

# COST Strategic Workshop

April 7-9, 2008  
Congress Innsbruck

<http://bfw.ac.at/mountain/>

## Global Change and Sustainable Development in Mountain Regions

### Executive Summary Recommendations for Research

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## INTRODUCTION

### The Workshop

COST supports strategic workshops in order to provide the participants an opportunity to elaborate future research needs. The Workshop „Global Change and Sustainable Development in Mountain Regions” was convened at the Congress Hall of Innsbruck, Austria from April 7-9, 2008. The event attracted more than 350 scientists, experts, practitioners, students, and scholars from 29 European and 10 non-European countries. It was based on three pillars ‘keynotes’, ‘discussion groups’, and ‘presentations of ongoing projects’. The keynotes were presented by leading experts in their specific field and addressed current key research questions. The format of the discussion groups ensured that every participant could articulate his experiences and ideas. The project presentations gave an overview on ongoing activities, and were used as networking opportunities.

### Background

Mountain regions – their ecology, economy and society – are particularly sensitive to Global Change. These three pillars need to be in balance in order not to jeopardize the livelihood of future generations. Land use is affected by the interactions of processes relating to these three pillars. Vice versa, land use management can mitigate the adverse effects of global change (e.g., protective forests, slope stabilization).

In the same vein, globalization is manifest in mountain areas, for instance, in depopulation in remote regions, restructuring of urban centres, and tourism.

In spite of the dramatic impacts of global change in mountain regions, it must be stated that international research programmes have not yet reflected the urgent need for investigation on the effects and on adaptive

strategies to face the challenges and to implement measurements to ensure sustainability, life quality and stability in mountain regions. At least two international research strategies were outlined in the last year: the Research Agenda to the Multi-Annual Working Programme 2005-2010 of the Alpine Convention (worked out by ISCAR), the GloChaMoRe Research Strategy by the Mountain Research Initiative, Berne. In complementing these activities, the COST Strategic Workshop was to provide a timely forum for discussion of measures to meet the challenges of climate change in mountain regions. Until today the international research funding organizations could only partially fulfil the expectations of the scientists. It must also be stated, that the Interreg IVB Programme Alpine Space changed the objectives and funding strategy towards application and implementation of the first campaign, so that new and innovative research can no longer be financed by this programme. Scientists all over the world are convinced that new research is an urgent need, as there are still many questions open, and strategies without a sufficient theoretical framework must fail.

### Objectives

Against this background the Strategic Workshop aimed at putting research topics on mountain ecosystem services on the political agenda and identifying the implications of climate and socio-economic change for current and future forms of land use. The workshop assessed impacts on selected ecosystem services such as hazard protection, recreation, and natural resources. Furthermore, scenarios of change and their implications for societies depending on these ecosystem services were appraised. In addition to the Alps, other mountain systems were also considered.

# PROGRAMME

## Keynotes

**HANNS KERSCHNER** (Univ. Innsbruck, Austria): Climate Change

**SANDRA LAVOREL** (Univ. Grenoble, France): Effects of Changing Land Use on Biodiversity and Ecosystem Services Provided by Traditionally Managed Grasslands

**CHRISTIAN KÖRNER** (Univ. Basel, Switzerland): Alpine Biota in a Warmer, CO<sub>2</sub>-rich World

**ROLF WEINGARTNER** and **DANIEL VIVIROLI** (Univ. Berne, Switzerland): Mountain Waters in a Changing World

**PHILIPPE BOURDEAU** (IGA, France): Mountain Tourism in Global Change, A Geocultural Approach

**GERHARD BERZ** (Munich University, formerly GeoRisks Research, Munich Reinsurance, Germany): Natural Disasters and Climate Change in the Alps: Trends, Costs and Possible Counter-measures

**DIETER STÖHR** (Forest Tyrol, Austria): Is there a Future for Mountain Forestry?

**GEORG GRABHERR** (Univ. Vienna, Austria): Elements of Sustainable Alpine Landscapes - The Biodiversity Perspective

**DAN BINKLEY** (Colorado State University, USA): Future Forests of the Rocky Mountains: Interactions of Climate, Development, and Policies

**JACEK KOZAK** (Jagiellonian University in Poland): Land Use Change in the Northern Carpathians: Driving Forces, Scenarios and Consequences

**HUGO ROMERO** (Universidad de Chile): Global Change and Sustainable Development in the Andes

**DRISS FASSI** (Univ Morocco): North African Civilization Diversity helps preserve the Natural Balance in the Atlas Mountains

**ELISABETH MEZE-HAUSKEN** (Gjensidige, Norway): Bad Weather Blues Realities - Measured and Perceived Changes of and Responses to Environmental and Climatic Change in Norway

**THOMAS KÖLLNER** (ETHZ, Switzerland): Demand and Evaluation of Ecosystem Services

**DOUGLAS MCGUIRE** and **THOMAS HOFER** (FAO, Rome, Italy): Effective Partnerships: The Political Dimension of Sustainable Mountain Development

**CHRISTIAN SALLETMAIER** (Province of Salzburg, Austria): EU-regional Policy for Mountain Regions

**MARCO ONIDA**, **REGULA IMHOF** (Alpine Convention, Austria) and **HARALD EGERER** (UNEP Vienna, Austria): The Alpine and the Carpathian Convention

**NICOLAS EVRARD** (Promonte EAM, France): Regional Implementation of Rural Development Policies

## Group discussions

**HARALD PECHLANER** (Univ. Eichstätt-Ingolstadt, Germany, EURAC, Italy), **FREDERIC BERGER** (CEMAGREF, France): Challenges for Sustainable Tourism

**THOMAS KÖLLNER** (ETHZ, Switzerland), **ANDREAS RIGLING** (WSL, Switzerland): Demand and Evaluation of Ecosystem services

**CRISTINA PRONELLO** (COST DC TUD), **LUCA CETARA** (EURAC), **AXEL BORSODORF** (Austr. Acad. Sciences): Sustainable Transport

**MARCEL HUNZIKER**, **MATTHIAS BUCHECKER** (WSL, Switzerland): Peoples' Attitudes towards Future Mountain Developments.

**ROLAND PSENNER** (Univ. Innsbruck, Austria), **BRUNO MAIOLINI** (Museo Tridentino, Italy): Water: Strategic Resource, Public Good, Ecosystem

**NORBERT KRÄUCHI** (WSL, Switzerland), **MARTIN GREIMEL** (Ministry of Agriculture, Vienna, Austria): Multifunctional Land Use in a Global Change Context

**CHRISTOPH MATULLA** (ZAMG, Austria), **HANS STÖTTER** (Univ. Innsbruck, Austria): Scenarios of Global Change

The discussions were organized according to the “World Café” Method, which was adjusted to the workshop, because of the high number of participants. The goal was to include as many researchers and practitioners in the group discussions as possible. The environment of the group discussion was set up like a café, with tables for six to eight with one chairperson at each table. At the end of the session the chairperson was to summarize the results from the individual discussion tables.

# KEYNOTES

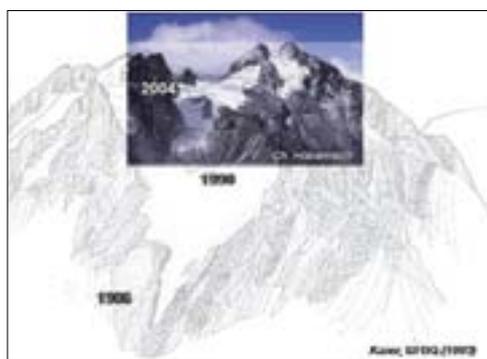
## CLIMATE CHANGE

Hanns KERSCHNER

As emphasized in the 4<sup>th</sup> Assessment Report of the IPCC, all scenarios for the future development of the climatic conditions point towards rising temperatures in all seasons during the 21<sup>st</sup> century, which are accompanied by changes in the moisture regime. The potential changes depend largely on the scenarios for future car-

bon dioxide output from fossil carbon, which in turn depends on the economic and technological development in the future. The patterns of expected climate change differ regionally on continental and subcontinental scales. The European mountain ranges will be affected in varying ways. The European Alps,

which are situated at the boundary between the humid-temperate climatic regime of the mid latitudes and the Mediterranean climatic regime, may be affected more than other mountain regions. This affects not only the seasonal temperatures, which will rise at all altitudinal levels, but also the amount and seasonal distribution of precipitation and hence the availability of water in different regions of the Alps.



## EFFECTS OF CHANGING LAND USE ON BIODIVERSITY AND ECOSYSTEM SERVICES PROVIDED BY TRADITIONALLY MANAGED GRASSLANDS

Sandra LAVOREL

Current agricultural and environmental policies focus on the reduction of impacts of agriculture on biodiversity and environmental quality on the one hand, and on the services that agro-ecosystems can provide beyond their basic production function on the other hand. There is therefore a growing interest in how planned and unplanned biodiversity can contribute both to the reduction of inputs and the

delivery of ecosystem services in addition to production. A review of the *effects of different components of biodiversity on the variety of services* involved as inputs to, and outputs from, mountain grassland systems, shows that there is increasing recognition of the effects of *functional diversity*, rather than species diversity *per se*. Based on this observation, an illustration of a detailed analysis of the

effects of plant functional diversity on ecosystem service delivery from traditional agricultural systems in marginal European regions, with special reference to subalpine grasslands was presented. Current results emphasize the effects of the traits of dominant species, while potential effects of trait and *functional complementarity among species* deserve further investigation.

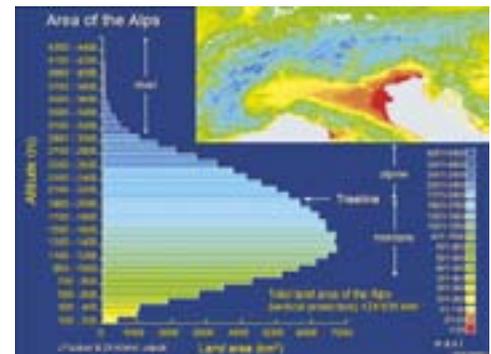


## ALPINE BIOTA IN A WARMER, CO<sub>2</sub>-RICH WORLD

Christian KÖRNER

High-altitude ecosystems cover a comparatively small fraction of the European landscape but exert major influences on large forelands through hydrological teleconnection. Geostatistics on high-altitude biota were presented and basic responses of these to a warmer, CO<sub>2</sub> enriched atmosphere, nitrogen deposition and land use were discussed. Warming will directly affect trees and thus, the high altitude tree limit, because of the aerodynamic coupling of trees to the atmosphere. In contrast, warming will affect low-stature vegetation largely via snow cover duration. Elevated CO<sub>2</sub> does not lead to higher productivity in alpine vegetation, but may select for certain responsive taxa at the loss of others. In contrast, nitrogen deposition, at rates close to current front-range fluxes, induces a major transformation of alpine vegetation. Consequences of land-use changes, particularly in the upper montane belt, may exceed the impact of all

previously mentioned drivers to an extent that *hydrology is significantly affected*. Such effects have never been quantified in economic terms, and need urgent attention at the catchment scale in light of the projected shortages in both water and electric energy. All these environmental changes will affect biodiversity, but neither the extent of such changes nor the ecosystem scale consequences are easy to assess, given the overwhelming significance of geodiversity at high elevation.



