad reed belt, the Biosphere Reserve Lake Neusiedl is not conform to the Seville-Strategy (1995) and the National Criteria for Biosphere Reserves in Austria (2006). The aims of this project were, in particular, options for enlargement and redesigning of the biosphere reserve according to the Seville Strategy through integrated landscape and regional development. Within the socio-economic surveys and first steps of a participatory process in-depth interviews were conducted. In the Hungarian part of the region the Biosphere Reserve Fertö (1979) was established on the area of the former National Park Fertö (later two times extended). Therefore the task of redesigning is similar but the legal and institutional framework of nature conservation and spatial planning is quite different. With regard to a potential future cross-border biosphere reserve a comparison study of stakeholder view in Hungary, financed by Action Austria-Hungary (OMAA), was realized in 2007/08. The investigation area is the whole Austrian-Hungarian region of Lake Neusiedl / Fertö.

Methods

Besides questioning of residents and tourists in the Austrian as well as in the Hungarian part of the region in-depth interviews of different stakeholders (e.g. agriculture, tourism, spatial planning, national park, nature park, world heritage, mayors) were conducted (30 in Austria, 16 in Hungary). The interview guideline includes three parts: regional identity and image, tourism and regional development and the future biosphere reserve.

Results

In due consideration of cognitive, affective and behavioural components of identity the analysis and interpretation of regional identity is based on the processes of identification by WEICHHART (1990, in respect of Graumann). Subject of the interviews was the first identification process – identifying

the region – with regional image factors and mental maps. Beyond that, we got a first impression about the third process – identifying with the region respectively the regional development. In the view of Austrian stakeholders the main image factors of the region are the lake as well as nature and landscape protection (more than 50 % of interviewees) followed by culture/cultural heritage, tourism, place names and wine/wine-growing (more than 33 % of interviewees). In Hungary the lake with the reed belt, culture/cultural heritage and landscape clearly dominate among regional image factors (more than 60 % of interviewees). A qualitative and integrated interpretation of the regional image shows some more differences between the stakeholder on the Austrian and Hungarian side of the lake. While in Hungary the connection of culture with the lake or lake and nature plays an important role, in Austria different combinations, place names and the regional diversity (more than four categories) determine the image of the region (see Figure 1).

