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BfN - Skripten 76

2003

FEDERAL AGENCY FOR NATURE CONSERVATION

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BfN-Skripten are not available in book trade.
An electronic version of this volume is available on the internet at www.bfn.de

Publisher: Bundesamt für Naturschutz (BfN)
Federal Agency for Nature Conservation
Konstantinstrasse 110
53179 Bonn, Germany
Tel.: +49 228/ 8491-0
Fax: +49 228/ 8491-200
URL: http://www.bfn.de

Printed by the printing office of the Federal Ministry of Environment, Nature Conservation and Nuclear Safety.

Printed on 100% recycled paper.

Bonn, Germany 2003

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1 Summary

After signing of the Convention on Biological Diversity (CBD) in 1992, sustainable use is considered as a cross-cutting issue and case-studies about the implementation within the framework of the Ecosystem Approach of the CBD are required. On the basis of those case-studies, Parties and Governments should develop ways to achieve the sustainable use of biodiversity. The study presented here, prepared within the scope of the R&D project "Developing Concepts for Sustainable Use in Selected Sub domains of Biological Diversity" aims at analysing the current state and use of high mountain ecosystems in Germany, considered as a case-study. The study investigates the compatibility of the sustainability principles of the Ecosystem Approach with the implementation of the Convention on the Protection of the Alps (Alpine Convention).

In the high mountain range of the Alps, climatic and geological conditions create an enormous variation of different natural ecosystems, each of them hosting a well adapted community of animal and plant species. The influence of different ice ages and the dynamics of glacial and periglacial processes are responsible for great parts of the actual morphology and appearance of recent landscapes. Next to natural conditions, human influence significantly shaped the alpine landscape. 2.000 years ago the regular use of alpine pastures became the dominant form of agriculture and resulted in some parts in a drawback of timberline to about 300 meters under the natural limit. This practise of alpine pasture (Almwirtschaft) is responsible for the typical impression that tourists bear in mind if they think of the Alps. Nowadays, winter tourism influences demographic changes: while urban centres in valleys and communities with mass tourism (especially in Bavaria and Switzerland) grow more than average, villages in remoter areas (especially in France and Italy) not only grow slower but loose inhabitants. Lots of farms were completely abandoned so that 24% of the alpine region are without human settlement today (BÄTZING 2002). In Italy, France, Slovenia and Germany the Alps are not only a kind of periphery in a geographical point if view, but in an economic, too. In Liechtenstein, Austria and Switzerland the Alps are in a central geographical and economical position.

The Alps consist of a mosaic of different types of ecosystems, that can be described along a vertical gradient of increasing altitude: valley bottoms with river beds, meadows, mountain forests, alpine pastures, alpine grasslands above timberline, and rocks in the summit regions.

Together with the bogs in various altitudes, the Alps host about 3.000 plant species (LAUBER & WAGNER 1998), 400 of which are endemic (GRABHERR 2001). Thus the Alps comprise about one third of the whole European flora.

The Alpine Convention is a legally binding document signed by all states participating in the mountain range of the Alps. In no other mountain range of the world a comparably binding framework for protection and sustainable use exists for the time being. The Alpine Convention covers and area of 190.912 square kilometres inhabited by 14.2 million people in 8 states, 53 regions and 5800 communities (BUWAL 2000). The Alpine Convention consists of a frame and thematic protocols. The frame defines the aims of the convention and the formalities of regular meetings and reports. The protocols cover specific thematic issues in depth. For the time being nine protocols have been agreed to:

the Nature Conservation and Landscape Management Protocol in 1994,

the Mountain Agriculture Protocol in 1994,

the Regional Planning and Sustainable Development Protocol in 1994,

the Mountain Forest Protocol in 1996,

the Tourism Protocol in 1998,

the Energy Protocol in 1998,

the Traffic Protocol in 2000,

and the Conflict Solving Protocol in 2000.

The possibility of developing further protocols or other means regarding the topics of Population and Culture, Water Management, Air Purity, and Waste Management are mentioned in the Convention (MOHR 2002).