## MOUNTAIN WATERS IN A CHANGING WORLD

Rolf WEINGARTNER and Daniel VIVIROLI

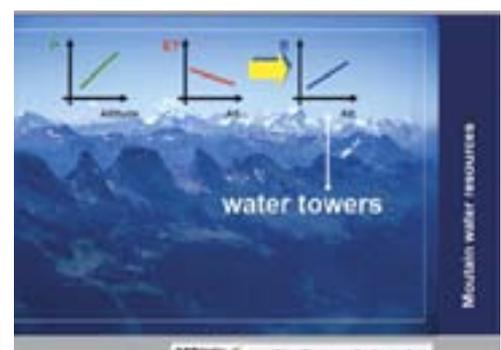
Starting with the runoff characteristics of the river Inn at Innsbruck, the close connection between mountains, water and man was discussed. This leads to the hydrological significance of mountains, an issue which was addressed at different spatial scales:

- By comparing the water balance of the European Alps with that of the whole of Europe, it is possible to determine the *water-tower function* of the Alps. Due to orographic precipitation, this mountain range produces a specific runoff which is three to four times higher than that of the lowlands.
- In a macro-scale study with a resolution of 0.5° x 0.5°, the water resources of mountains in the global context were quantified. Outside the humid tropics, mountains and hills deliver much more runoff (56% of total land surface runoff) than would be expected from the area they cover (40%). Compared with the proportion of total area (30%), mountains in the arid zone clearly provide a highly disproportionate runoff (67% of the total).

- An example on the meso-scale indicates that mountains are extremely important not only from the point of view of water resources but also as the *origin of floods*.

How are the hydrological characteristics of the Alps affected by global change? This challenging and complex issue can be presented through examples. A clear distinction needs to be made between the retrospective and the prospective view:

- The changes observed in the water balance in Switzerland cannot yet be termed dramatic (retrospective view). It is essential to point out that the



influence of increased glacier melt on runoff is often overestimated. Although approximately half of the volume of ice has disappeared since the end of the Little Ice Age around 1850 melt water contributes around 1% to annual runoff in Switzerland. However, in Alpine highly glacierized catchments, this figure may be higher, in particular during summer.

- In the Alps, “snow” and “glaciers” are particularly susceptible to climate change; they in turn influence the seasonal runoff pattern. If global warming decreases snow and ice this will have far-reaching consequences for runoff (prospective view). Moreover, the seasonal runoff pattern will change with the predicted rise in the snowfall line and the predicted increase in winter precipitation.
- An increase in the frequency of major floods can be seen in certain catchments (e.g. the River Kander in

the Bernese Oberland). It is not clear whether this increase is due only to climate change (more frequent and more intense heavy rainfall) or whether a cycle of periods with greater flood frequency plays a role. It is also possible that there is an overlapping effect of both climate change and flood cycle.

Several projects are focusing on the hydrological consequences of climate change in the European Alps (e.g. RheinBlick2050, AdaptAlp, Climate change and hydropower production, ACQWA). Interdisciplinary and applied research is required. The non-linear change in the hydrologically relevant key characteristics (snow, glaciers, vegetation, soils) leads to a system of imbalance which is difficult to determine or model. Researchers are facing many challenges in connection with the quantification of the hydrological consequences of climate change.

## MOUNTAIN TOURISM IN GLOBAL CHANGE. A GEOCULTURAL APPROACH

Philippe BOURDEAU

Mountain tourism – and in particular snow-tourism– is more and more seen as an out-dated phenomenon, reduced to a « niche market », and exposed to crisis and criticism in a context of growing contradictions. In spite of its major role, climate is far from being the only factor of change in mountain tourism: ageing of population, shifts in recreational cultures, competition between tourist destinations, new relationships between urban and mountain areas, social demand for sustainability, amenity migrations etc. stress the need for new approaches to understand the sense of ongoing movements. Among the key-factors to consider is the in-depth change of the 20<sup>th</sup> century “time and geographical order” between spaces, times and uses of “Home” (town, every day’s life, work) and “Elsewhere” (nature, out of every day life, leisure). This change is typical of post-modernity, producing a betweenness which dissolves boundaries by setting continuities and mixing instead of ruptures and

fragmentations: town-nature, home-faraway, inside-outside, natural-artificial, authentic-inauthentic, tourist-not tourist, work-leisure, every day-holidays, etc. While becoming central in way of life, territory and economy, recreation (i.e. leisure, tourism, sport) seems more and more to dissolve and conceal itself as an autonomous object and factor. This trend, in which increasing convergences between residential, economic and entertaining functions play a key-role, can be called post-tourism. This notion takes into account the change of status of mountain tourist practices and tourist places in the context of globalisation and post-modernity: metropolisation, residential turn, end of tourist Utopia and U-chronia, mixing of times, places and activities (professional, cultural, social, recreational etc.), growth of tourism in common places, birth of experimental tourism. Bringing at the same time uncertainty, crises and innovation, these changes need to renew the “tool box” of social sciences by

using new concepts and references: from tourist stay to all-year or half-year stay, from tourist economy to residential economy, from resort to town, from specialization to diversification, from tourism industry to counter-culture, from tourist to “recreworker”, and at last from engineering or marketing to intelligence. Providing this, the way out from “all ski” can also be considered as an exit from “all snow” and even “all tourism”.

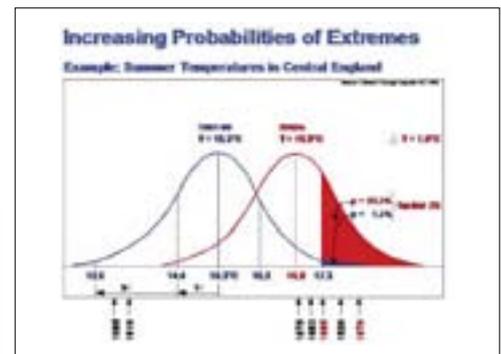


# NATURAL DISASTERS AND CLIMATE CHANGE IN THE ALPS: TRENDS, COSTS AND POSSIBLE COUNTER-MEASURES

Gerhard BERZ

Over the last few decades, the international insurance industry has been confronted with a drastic *increase in the scope and frequency of major natural disasters*. This trend is attributable primarily to the continuing steady growth of the global population and the increasing concentration of people and economic values in urban areas. Another factor is the global migration of populations and industries into areas, such as coastal and alpine regions, that are particularly exposed to natural hazards. If the global warming predictions come true, current problems will be magnified drastically. Changes in many atmospheric processes will significantly increase the frequency and severity of heat waves, droughts, bush fires, tropical and extra tropical cyclones, storm surges, severe storms, floods, landslides and rock falls in many parts of the world. These events will inevitably have a profound impact for all types of insurance.

In high-risk areas like flood plains and avalanche zones, it will be necessary to impose considerable restrictions such as significant deductibles and low liability or loss limits in order to provide insurance cover at all. In densely populated areas, the loss potentials of individual disasters will *confront economies and insurance industries with serious capacity problems*. Recent disasters have underscored the need to be better prepared for the risks of the future.

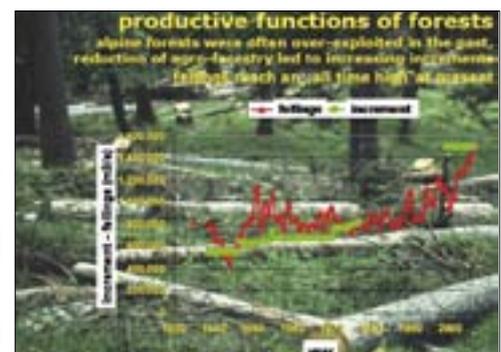


## IS THERE A FUTURE FOR MOUNTAIN FORESTRY?

Dieter STÖHR

Forestry in the Alps implies *manual work*, being dangerous and expensive. Only a small part of harvesting can be fully mechanized using harvesters, due to the steepness of the terrain. Decreasing prices for timber and increasing labour costs have changed the situation of Alpine forestry for the worse. Nevertheless, the timber industry plays a key role in the economy of the Alps. In Austria, exports of wood products are valued at 8,5 billion €/year. However, pure economic criteria are not the only ones for assessing the importance of forestry in the Alps, where forests have many functions for the Alpine population. In a first approximation, the forests of the Alps seem to be in a fairly good condition: *The forested area is increasing, as well as growing stock and annual increment.*

there new efficient techniques to control mass propagation of bark beetles? In many parts of the Alps, the protective functions of forests greatly exceed their importance for timber production. Many problems in this context remain to be answered: How can forests on steep slopes, affected by avalanches, erosion or rockfall be managed efficiently? Which tree species will cope best with the future climate? How to establish forests now, for climatic conditions which will be quite different? How to promote awareness among local foresters of the importance of biodiversity, with regard to the above mentioned changes? The overall effects induced by climate change, eutrophication and changed forest management are not entirely known.