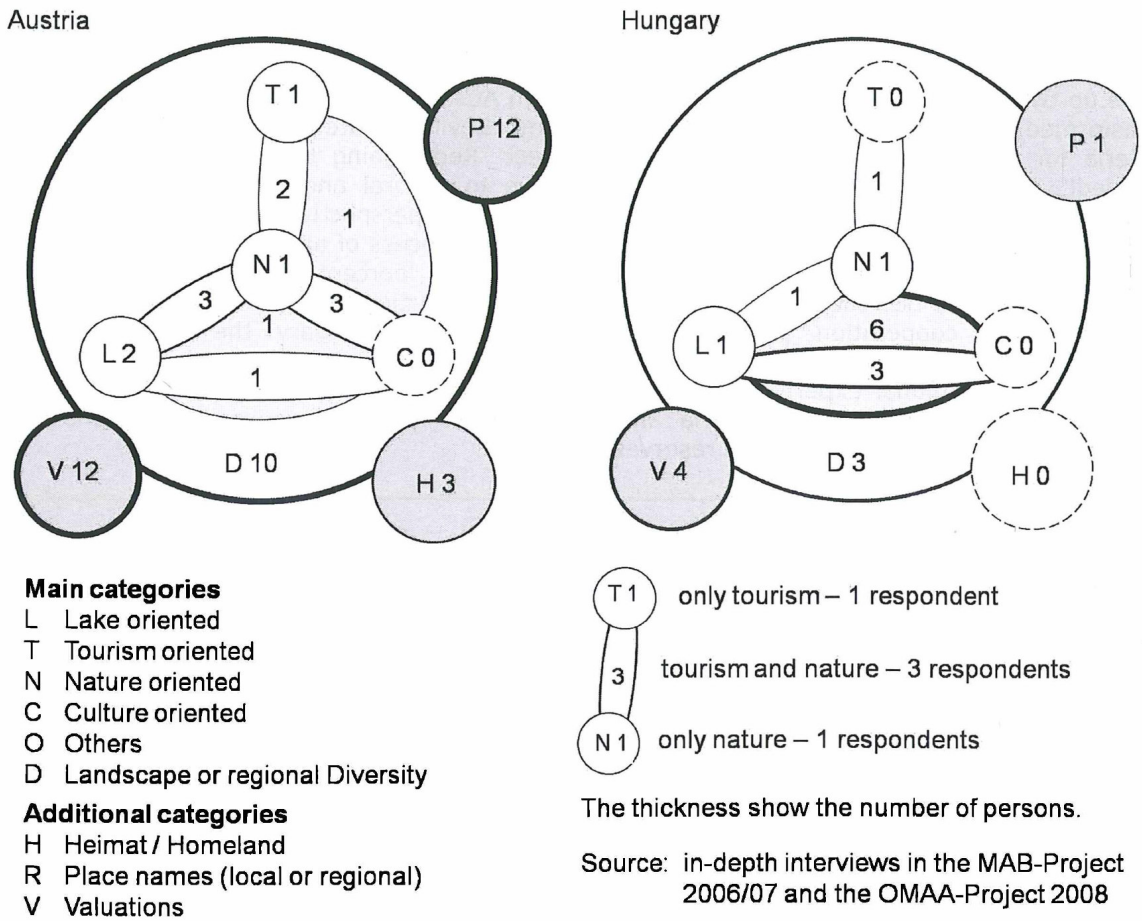


Figure 1: The regional image in the view of Austrian and Hungarian Stakeholder

In the field of regional development a clear correlation between the regional image and the strengths of the region is identified. First of all, the Austrian respondents have mentioned the lake, landscape and touristic aspects, followed by economic factors, the people and nature conservation. In Hungary beneficial geographical position of the region and the possibilities of cooperation are ranking first among the strength. The importance of cultural aspects is again greater than in Austria. The biggest problems are seen in the lack of money, the bad state of the road network and different conflicts, for instance between the development of settlements and nature conservation. In Austria quite different problems are mentioned, in particular structural problems in tourism and the short season, a lack of jobs, increasing transit traffic and a low water level of the lake (see Table 1).