Although the Alpine Convention was formulated not under the impression of the Rio summit in 1992, but years before the invention of the CBD and the Ecosystem Approach, it covers in its frame convention and the protocols the aims of the CBD, especially the conservation of biological diversity and the sustainable use of its components.

Principle 1 and 2 of the Ecosystem Approach demand, that management objectives should be a matter of societal choice and management should be decentralized to an appropriate level. The Alpine Convention clearly considers these demands in a sufficient way.

Principle 3 demands managers to consider the effects (actual or potential) of their activities on adjacent and other ecosystems. This demand is clearly formulated in the Alpine Convention and the protocols. Unfortunately, effective monitoring systems are still lacking and are often not even demanded. But to control the success of any managing effort, monitoring is inevitable, if doubling of mistakes is to be avoided and advice for best practice should be given. This monitoring must consider effects on an ecosystem base, no matter if borders of nations or districts have to be crossed.

Principle 4 demands that economic considerations have to be integrated in management efforts and Principle 10 calls for a balance between conservation efforts and sustainable use. The meaning of both principles is fundamentally integrated in the Alpine Convention and the protocols, as it is explicitly the aim of the Alpine Convention to protect and sustainable use alpine diversity. The different protocols recommend financial support for traditional and sustainable ways of land-use, forestry and agriculture if the overall market situation renders these ways less profitable.

Principle 5 calls for the protection of ecosystem functioning. The Alpine Convention as a whole takes into account that protection of the functioning of ecosystems is of greater significance for the long-term maintenance than just protection of species. The connection of alpine national parks into a network of protected areas expresses the understanding, that ecosystems have to be protected as a whole. Nevertheless, measures to strengthen or rebuild populations of single species threatened by extinction are added to the efforts.

Principle 6 demands that management has to be appropriately cautious and must respect the limits of ecosystem functioning. The Alpine Convention and its protocols agree on respecting these limits, knowing that mountain ecosystems are even more vulnerable and take longer to recover than other systems. Despite the consensus of respecting the limits, there is a lack of defining the carrying capacity and limits of

mountain ecosystems and again a lack of monitoring concepts to guarantee the keeping of environmental standards.

Principle 7 demands to take measures in an appropriate temporal and spatial scale. As all states partitioning at the mountain range of the Alps are members of the Alpine Convention, it can be seen as a perfect example of guaranteeing the adequate spatial scale for any measure, because the whole bundle of alpine ecosystems is part of the area, the convention covers.

Principle 8 mentions that objectives for ecosystem management should be set for the long term. As the Alpine Convention explicitly defines sustainability as main goal, the long-term approach is fundamental.

Principle 9 warns that change in ecosystems is inevitable and management has to cope with long-term changes, as e.g. climatic change. The Alpine Convention is well aware of the fact, that climatic change will have more dramatic effects in the Alps than in lowlands and urges parties to prevent soil erosion and avalanches by planting and protection of forests. Many changes that occurred in alpine systems in the last decades are man-made and hence not inevitable. The convention sees the need to stop these changes (e.g. by limiting road construction or expansion of skiing areas, by supporting traditional farmers).

Principle 11 and 12 demand to integrate all kind of knowledge and experience from all stakeholders into management measures. The convention and the protocols call for sharing of experience between all Parties and different data networks are already implemented. Participation of non-governmental organisations was essential in formulating the convention and protocol text and still is in coordinating measures and spreading information. Nevertheless, an announced protocol “People and Culture” is still missing.

As a result it can be observed that the Alpine Convention and the protocols consider nearly completely the demands formulated in the 12 Principles of the Ecosystem Approach of the CBD. Hence, the conceptual framework offers all possibilities to implement management measures that help to protect and sustainable use mountain diversity. As in so many cases, implementation of direct measures follows only slowly after agreeing on a common strategy or convention. Although the Alpine Convention can be presented as an example for other mountain regions as well, the process of implementation is quite slow (GÖTZ 1998). Ten years after signing the convention, still only three signatory parties have ratified all protocols (Liechtenstein, Austria and Germany in 2002). Furthermore, protocols for such important fields like “People and Culture”, “Air Purity”, “Water Household” and “Waste Management” are still missing although they were planned from the start. Entering into force of all nine existing protocols in December 2002 (after ratification by the three states Liechtenstein, Austria and Germany) will hopefully fasten the implementation process.