## ELEMENTS OF SUSTAINABLE ALPINE LANDSCAPES - THE BIODIVERSITY PERSPECTIVE

Georg GRABHERR, Maria ASCHAUER, Markus GRABHER

The effects of so-called global change phenomena on landscape and biodiversity - in particular land use change, climate change, neobiota - were discussed, and examples were provided. Case studies were given for the Province of Vorarlberg in Austria, a typical alpine region. It is remarkably wealthy, which enhances pressures on the environment. Besides the biodiversity of habitats, conservation of endangered habitats and species, specific consideration was given to the *shrinking availability of*

*remote small valleys* (Landschaftskammern) which are not or only moderately developed. Land-use change is still the most important driver for landscapes quality - at small as well as large scales. Climate change may have - in the long term - an effect on land use, and therefore on seminatural and synanthropic biota. Natural systems will react - and are already doing so - but with significant lag phases. Neobiota (pathogens in particular) might endanger important biota, but most are harmless. Sustainable landscape elements are primarily those which are natural, and which do not depend on specific land use practices. Those which do need specific measures for maintenance depend on environmental subsidies. *Conservation needs to be an integrative part of landscape management and therefore environmental policy; it must be supported by comprehensive monitoring.*



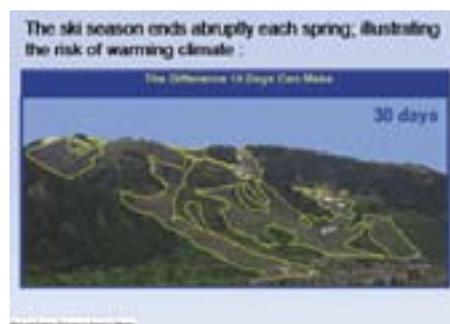
## FUTURE FORESTS OF THE ROCKY MOUNTAINS: INTERACTIONS OF CLIMATE, DEVELOPMENT, AND POLICIES

Dan BINKLEY

The forests of the Rocky Mountains in the western United States occur at elevations that combine relatively severe climates (including periodic droughts, and routine long winters) and increasing human population and use. Historic patterns of major forest disturbance have included fire return intervals of 10 years to centuries (decreasing with increasing elevation), and insect outbreaks (particularly bark beetles). Recovery from these disturbances typically occurred over decades and centuries. These periods of rapid and slow changes of forests

at landscape scales have become a major focus of concern with social and economic development of the region. In Colorado, more than 1 million people live in the mountain "red zone" with a high risk of severe wildfires; natural patterns of disturbance and recovery are not aligned with socially desired conditions. A warming climate may have contributed to *widespread rapid mortality of old aspen forests* (perhaps related to drought and record heat) and old lodgepole pine forests (perhaps resulting from drought and an absence of severe cold in

winter). At the same time, the *winter snowpack* has begun *melting sooner*, with broad implications for water storage and irrigation for agriculture. The development of well-informed forest policies may help moderate the conflicts that are developing between social and ecological development of Rocky Mountain landscapes.

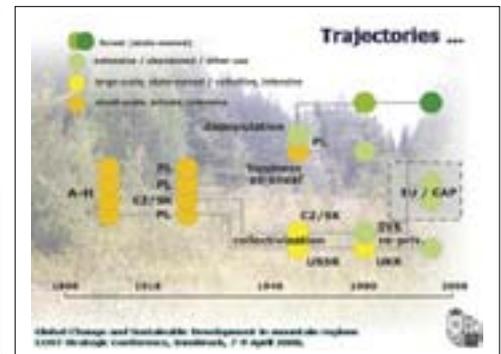


# LAND-USE CHANGE IN THE NORTHERN CARPATHIANS: DRIVING FORCES, SCENARIOS AND CONSEQUENCES

Jacek KOZAK

The presentation focused on changes in land use and land cover occurring in the northern Carpathian Mountains in Central Europe, and attempts to point to major drivers of change and to formulate future scenarios, on a basis of existing trends and analogies in other mountain areas. In the northern Carpathians a slow *decline of mountain agriculture* is taking place since the peak of agricultural expansion around the middle of the 19<sup>th</sup> century. Throughout the 20<sup>th</sup> century, the decline of agriculture resulted in a steady increase of forest cover, strengthened in some regions by depopulation processes. This forest transition has speeded up since 1989, as the transformation of economies in former communist countries has contributed to a significant abandonment of agricultural land, and contemporary forest succession. However, the last 20 years have also witnessed *rapid urbanisation* and development of *tourist*

*infrastructure* (e.g. ski resorts) in many locations in the mountains. Both major forms of land use / land cover change in the northern Carpathians - forest expansion and urbanisation - modify (or erase) the former, cultural landscapes of the region, dominated once by agricultural activities. Both are almost fully controlled and driven by complex interactions within the socio-economic system, at different levels of spatial hierarchy.



# GLOBAL CHANGES AND SUSTAINABLE DEVELOPMENT IN THE ANDES

Hugo Iván ROMERO

The Andes is one of the most relevant spatial organizers and sources of natural resources and environmental services in South America and historically, has been one of the main economic supporters of development at global and continental scales. Difficult accessibility and climatic constraints have favored refuges for many biological species and human populations. However, global *environmental changes* and the *globalization of the economy* are dramatically impacting Andean landscapes. Given the relevance of the topic, the situation in the Southern Andes, corresponding to Chilean Patagonia, extending between 45 and 49°S, is an example of global changes affecting the whole Andes. A remarkable climate change has been observed in the southern section of Chilean Patagonia. Annual and monthly precipitations are experiencing large reductions, and higher minimum temperatures and more frequent heat waves have been recorded in the last decades. Consequently, an important process of glacier retreat and snowmelt is revealed by remote and field measurements. On the other hand, economic globalization has meant the reduction in support of

national public policies and institutions in charge of nature conservation, and the arrival of very powerful foreign companies that are planning giant investments in hydropower and aquaculture. Chilean Patagonia, like most of the Andes, is confronting a dramatic dilemma between, on one hand, global economic goals forcing the rapid exploitation and export of its physical and biological richness and diversity, and the migration of local people towards the rapid urban sprawl areas; and, on the other hand, ecological and cultural conservation goals. Unfortunately, these non-economic aims appear to be completely underestimated by development indicators and financial and governmental institutions acting at world, regional and national scales.

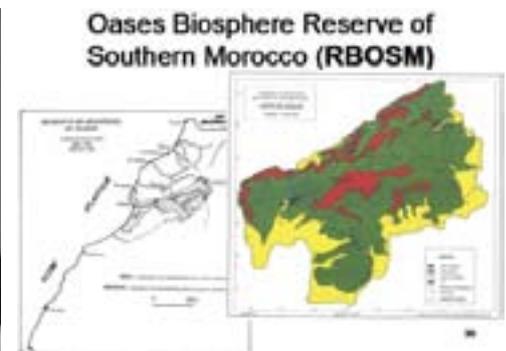


## NORTH AFRICAN CIVILISATION DIVERSITY – HELPS PRESERVE THE NATURAL BALANCE IN THE ATLAS MOUNTAINS

Driss FASSI

The Atlas Mountains are the backbone of Morocco, and of the Maghreb as a whole, offering to the world the Mediterranean bioclimatic zone of the southern shores. They are considered to be a physical shield against the Sahara desert. Nevertheless, they are, themselves, running the risk of being overwhelmed by hyper-arid climate, just like the Ahaggar Mountains and other Saharan massifs. A dreadful precedent has happened during a dry, sand drifting, interstadial of the Würm period. Indeed, the real protection consists more in the biotic entities, covering the mountain slopes and fringing them, than in the tectonic structures. Nowadays, these ecosystems are facing an abnormal wave of desertification, resulting from the convergence of two synergic factors of natural resources degradation. There is an acceleration of climatic deterioration, clearly shown by *excessive periods*

*of drought* in the second half of the 20<sup>th</sup> century, coming after the initiation of unsuited models of natural resources extraction, established by *foreign colonisation*. In order to avoid the probable close perspective of an ecological disaster, namely a Maghreb without forests, we are presently witnessing some efforts to rediscover and take the best from the sustainable techniques and related behaviours of local ancestral civilisations.

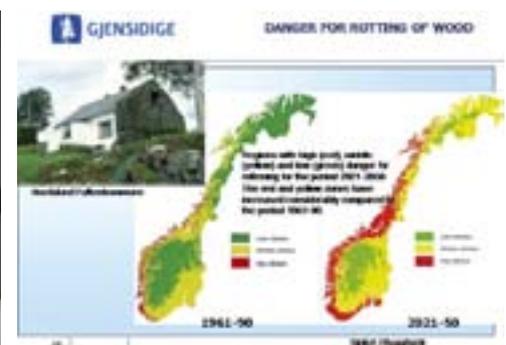


## BAD WEATHER BLUES REALITIES - MEASURED AND PERCEIVED CHANGES OF AND RESPONSES TO ENVIRONMENTAL AND CLIMATIC CHANGE IN NORWAY

Elisabeth MEZE-HAUSKEN

People in Western Norway are used to bad weather. Faced by the rough North Sea on their western side, and by high mountain plateaus on the eastern side, they have learned to adapt to the challenges of nature. But how will they cope with even more precipitation in the future as predicted by climate change models? Where are the limits of adaptation, both physical and psychological? The presentation tried to unveil the cliché of good and bad weather, by *contrasting meteorological measurements with people's perceptions*. Grasping the disparities of these two realities can be regarded as an important issue for determining how changes in climate, specifically in extreme events, will impact the local society. As a practical example, the challenges of the insurance sector are discussed. Insurance, as a form of risk man-

agement, primarily used to hedge against the risk of a contingent loss, will have to bear high damage costs occurring with an increase in extreme events. An understanding of people's weather experience, their expectations and climate "needs", will contribute to improve risk management and societies' adaptation.



# SUPPLY AND DEMAND FOR ECOSYSTEM SERVICES IN MOUNTAINOUS REGIONS

Thomas KOELLNER

Mountain ecosystems provide a large array of services (e.g. prevention of soil erosion, regulation of water flow, maintenance of genetic resources, production of biomass), which are highly sensitive to changes of climate and land use. Two research projects are dealing with the evaluation of the *supply and demand for ecosystem services* facing such global change: in the Swiss and in the Costa Rican mountains. These projects highlight research problems and needs for further research about mountainous ecosystem services from an ecological economics perspective.



## EFFECTIVE PARTNERSHIPS: THE POLITICAL DIMENSION OF SUSTAINABLE MOUNTAIN DEVELOPMENT

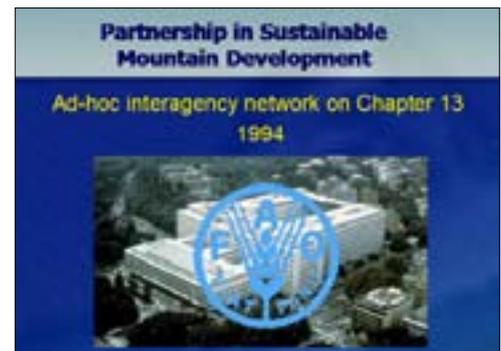
Douglas MCGUIRE

There is now increasing recognition that mountains are fragile ecosystems and have global importance regarding freshwater, biological and cultural diversity and other key issues. Mountains provide a direct life-support base for about 12 per cent of the world population, as well as essential goods and services to more than half of humanity. Yet many of the world's most impoverished and food-insecure people live in mountain regions. Consequently, there is a need to ensure the ecological health and the economic and social improvement of mountain areas, for the sake of both mountain inhabitants themselves, whose livelihood and overall well-being are at stake, and of people living in lowland areas.