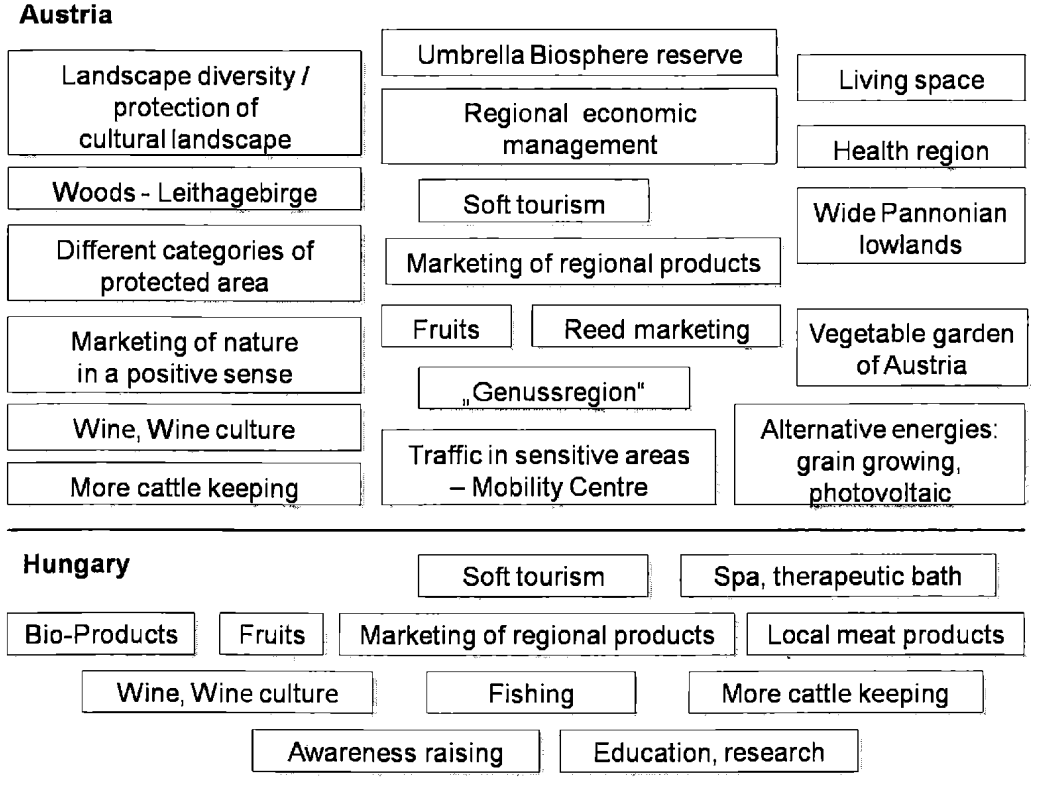
Most respondents didn't know the Biosphere Reserve, but were receptive to this issue. Some interview partners in Austria as well as in Hungary react sceptically to this new protection category and institution. Austrian stakeholders see the importance of a future Biosphere Reserve Lake Neusiedl more in regional development than in the landscape protection, because several other protection categories exist in the region (e.g. National Park, Natura 2000 areas, World Heritage, Nature Park). A biosphere reserve could coordinate the landscape preservation and contribute to raising awareness and regional identity. In Hungary, the expectation of a possible biosphere

reserve in the future, based mainly on cohesion in the region (this is corresponding with the aforementioned strengths). Furthermore, its importance is seen in tourism development, research and like in Austria in the awareness raising and regional identity. The ideas for the redesigning of the biosphere reserve are diverse in both states while offering numerous opportunities for synergies and cooperation (see Figure 2).

Table 1: Strengths and greatest Problems of the Lake Neusiedl / Fertö Region in the view of Austrian and Hungarian Stakeholder

Austria	Hungary
Strengths	
landscape / lake / climate tourism	beneficial geographical position bilateral possibilities for cooperation
wine / regional products people / culture traffic / infrastructure economic resources / development	nature / traditional cultivation spiritual and cultural values
nature conservation / protected areas job market / quality of life beneficial geographical position / border region	touristic potential identity / positive identity
Problems	
structure of tourism / deficits	lack of money
lack of jobs / commuters motorway / transit traffic water level of the lake / water supply	bad state of the road network
change of land use / settlement pressure deficits in infrastructure / lack of money regional development / management agricultural marketing	conflict of interest between individual interests, nature conservation and settlement development

Source: in-depth interviews in the MAB-Project 2006/07 and the OMAA-Project 2008



Source: in-depth interviews in the MAB-Project 2006/07 and the OMAA-Project 2008

Figure 2: Possible orientation of a future Biosphere Reserve in the view of Austrian and Hungarian Stakeholder

Discussion

In the transboundary Lake Neusiedl / Fertö landscape, which is characterised through decades of separate development, interviews of Austrian and Hungarian stakeholders show similar as well as quite different perceptions and ideas. The comparison study and the discussion in an Austrian-Hungarian research team contribute to a better understanding of these differences within a cross-border and intercultural region. In the Lake Neusiedl / Fertö region several cross-border protected areas and institutions exist, which show again and again the influence of the different economic, political and social conditions in Hungary and Austria. It is a very important task nowadays, to develop some interregional cooperation between Austria and Hungary. One of the main tasks in this job is the touristic development.

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