Today, global change, including climate change, is impacting mountain communities and ecosystems in unprecedented ways. As highly sensitive ecosystems, mountains are often early indicators of change and very much at risk of negative impacts due to such change. Drivers of change in mountains, both physical and socio-economic, are not well understood and further research is needed on many fronts. Additionally, the gap between research and policy remains quite wide, policy and decision makers are not often consulted in setting research agendas and consequently their support is often insufficient or even lacking.

Innovative forms of partnership are required to bridge this gap and overcome existing obstacles to more widely support-

ed research efforts in mountains that are coherent with policy agendas at all levels. The Mountain Partnership is a voluntary alliance of some 150 governments, civil society and inter-governmental organizations, working together in collaborative initiatives to achieve common goals and objectives. Given the diversity of its membership, it provides a forum to improve collaboration between the research and policy worlds and make research on mountain issues more relevant and more widely supported by decision makers. The Partnership is providing a context for the development of regional collaborative arrangements for mountains, such as in the Carpathian Mountains and the Balkans, and is supporting exchange of information and experience between mountain regions, both within and outside Europe. This strategic workshop has an important significance in the European context and can serve to enhance research efforts and linkages with policy actors concerned with sustainable development in mountain regions. It provides an opportunity to more



effectively link research efforts within Europe and beyond and has the potential to make a significant contribution to enhance understanding of how global change is affecting mountains and to increase the relevance of mountain research in policy agendas. The Mountain Partnership can

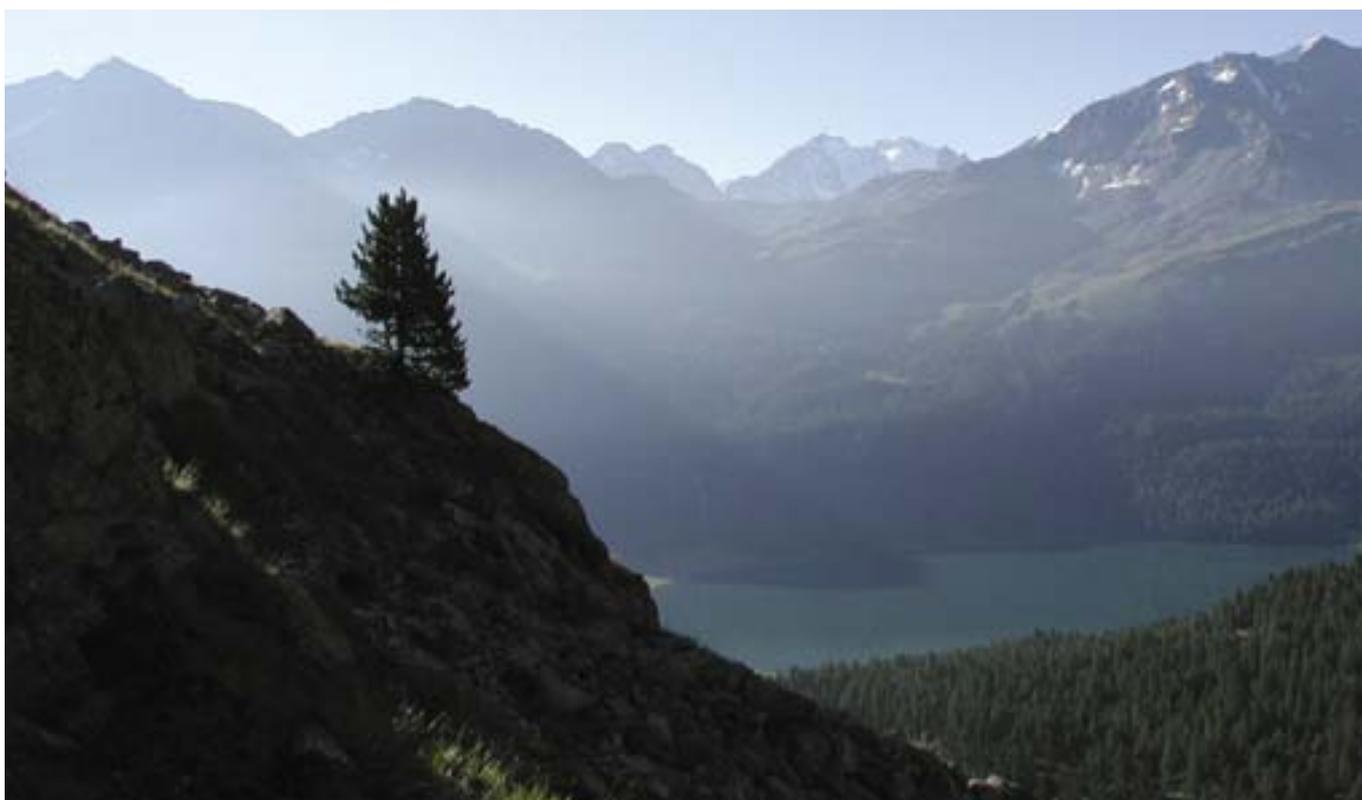
help maintain political momentum and ensure that the strategic workshop results are channelled appropriately and effectively to governments and relevant regional and international fora and linked to other conferences and processes dealing also with global change in mountains.

## ALPINE SPACE PROGRAMME - EUROPEAN TERRITORIAL COOPERATION 2007-2013

Christian SALLETMAIER

The European Territorial Cooperation Alpine Space Programme supports transnational cooperation projects in the Alpine Space fostering territorial development and cohesion. Its overall aim is to maintain and increase the competitiveness and the attractiveness of the cooperation area by developing joint actions in fields where transnational cooperation is required for sustainable solutions. Transnational Alpine Space projects provide the possibility to test strategies and approaches for European spatial development and to develop transnationally effective solutions. About 130 Mio. € are available for the co-funding of projects, with 97 Mio. € coming from the European Regional Development Fund (ERDF). For a project selected for co-funding by the programme, up to three quarters of the total project costs will be funded by the

ERDF, the remaining costs have to be covered by other public funds. The Alpine Space Programme concentrates on the following priorities: (i) Competitiveness and Attractiveness, (ii) Accessibility and Connectivity, (iii) Environment and Risk Prevention. The Alpine Space Programme 2007-2013 is now on track to stimulate other outstanding results through new cooperation projects!



# REGIONAL IMPLEMENTATION OF RURAL DEVELOPMENT POLICIES

Nicolas EVRARD

## 1. What is AEM?

The European network of local and regional authorities and elected representatives from mountain regions, the institutional and political network of European mountain territories defending the specificities of mountain regions towards the European institutions and exchanging best practices between mountainous local and regional authorities.

### How to define rural development policies in mountain regions?

- To maintain and increase the economic base of mountainous rural areas,
- To have better rural demographic trends and increase the welfare of mountain populations,
- To conserve and rehabilitate natural and cultural heritage.
- Main activities: agriculture, tourism, craft.
- Dominant dimension: environment and landscape.

### Is there any European specific approach?

There is a trend of an European integration but historically there are various approaches.

First because of climatic conditions, North, Central and Southern mountains are not facing the same conditions of living and working.

Climatic and environmental conditions are especially different between the Northern and Scandinavian mountain areas, the central parts of humid European mountains with important differences between high and middle mountains, and the Mediterranean mountain areas suffering from drought.

But all European mountain regions are facing the same kind of problems that could be generalized through the concept of “natural permanent handicap” used both in European agriculture and rural development policy and in the European cohesion policy.

## 1.1. Two main trends for mountain policies in Europe

### Sectorial:

The sectorial approach is focusing its action on one activity sector, on one dimension (agriculture, environment or craft).

Examples: Austria, Norway, Greece

### Integrated:

multisectorial and partnership

Examples: Spain, France, Italy, Switzerland

## 1.2. Elements of analysis for a regional lecture of rural development policies

### The question of territorial coherence of regional and local institutions:

Regions (or countries) only marginally concerned by mountain issues could have a different approach from mountain regions (or countries).

### Globalisation and European integration impact:

Mountainous urban dimension turn to urban network more than mountain solidarity.

### Mountain economic cycle and recognition of mountain specificities:

Permanent handicap and high costs.

## 1.3. Elements of convergence between European mountain regions

- a dominant economic sector : agriculture, tourism, craft
- a fragile economic system
- a problem of accessibility (transport, energy, communication ) + GIS
- a fragile environment
- a capacity of pilot and innovative actions about sustainable development (3 pillars) and climate change.

## 2. Rural, urban or urban-rural? For a European “ranges” strategy

- Need of economic and human science research,
- Need of a European commune strategy for the sustainable development of mountain regions,
- Need of more partnership and cooperation between research actors and policy makers.



# THE ALPINE AND THE CARPATHIAN CONVENTION

Marco ONIDA, Regula IMHOF and Harald EGERER

The Alpine Convention is a framework agreement for the protection and sustainable development of the Alpine region. It was opened to signature on November 7<sup>th</sup>, 1991 in Salzburg (Austria) and entered into force as from March 6<sup>th</sup>, 1995.

The convention recognises the Alps as a single space in a global context, that is to say a single space, in which the different parts – nature, economics and culture - are interdependent. The specific features of the region contribute to the creation of an identity which requires a super-national development.

In order to achieve this objective, the Contracting Parties take appropriate measures in particular in the areas of population and culture, regional planning, prevention of air pollution, soil conservation, water management, conservation of nature and the countryside, mountain farming, mountain forests, tourism and recreation, transport, energy and waste management.

While the individual Contracting Parties are responsible for implementing the texts of the treaty on their sovereign territories, the bodies of the Alpine Convention engaged to inform the public, to monitor the implementation, to monitor trends in the Alps including alpine-specific research, to draw up joint international initiatives and to support co-operation and the exchange of experience.

The Multi-Annual Work Programme (MAP 2005 – 2010) of the Alpine Conference represents a medium term framework over a period of six years that defines the main tasks. The two-year-programmes of the individual presidencies are to complement and to concretise the targets.

Research and systematic monitoring play an important role to achieve the aforementioned objectives and for the implementation of appropriate measures in the areas mentioned. Therefore, the Contracting Parties agree to:

1. cooperate in carrying out research activities and scientific assessments;
2. develop joint or complementary systematic monitoring programmes;
3. harmonize research, monitoring and related data-acquisition activities.

## The System for the Observation and Information on the Alps (SOIA)

The SOIA aims at contributing to Alpine policy development by providing data- and information management with a process-oriented approach involving key

partners. Reporting on the state of the Alps is first of all important so as to have coherent background information for decisions in the area of sustainable development of the Alpine space. It provides information for inner alpine policies but it also strengthens the position of the Alpine Space by representing it in the larger European Environment, Economy and Social context.

For the observation of the main themes and goals identified indicators were developed to establish a coherent system of observation over time.

SOIA contains today 4 main elements: a data base, regular and thematic Reports on the State of the Alps (RSA), establishment and maintenance of a long-term partnership and network for Alpine Research with research institutions and administration as well as the active dissemination of results concerning Alpine research.

The System for the observation and information on the Alps supports with these four elements the description and the identification of key questions in the Alpine Space. Furthermore, on the base of the priorities set out in the Multi-annual Work Program (MAP) of the Convention ISCAR, the International Scientific Committee on Research in the Alps has developed a research agenda with priority research questions for the strategic development of the Alpine region.



# DISCUSSION GROUPS

## WATER: STRATEGIC RESOURCE, PUBLIC GOOD, ECOSYSTEM

Roland PSENNER and Bruno MAIOLINI, with the support of Maria Christina BRUNO and Sophie KIESELBACH

### Executive Summary

Providing water of high quality and in sufficient quantities is a key concern for all users. While quality is commonly interpreted as chemical and hygienic properties of drinking water, the key issue regarding sustainability of water resources is the state of aquatic ecosystems. Ecosystem functions such as biodiversity, flood protection, groundwater recharge, denitrification, hydropower generation, tourism, recreation etc. are intimately connected to the state and the quality of aquatic ecosystems. Thus, all problems related to „water“ cannot be treated separately, but must be seen under the aspect of the state („quality“) of rivers, lakes, glaciers, groundwater and atmospheric depositions.

### Problem Statement

- The increasing need of clean water creates conflicts between different users and stakeholders: tourism, drinking water supply, agriculture, industry, hydropower generation etc. Generally, a contradiction exists between ‘clean’ energy demand (water abstraction etc.) and ecological integrity.
- There is a sharp north-south gradient with regard to water scarcity which will enhance already existing potential conflicts as outlined above.
- Currently we observe a rapid loss of stream typologies, e.g. glacial streams, and related biodiversity, i.e. water courses unique to alpine catchments. Disturbed regimes of mountain rivers leading to changes in natu-

ral dynamics and a loss of connectivity have strong negative effects on fish fauna and biodiversity in general.

- Increasing land-use changes and vegetation cover changes will lead – together with climate change – to enhanced erosion and evapotranspiration, increased frequency of floods, etc.
- Pollution and eutrophication (nitrogen deposition) and the unexpected and yet unexplained release of trace metals from melting permafrost and block glaciers has a strong impact on water quality and biodiversity.

In addition, a lack of a specific mountain/Alpine legislative framework for water management and land use is registered.

### Research Needs and Open Questions

- A common Alpine database (updated, available to everyone) and thematic maps on freshwater ecosystem connectivity, water quantity and water uses is necessary.
- Evaluation of the ecosystem services (including the socio-economic and cultural aspects) to help solving conflicts.
- Water, a private or public good? The answer(s) to this question will have enormous implications on ecology and society.
- Development of improved water balance models for the Alps.
- Evaluation of the effects of global change and other anthropogenic impacts on biodiversity scenarios.
- Development of common methodologies and aims for Alpine river restoration.



- Establishment of cross-sector, multidisciplinary research groups.
- Evaluation of spatial gradients from northern Africa to southern Italy as signals (canary in a coal mine) of anticipated – and possibly inevitable – changes.

## Solutions and Suggestions

- Preparation of a new legislative framework in order to adapt the rules of the WFD 2000/60 EU for the conditions of the Alpine space.
- Water pricing is seen as one way towards a more sustainable use of water.
- Protection of remnant glacial streams at risk of extinction.
- Reduction of further infrastructures (channelization, dams...) in rivers and floodplains is necessary to reach higher water and ecosystem quality. Restoration of “natural” conditions will increase stream resilience to changes in hydrology induced by climate change.
- Better solutions for efficient use of energy: it is impossible to comply with all energy needs even when we turbinate all Alpine rivers.
- Reduction of the gap between science and society: education for best practices in water use is seen as a clever solution.
- Increasing the awareness of water issues through an open approach (social sciences, economy, eco-hydraulics ...) which needs a common language for all users.



- Focus on what is feasible and does make a change (“triage” = selection process), and forget about what cannot be rescued or restored.

## DEMAND AND EVALUATION OF ECOSYSTEM SERVICES

Thomas KOELLNER and Andreas RIGLING

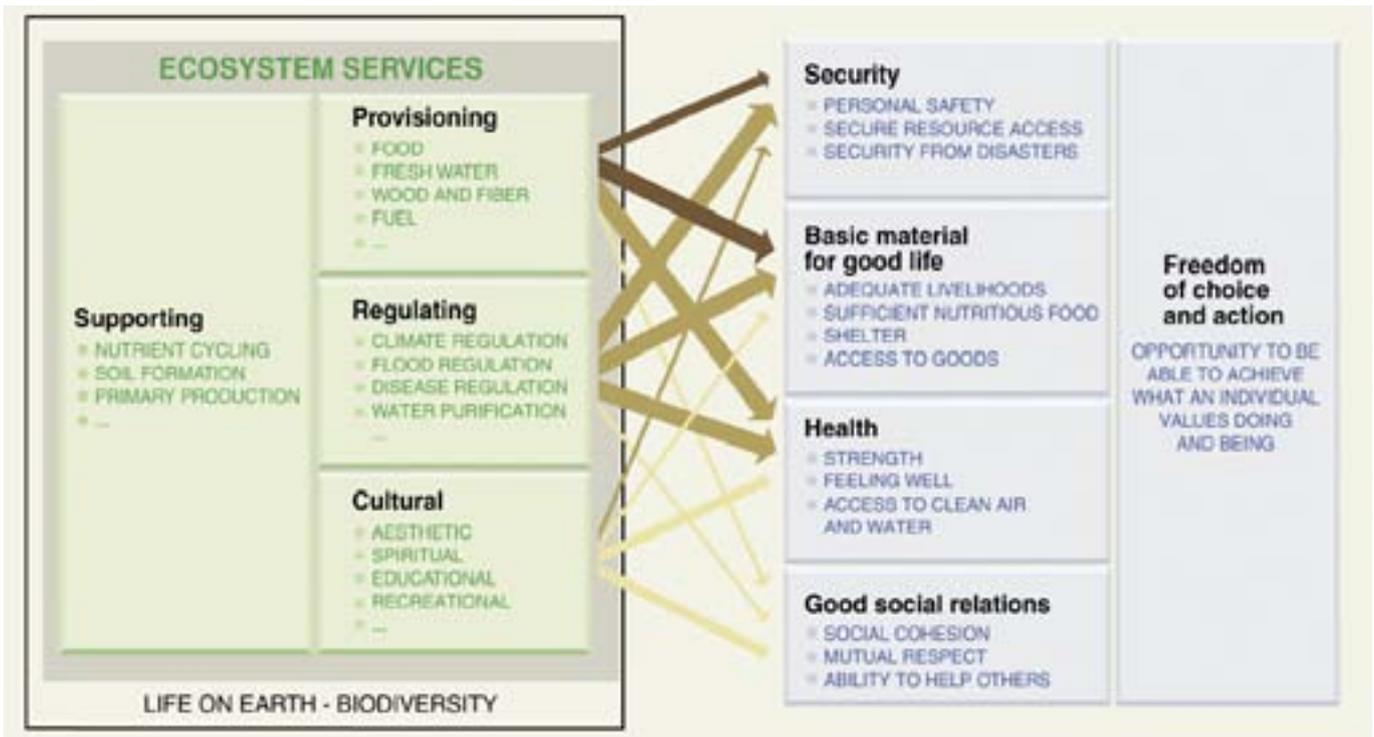
### Executive Summary

Ecosystem services from mountains are under pressure due to global change. Science, the community, private business and policy-makers must join forces to come up with an evidence-based research agenda which reflects (i) the future changes in the supply of ecosystem services due to global change, (ii) the socio-economic demand for ecosystem services and (iii) the required design of policy instruments, market mechanisms, and land-use practices to support the adaptation of the regional ecological economic system to global change. The discussion groups stressed the need for developing projects, which (i) support the ecologically sound, economically feasible and socially acceptable optimization of land use

planning and adaptive management of ecosystem services. (ii) It was stressed that new projects should help to develop strategies for compensation of actors providing ecosystem services as well as compensation of actors, especially the poor, suffering from a loss of ecosystem services.

### Problem Statement

Mountain ecosystems provide a large array of services (e.g. prevention of soil erosion, regulation of water flow, maintenance of genetic resources, production of biomass), which contribute to human well-being (see graph). These “ecosystem services” of the world’s moun-



*Ecosystem services and their contribution to human well-being according to the Millennium Ecosystem Assessment.*

tains are highly sensitive to changes of climate and land use.

The goal of the discussion group “Demand and Evaluation of Ecosystem Services” was to consider the research needed in order to evaluate the supply and demand for ecosystem services of mountains facing global change. Approximately 80 participants discussed the topic using the World Café Method.

The participants were asked to structure their output of the discussion as follows: problem statement, goal, partners, methods, expected results, use of results. The exercise resulted in eleven research ideas. In a further step, the key elements of the eleven research ideas were extracted.

## Research Needs and Open Questions

- *Identification and assessment of ecosystem services:* Many research ideas contained the goal of identifying the relevant ecosystem services in a given case study and the goal to assess the provisioning of ecosystem services (from both ecological and socio-economic perspectives).
- *Awareness about ecosystem services:* Several research ideas mentioned that one goal is to increase the awareness of relevant stakeholders about the importance of ecosystem services. Often the spatial (and

temporal) distance between the source of the ecosystem services upstream and the user of the ecosystem services downstream may be a reason for the low awareness level.

- *Competition and synergies between different ecosystem services and regions:* Some research ideas addressed the problem of competition between different ecosystem services (e.g. management focus on one single service may reduce the provisioning of other services). Also the need for finding synergies between ecosystem services was stressed, and that disparities between regions (mountains–lowlands, North–South) with respect to wealth and level/change of ecosystem services are an interesting research problem.



*The World Café on Mountain Ecosystems*

- *Optimization and planning of ecosystem services:* Based on the research needs above, it will be necessary to optimize the wide range of ecosystem services resulting in multi-purpose landscape management on a regional up to continental scale.
- Compensation of actors providing ecosystem services as well as compensation of actors, especially the poor, suffering from a loss of ecosystem services.

## Partners

The participants identified a large number of potential actors to be potentially involved in research projects:

- *Interdisciplinary research partners:* Different scientific disciplines were mentioned, including Ecology, Hydrology, Geology, Geography, Sociology, Anthropology, and Economics.
- *Transdisciplinary research partners:* The need for trans-disciplinary research collaboration between science and societal stakeholders was highlighted. Potential stakeholders are policy-makers, consumers, NGOs, landscape planners, industry, forest owners and forest managers.
- *Mountain-Lowland and North-South/East-West Partnerships:* The need for regional partnerships was stressed to address sustainable management of ecosystem services.

## Methods

A variety of methods were suggested, to be organized as follows:

- Stakeholder dialogue for identification of relevant ecosystem services
- Decision-maker dialogue for knowing decision problem and context
- Quantification of ecosystem services changes with monitoring (spatial and temporal), experiments and modeling (past and future), including evaluation
- Conversion of results into useful tools (maps, databases, assessment and monitoring tool) for decision-makers
- Guidelines for stakeholders

## Solutions and Suggestions

Participants of the discussion groups mainly focused on two goals with their project ideas:

### Overarching topics

- Ecologically sound, economically feasible and socially acceptable optimized land use planning for adaptive management of ecosystem services.

### Topics in particular

- Multiple Criteria Analysis (MCA); interaction between different ecosystem services (i) Safety, (ii) Well-being / income (iii) land use, ../ prioritization;
- Identifying forest ecosystem services; evaluation that uses an accepted framework of indicators and methods; optimization/adaptation of forest management systems, compensation to land owners;
- Awareness of benefits of ecosystem services in mountain regions; analysis of interfaces between consumers, tourists, industry, administration, public (fishers, farmers, hunters), land owners;
- Regional cost-benefit analysis; communication of costs of ecosystem management; developing countries;
- Evaluation of threshold values for sustainable land use; identify win-win situations;
- Land-use change affects ecosystem services (water retention, erosion, warming of local climate, socio-economic, biodiversity); prevention of ecosystem service changes;
- Modelling scenarios (past and future) and quantification ecosystem service changes; conversion of results into useful tools (maps, databases, assessment and monitoring tool) for decision-makers;
- Long-term commitment to ecosystem service research;
- Management guidelines;
- Early warning water quality systems; safety, reduce costs of cleaning water, ecosystem wellness;
- Response function action-effects; tool for regional planning, e.g., in watershed catchments;



# MULTIFUNCTIONAL LAND USE IN A GLOBAL CHANGE CONTEXT

Norbert KRÄUCHI and Martin GREIMEL

## Executive Summary

The discussions group tackled questions related to possible land use changes in mountainous regions associated with change scenarios and their implications for social issues (including risk prevention and protection), micro- and macroeconomic and environmental topics. During this session, knowledge gaps were identified, a list of future research needs was set up, and recommendations for research programme managers were drafted. The session was attended by 76 people at 10 tables.

## Problem Statement

The chairs stressed that the land used by humans in the mountain region never had only a single function but has always been used in a multifunctional way. Land use and the respective functions can be summarized (see graphic on the right side).

The proportional distribution within these functions is increasingly influenced by global change scenarios. The chairs pointed out that global change is not only related to climate change but also to other important drivers like demographic changes (e.g. in-migration, decreasing population, aging, emigration,...), changes in demand (e.g. food versus fuel,...), political changes (e.g. regulations, subsidies, regimes,...), changes in perceptions (e.g. lifestyle, cultural,...).

## Research Needs and Open Questions:

- Analysis of already done RTD activities: best practice advices
- Optimal decision-making processes
- Improved information transfer tools
- New tools for communication
- Ways to convince stakeholders to take over responsibility
- Analysis of indigenous/local knowledge
- More pilot studies (time series) required
- Better/interconnected models for simulations needed
- Evaluation of indicators
- Market/validation concepts for soft value function
- Life cycle analysis for land use
- Research on the transferability of RTD results between different mountain areas (more droughts



*Multifunctionality of land use (adopted from SENSOR; [www.sensor-ip.org](http://www.sensor-ip.org))*

- versus more rain)
- Impact of artificial snow
- Enhanced uses of GIS technology (not only mapping)
- Analysis of actual and future pressure on land use (land use maps)
- Improve knowledge on food versus fuel issue
- Better differentiation between human and other impacts on land use change
- Sustainable land use concepts with lower manpower input
- Information on interaction of urban areas on mountain regions
- Evaluation of single versus multiple land use functional approaches (e.g. diversion of intensive forestry and protective forestry) better than multifunctional land use
- Identification of critical thresholds (acceptable changes) on sustainable land use
- Improve land use visualisation tools

## Conclusion

Most of the RTD questions that came up during the discussions were related to social issues and only a few dealt with natural science knowledge gaps. There is substantial (sufficient to act) knowledge about global change effects on land use but: Knowledge transfer into action must be considered the major challenge for the future!

# CHALLENGES FOR SUSTAINABLE TOURISM

Harald PECHLANER and Frederic BERGER

## Executive Summary

Traditionally, in mountain areas, tourism activities are closely linked to meteorological conditions, natural risk prevention, transport infrastructure and the quality of the landscape. But in the future, all these components will be impacted by climate change. For example, global warming has and will have consequences on winter tourism via its impacts on the snow cover in terms of quantity, spatial distribution and duration. This will directly have repercussions on ski resorts' activities and winter tourism at a local and regional scale. As a result, ski resorts will be obliged to respond flexibly to the new exogenous conditions. One solution is to use snow guns and to produce artificial snow. Another is to offer alternative tourism activities. Finally, only the "viable" ski resorts which are able to offer constant solutions will be able to maintain their economic momentum. This is one of the situations which stakeholders and decision makers will have to face.

## Problem Statement

- The challenge for tourist areas is how to anticipate and to take into account global change in order to develop sustainable products. This cannot be done without taking into account changes in societal behaviour. For example, there is now a real conflict between fast-food and slow-food. Are we also observing this evolution in the field of tourism? Are we going to pass from "fast" winter tourism only based on consumption to a "slow" year-round tourism which is better balanced with the sustainable management of natural and human resources?
- Over the last 20 years thousands of pages - scientific and technical ones - have been written on sustainable tourism. Do we know everything about this subject? How can we now translate "nice and generous" ideas, scientific theories, and empirical tools into acts?
- One of the first acts should be to analyse this "grey" literature in order to make an efficient state of the art about the available theories, tools and data, to arrive at a better definition of what is a "sustainable tourism", who are the actors involved, at which scale the analysis has to be done and so on. The first approaches were usually based on single-factor studies.
- If we want to have a complete understanding of what is a sustainable tourism, a global approach is needed

and has to be developed by researchers and decision makers. The study of the globalism of sustainable tourism factors means that environmental, social, cultural, societal, security, economical and political factors will have to be investigated using multi-disciplinary and multi-scalar assessments.

- Up to now, nature has been used by the professionals of tourism activities only as a tool for generating a constant economical income. But tourists and local population have not developed the will for harmonious interaction with nature. On one hand, the local population wants to preserve its quality of life and expect a constant input from tourism, on the other hand tourists are looking for "authenticity" without leaving behind a ruined environment. So the status of the nature is changing passing from a mean to the perception of a support for tourism activities with the possibility of temporal and spatial evolution. In such a situation, a key question is how to identify and meet both hosts' and guests' expectations.



## Research Needs and Open Questions

- Which relationships, tools and data are valid, which methods are relevant for studying the current situation and for estimating future ones?
- Does sustainable tourism equate to sustainable environmental management? If yes, what will be the objectives of a sustainable tourism: to protect the environment for future generations? For a better quality of life but for whom? To "save" the planet? To ensure that tourists enjoy their vacation periods?
- How to equilibrate winter and summer tourism and for which reasons and at which scale? During the last century the period of tourism has switched from summer to winter, are we going to see in the not-too-distant future a new switch or the increase of a multi-seasonality offer? How to deal with a variety of tourist products in various destinations? What are the adoptive and adaptive capacities of tourist areas?
- Does sustainability mean only diversity of the offers

of the market? Does diversity of the offer mean resilience and resistance of the economic system supporting the tourism market?

- Which kind of adaptive strategies are suitable? Can a technical approach lead to a sustainable solution? Is it possible to replace snow with another surface for skiing (sand, grass...) and if yes, where and how? What will be the consequences from such a technical point of view? Do we know the real impact of artificial snow on biodiversity, water resources and quality, on the landscape and its attractiveness?
- How to identify and manage the trade off between ecological and economical issues between “hosts’ and guests’” expectation?
- How can we avoid “Indian Reservations” (cultures, settlements, landscapes fixed in ‘tradition’) that some tourists expect with regard to due “authenticity” and “originality”? How to assure that local development satisfies the demands of tourists? How to avoid conflicts of interest between tourists and local populations?
- How to avoid tourism concentration due to climate change and the concentration of the offer? What could be an alternative offer in winter?
- How to downscale climate data and scenarios to the local scale? Do we have the necessary data and tools?
- What is the role of agriculture in stabilizing local tourism economy and cultural landscapes?
- How to link agricultural and forest policies to the tourism ones?
- How to define and develop an adapted niche market?
- How to balance the concept of sustainability between a normative and a functional perception?
- How to integrate international questions? i.e. Central and Eastern European countries become a new destination for westerners so how to regulate mobility, to develop a sustainable travel policy?
- Are we going to see the development of a tourism offer benchmarking based on sustainability? If yes, what would be the criteria?
- Is it suitable to develop a sustainable tourism label? If yes, who will assign it, and which criteria and indicators will be used?



- Is sustainable tourism equal to ecological tourism?
- How to avoid conflicts of use between local development, local population and tourists with the development of new tourism activities such as mountain biking, for example?

## Solutions and Suggestions

### Future research should

- focus on integrative and participative approaches for a better planning of tourism offers;
- develop an efficient reflexive understanding of the challenges of sustainable tourism;
- develop adequate and adapted models to work on the linkage between policies that directly and indirectly influence land uses; participate in the governance of tourist areas;
- develop a multi-disciplinary network;
- identify which data bases are usable and propose the creation of an international network of experimental tourist sites;
- collect data on a long-term basis to be able to create an international data base for better evaluation of the real impacts of global change on tourism.
- This network of experimental sites should be set up in order to apply, validate and develop representative models, according to the situation.



# SUSTAINABLE TRANSPORT

Cristina PRONELLO, Luca CETARA and Axel BORSODORF

## Executive Summary

Transport is a main concern for sustainable development in a globalizing world, facing the challenges of global warming. Whereas the Alps and other Western and Southern European mountain ranges suffer by an overload of traffic (local, regional and transit traffic) with its consequences for the life quality of the people and the mountain environment, other mountain regions (in Eastern and South-Eastern Europe and other continents) urgently need more connectivity to assure the quality of life and future perspectives for the local people and the regional economy.

This discussion group aimed at identifying future research needs in the sustainable transport sector in mountain areas and at drafting recommendations for policy makers.

The discussion group was formed by experts who analyzed the following two main topics: transport data and transport infrastructures.

## Problem Statement

- More detailed transportation data are needed for environmental assessment, to perform an efficient environmental analysis and for strategic planning of national or regional transport;
- The problem is how to include specific questions in data collection to better understand the specific users' behaviour and the need to better customize transport policies and obtain more sustainable mobility, especially in mountain areas (also due to tourist implications).



- In general, transport supply data are available at the national level and some countries have some specific databases. On the transport demand side, the situation is more differentiated: in some western European countries national travel surveys are carried out regularly, while new EU member states generally do not collect traffic data and origin/destination modal data on a regular basis. In addition, all these data refer to residents' mobility and "not systematic transport demand" is not recorded. This lack is especially felt for mountain areas where tourist trips represent the highest share of mobility. Concerning freight transport, in western European countries, data collection is mainly performed in specific locations and periods of time (cross-sectional surveys). A common standard is still lacking and there is a strong need to develop a common methodology to design both passenger and freight surveys.
- Instead of collecting environmental data (e.g. on air pollution and noise), most countries tend to estimate them using ad hoc software for the calculation of emissions and noise. Continuous monitoring is not assured both in space and time. Therefore, there is a need to identify locations and to design a measurement network allowing the collection of appropriate data in sensible mountain areas. It can be useful to monitor environmental pressures linked to inhabitants and visitors' mobility.
- Occasional information is available on market segmentation, some studies are available in US and Europe on transport user profiles. Some are specifically focused on tourist mobility. For example, a recent study on tourist locations in Germany tried to analyze tourist behaviour. The different needs of tourists and inhabitants have been identified and the consequent research implication is to consider these with different clustering approaches. It would be important to foresee surveys including attitudinal and behavioural variables and investigating the chain trips, to understand if it is possible to find common policies for mountain areas or if policies have to be tailored for different users in different geographical areas.
- The topic of sustainable accessibility was analyzed in order to understand how to assure accessibility in less developed mountain areas, to support the economic development without compromising environmental integrity and avoiding mass invasion typical of highly frequented tourist locations.

## Solutions and Suggestions

- Consider the specificity of mountain areas from both environmental and cultural points of view.
- Keep some traditional transport modes in natural mountain areas in order to valorize their cultural richness, especially for tourists.
- Guarantee a minimum level of accessibility to inhabitants through investing in public transport systems and appropriate fares to obtain a modal split.
- Design eventual new infrastructures jointly with a mobility management system.
- Provide green taxes, appropriate economic instruments, pricing policies to control the access to the most sensitive areas and preserve their environmental value.
- Establish a common planning agenda for less developed mountain areas aiming at assuring a balance between trip times and cost to access the locations worthy to be developed.



- The development of a database of both transport and environmental data is suggested to have comparable data for mountain areas and encourage the sustainable development of these areas in the new member states.

## SCENARIOS OF GLOBAL CHANGE

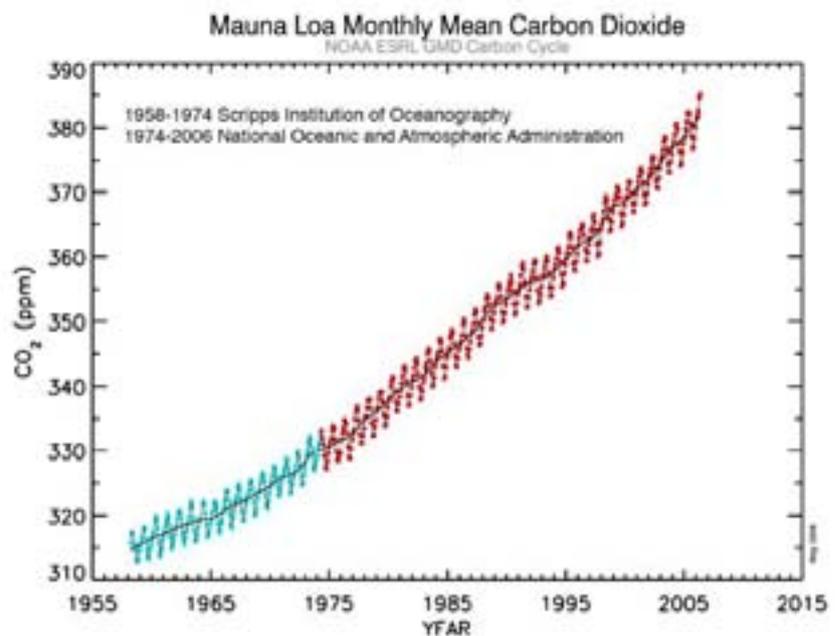
Christoph MATULLA and Hans STÖTTER

### Executive Summary

Ever since the current change of the Earth's climate was attributed to human activities (e.g. the flow of anthropogenic greenhouse gases into the atmosphere), questions related to the mitigation of the anthropogenic impact and to adaption measures have been raised. As such, is important to derive estimates of how the climate system of the Earth may react to different ways that mankind may progress in the future. These different pathways are formulated in so-called emission scenarios (i.e. the temporal run of greenhouse gas concentrations until the end of the 21<sup>st</sup> century). Emission scenarios are entered into computer models (so called climate models) that simulate the reaction of the climate system to enhanced greenhouse gas concentrations. Based on these scenarios of global change, meaningful discussions about what measures to take can begin.

Briefly, climate modelling serves as the basis of many applications

regarding the potential future of different ecosystems. For stable and useful results, not only one climate change scenario is needed, but a set of scenarios that cover a reasonable range of possible future evolutions. Hence, the generation of a set of climate change scenarios is a prerequisite of impact assessment.



## Problem Statement

- Climate models (GCMs) are the most sophisticated tool available to run long-term climate projections. Such projections are driven by so-called emission scenarios, which indicate how much greenhouse gases may be released into the atmosphere by mankind in the future. These depend on trends in energy consumption, population growth, etc. Different emission scenarios reflect different pathways how mankind may evolve.
- The climate system is complex. There are processes within the components of the climate system and between them. These processes take place at very different spatial and temporal scales. GCMs that simulate the climate system are just an approximation to the 'real' climate system of the Earth and have various shortcomings. Different GCMs (as developed in the USA, UK, Germany, Canada, etc.) have different weaknesses and strengths.
- Global change, climate variability and climate trends impact on seasonal cycles of plants and animals in the Alps. The phenological observational networks in central Europe including the Alps have been accumulating a wealth of data. Apart from phenological observations, historical records have been searched for phenological hints. Based on such data sets, relationships between biota, plants and animals and climate variability can be studied in depth and help to extrapolate possible reactions of plants and animals in a future climate. Relationships between climate variability and phenology are still to be fully explored in time and space.
- Within the GAW - DACH (Global Atmosphere Watch) cooperation between Germany, Switzerland and Austria, atmospheric trace gas concentrations have been monitored at background mountain observatories for at least 15 years. Trends of the background concentration of atmospheric trace gases represent an important reflection of the global trace substance budget, and allow conclusions about

changes of trace substance sources and sinks. The significance of these substances lies in their influence on geobiophysical processes, the radiation budget of the atmosphere and finally climate. The Alpine background observations offer a unique opportunity to study atmospheric trace gas concentration variations in their relation to atmospheric circulation and global trends of sources and sinks.

## Research Needs and Open Questions

- Is climate really an important factor of global change?
- Are socio-economic factors more important?
- Belief in climate change is bias by opinions; there is a difficulty in testing the inputs on the scenarios (no retrospective view).
- An improvement of the scenarios is relevant for policy makers.
- There is a need to better communicate associated uncertainties; thinking of secondary benefits of addressing climate change; stressing the importance of social models and a need to improve monitoring these.
- For mountain areas, it is most important to focus on regional models and scenarios.
- If the European Alps are in the focus enhance the grid resolution; better and more detailed data at the regional scale are needed.
- Input for the global circulation models: is there a need to refine various socio-economic models or is it better to concentrate only on regional socio-economic changes as they may be more important to regional climate impacts and adaptation strategies?
- What are the context models for?
- What are the scales, options, philosophy of those who apply them?
- For the derivation of regional or local scale climate change, information is necessary to apply downscaling techniques. Downscaling techniques are necessary to



translate the GCMs' results - which are meaningful on a continental scale but not for smaller regions such as the European Alps - down to the desired regional resolution, so that potential impacts on specific ecosystems can be assessed.

- Assessments of the future impact of climate on ecosystems are often based on ecosystem models which require climate change scenarios.

## Solutions and Suggestions

- The modelling of possible future states of the climate system should be based on a variety of socio-economic scenarios. A variety of so-called emission scenarios is necessary in order to span the wide range of possible futures of the climatic system.
- A reasonable attempt to assess the adaptation potential of ecosystems together with their uncertainties should be based on (i) climate scenarios spanning diverse scenarios of mankind's evolution (ii) more than one GCM, (iii) a set of downscaling approaches, (iv) more than one ecological model.

- Strengthen the systems analysis of emission scenarios of all types to evaluate, for instance, which can have a synergy effect, and which can „compensate“ each other.
- Provide a global control for the transfer of environmentally problematic technology from developed countries to other states/continents, given that their impacts will come back through global processes.
- Secure a strong „feedback“ and control as well as the revision of such decisions through professional and „social“ public „appraisal“.
- Foresee a „succession“ of scenarios, e.g. concentration or de-concentration of population in mountain areas with socio-economic consequences and compensations.
- Compensate decreased water accumulation in the mountains, in the form of snow and glaciers, by mountain reforestation.
- Enhance afforestation by using better adapted species
- Rise awareness and education
- Set up a CO<sub>2</sub> market
- Involve local communities, regions, policy makers, scientists and students.

## TOWARDS FUTURE MOUNTAIN DEVELOPMENTS: PUBLIC ATTITUDES AND SOCIETIES' ADAPTIVE CAPACITIES

Marcel HUNZIKER and Matthias BUCHECKER

### Executive Summary

Climate change, globalisation of the tourism market, and reduced state subsidies will significantly influence future mountain development and make mountain livelihoods more vulnerable. Thus, regional communities have to innovatively respond to sudden changes and optimally allocate their resources. The session strove to reach the following aims during three rounds of discussions: (1) to discuss and define the *issues, approaches and problems* society is confronted with regarding future mountain development; (2) to propose *research areas and questions* that should be considered in future research activities of the EU; (3) to suggest possible *scientific approaches* to deal with these research areas and questions; (4) to propose possible *outputs and outcomes* of research in this field as well as to suggest political/economical *instruments to implement* potential results.

### Introduction

Future mountain development will be subject to higher volatility due to climate change and its implications, an increasingly globalised tourism market and reduced subsidies for peripheral regions as well as for agriculture.



Thus, dynamics of land use change will increase, and mountain livelihoods will become more vulnerable. As a consequence, there is a widespread call for supporting adaptive capacity of mountain regions in order to empower regional communities to innovatively respond to sudden changes and optimally allocate their resources. But little is known about how to achieve this goal. How can the chances and risks of strategies be determined? Which role shall public attitudes towards and perceptions of global and environmental changes play, and which public shall be included? Which will be the contributions needed from experts and decision makers at different state levels? Which instruments, structures and legal tools are needed to efficiently negotiate accepted decisions?

## Aims of the Session

1. To discuss, criticise, re-define, change, supplement the before mentioned *issues, approaches and problems* (first round)
2. To propose *research areas and questions* that should be considered in future research activities of the EU (second round)
3. To suggest possible *scientific approaches* to deal with these research areas and questions (second round)
4. To propose possible *outputs and outcomes* of research in this field as well as to suggest political/economical *instruments to implement* potential results (third round)

## Results of the Workshop in Bullet Points

### ad 1) Discussion of the most relevant issues in the field

Principally the issues mentioned by the chairs in their introduction were well agreed. However, there were numerous refinements and supplementations as well as some critical questions.



1. **Meta-Issue:**  
Who defines the research issues? Scientists or society?
2. **Critical reflection of framework of bottom-up and top-down approaches:**
  - ‘Experts vs. local stakeholders’ is too simplistic and must be differentiated. The different approaches should be part of an iterative process.
  - „Top-down participatory approaches“: Are all the participatory processes just a result of social desirability within our research field? Is it finally a kind of „instrumentalism“? How much do we actually take into account people’s priorities and preferences? Do people care and matter about such processes at all? Finally: who decides, who benefits, who pays? The answers are unknown, but they are important since there are significant consequences!
  - Bottom-up approaches are also questioned due to the phenomenon of changing opinions (random effects) and the problem of causing conflicts by this approach. In addition, it is questioned whether the problem of conflicting goals on different levels can be resolved.
3. **Contributions to the key issue: How to make people involved in decision-making of local/regional governments?**
  - Decision-makers must agree with the necessity of such involvement and learn that the empowerment of all groups improves local/regional government processes.
  - Groups that are not involved, but should better be involved: females, young people, and political minorities. More inclusiveness can be achieved by local civic action and engagement.
  - The scale of decision must be considered: a nested process design might be helpful and interaction of steering is needed.
  - What group composition is adequate to make good decisions regarding costs of the process, its effects and quality? The relevant levels are important as well as the identification of stakeholders and adequate instruments.
  - Identification of the right mean of communication of results and knowledge.
4. **Knowledge and education**
  - What is the right level of knowledge needed for such processes?
  - Distinguish between and link together facts-knowledge and solution knowledge, local/indigenous and external/scientific knowledge
  - Dealing with uncertainties must be an issue of research

**5. Interaction between environment and perception:**

- It is important to take into account how the environment shapes the perception and attitudes of the people (see keynote of Elisabeth Meze-Hausken): comparative studies are needed!

**6. Other issues**

- Agricultural and tourist activities in mountains
- Optimization of economic activities and life in the mountains.
- Keeping landscape open and people in the valleys, development of cultural landscape
- Out-migration and abandonment, loss of innovation and ideas: how to establish connectedness to places?

**ad 2) Proposing research questions and scientific approaches regarding the issues**

In the following, the research questions and scientific approaches are again broken down into bullet points, synthesised and clustered.

**Proposed Research Questions:**

**1. Meta-Level:**

How can science, NGOs and stakeholders best collaborate on issues, visions, challenges (in a region)?

**2. Key question (as proposed by the chairs):**

- When is a bottom-up approach working, when is it needed? How can an optimal balance between top-down and bottom up be achieved, and how could a scale-nested, iterative decision process contribute to it?
- What is the right scale level of analysis?
- To whom trust is given and why, why not?

**3. Transfer of results and knowledge to the public (after a research project)**

- How to communicate results on global change to the public?
- How to translate scientific knowledge into policies?

**4. Question regarding best implementation strategies:**

- What are best incentives for furthering public-private partnership?

**5. Questions regarding the special issue „abandonment and out-migration“:**

- How can people/groups live together if they have strongly differing interests (ecological, economical conflicts!)? Imposition from outside necessary?

- Why do people leave their home, village, region? Personal motivation, economic or social pressure? Questions of heritage distribution? We do not know; maybe this is region/nation-specific.
- What promotes connectedness: Are incentives needed? To what extent will they be effective?
- Education systems: schools in regional language, more incentives to stay?
- Solutions of private public partnerships

**Scientific approaches**

- Scientific investigations must be supplemented by exploration of good practices.
- Comparative studies are needed, in particular regarding the situation in Eastern Europe.
- Anthropological studies are missing: need for more knowledge about social capital (living conditions, tradition, value systems etc.).
- Approaches and results of social-science studies should become a standard „counter-part“ of natural-science projects. System knowledge must tap all kinds of knowledge, not only about nature. In addition, long-term socio-ecological research is needed. Here lies a fundamental gap that must be bridged by mutual/social learning! Tasks: synchronize agendas, finding common language, training about the „opposite“ research disciplines.
- Framework conditions must be taken into account.
- Context relevant, applied research at various scales (geographical, political, socio-cultural).
- Case study approach is promising.

**ad 3) Identifying possible research output, outcome and implementation instruments**

In the following, ideas regarding implementation are again listed in bullet points, synthesised and clustered. Output and outcome was hardly discussed.

**1. Transdisciplinary research (could also be part of „Approaches“)**

- Transdisciplinary research is needed to improve decision making by taking into account the different kinds of knowledge
- Communicate research strategy and first results to stakeholders, politicians from the beginning of the project to improve acceptance of the results.

**2. Prerequisites for Implementation**

- Segment people to have an idea of group-specific interests.
- Identification of common criteria: consensus building!

- Enhance partnership for communication etc.
  - Scale: Panarchy approach (search for resilience alliance) at various levels.
- 3. Communication, transfer and actual implementation**
- Improve communication and understanding between the different experts to avoid misunderstandings.
  - Different communication strategies are necessary to serve the different steps of the research and transfer process.
  - Establish an interface between decision makers on local, regional, state levels.
  - Involve an „intercultural“ expert to understand the process.
  - Hand over results to people who will proceed implementing them.
- 4. Example „regional development“**
- Agenda 21 processes.
  - Development of local/regional systems can avoid or reduce local traffic and avoid „Outmigration“. But, infrastructure in these regions is needed for that.
  - Explore opportunities and constraints.
  - Development of the system of biosphere reserves.
  - Diversification of local products.
  - Lean government.
  - Adaptive management.
- 5. Example „natural hazards“**
- Develop new (legislative) methods to answer questions related to the increasing danger of natural hazards (due to climate change).
  - Do not care only about 150-year events, also about events with higher periodicity. Show people, which areas are affected in order to foster sensitivity regarding such events in general.





## INNSBRUCK DECLARATION

More than 350 participants attended the COST Strategic Workshop on Global Change and Sustainable Development in Mountain Regions in Innsbruck, Austria, on 7-9 April 2008. These leading scientists, practitioners, stakeholders and decision makers:

- recognize the enormous scientific expertise and human capital available in mountain regions,
- are convinced that this capital must be drawn upon to ensure timely responses to the challenges of global change (climate, demographic, economic, social, political and cultural) in mountain regions,
- emphasize that global change will have much stronger impacts in mountain than in lowland regions,
- highlight the importance of the mountains for ensuring protection against natural hazards and for providing water, energy, other natural resources, and recreational and touristic amenities for people living in the lowlands.

The participants request those responsible in the European and International Institutions, in Research, Political and Economic Programmes, and in National and Regional Corporations and Institutions to initiate, facilitate and expand their programmes and research strategies for mountain science in order to secure sustainable development under global change in mountain regions. The participants are convinced that such actions would sustain people's livelihoods not only in the mountains but also in the adjacent lowlands and across the continent of Europe.

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# RESOURCES

- Webpage <http://bfw.ac.at/mountain/>
- List of participants at meeting: <http://bfw.ac.at/rz/bfwcms.web?dok=7034>
- Keynotes / Presentations: <http://bfw.ac.at/rz/bfwcms.web?dok=6898>
- Webstream (generated by Astrid Björnsen-Gurung, MRI):  
<http://mri.scnatweb.ch/media/webcasts/cost-strategic-workshop-global-change-and-sustainable-development-in-mountain-regions-7-9-april-08.html>

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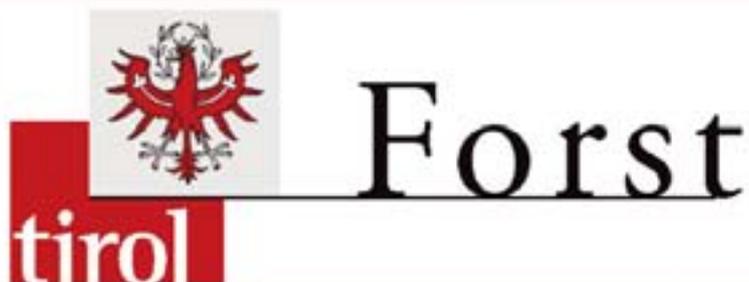


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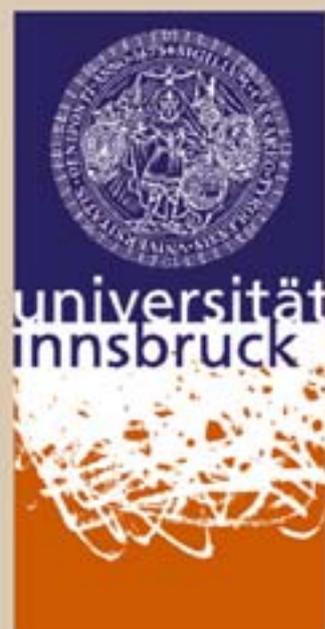
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