The Ecosystem Approach itself bears some implicit problems that render the implementation difficult: First of all, the wording of the principles and the guidelines is held so general that it can not be used as a direct *modus operandi* to implementation. Here, a need of concrete rules for action (or restraint from action) is obvious. Secondly, the Ecosystem Approach (Principle 1, societal choice, and Principle 2, decentralization) requires more or less democratic structures. Unfortunately, these structures are not given everywhere, sometimes especially not in areas with high biodiversity. Third, the Ecosystem Approach calls for an appropriate balance between conservation efforts and use in managing measures (Principle 10). This principle allows wide interpretation inasmuch as the need to use ecosystems (or to change and destroy them) directly depends on the economic needs of the state hosting the ecosystem under question.

Thus, the danger of justifying the destruction of biodiversity by economic needs is not banned. However, appropriate application of this principle in the spirit of the ecosystem approach should preclude such an interpretation.

The Ecosystem Approach sees humans as a part of most ecosystems and demands cautious management of ecosystems (Principle 6). Nevertheless, it must be accepted, that in some ecosystems the functioning can not be guaranteed (as demanded in Principle 5), if humans try to use the system or to become part of it. Principle 8 demands to consider future benefits and to favour long-term gains instead of immediate but unsustainable uses. Unfortunately, in many cases, those who renounce from immediate benefits can not be sure to benefit from future gains in a long term perspective or can not afford to abstain from immediate use due to vital economic needs. Signatory states must seek solutions that enable people to economize in a long-term perspective.

The ecosystem approach should be understood as a basic guideline for the integrated management of ecosystems but not as a *modus operandi*. Due to its highly theoretical organization, it is not adequate as guidance for concrete measures.

Nevertheless, it is certainly possible to successfully employ the approach for introducing the concerns of the CBD into relevant areas of politics.

2 Introduction

The Convention on Biological Diversity (CBD) pursues three fundamental, interconnected objectives:

- the conservation of biological diversity
- the sustainable use of its components, and
- the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The CBD defines "sustainable use" as "the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations." (SECRETARIAT OF THE CONVENTION OF BIOLOGICAL DIVERSITY 2001, p. 6). In this context "sustainability" describes a course for a constructive change that sustains and enhances biological diversity, ecosystem productivity and human welfare. Sustainable use is regarded as a cross-cutting issue and the Secretariat of the Convention on Biological Diversity (SCBD) called upon "to gather, compile and disseminate through the clearing-house mechanism and other means, case-studies on best practises and lessons learned from the use of biological diversity under the thematic areas of the Convention." (SECRETARIAT OF THE CONVENTION OF BIOLOGICAL DIVERSITY 2000, p. 115). On the basis of those case-studies, Parties and Governments should develop ways to achieve the sustainable use of biodiversity within the framework of the ecosystem approach. Parties are called to present progress reports for consideration by the Subsidiary Board on Scientific, Technical and Technological Advice (SBSTTA) prior to the seventh Conference of the Parties (COP7) to be held in Kuala Lumpur in 2004. COP 7 will give focus to mountain ecosystems.

This sub-study, prepared within the scope of the R&D project "Developing Concepts for Sustainable Use in Selected Sub domains of Biological Diversity" aims at analysing the current state and use of mountain ecosystems in Germany, considered as a case-study. The study investigates the compatibility of the sustainability principles of the Ecosystem Approach with the implementation of the Convention on the Protection of the Alps (Alpine Convention). A study on the sustainable management of forests in Germany has already been published within the R&D project (HÄUSLER & SCHERER-LORENZEN 2001).

In Annex A to its decision V/6 (SECRETARIAT OF THE CONVENTION OF BIOLOGICAL DIVERSITY 2001, p. 566) COP V of the CBD has defined the Ecosystem Approach as "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention." In paragraph 2 of Annex A it is recognized that "humans, with their cultural diversity, are an integral component of many ecosystems." This is particularly true in the cultivated landscape of Central Europe and in the Alps, where centuries of extensive use (cattle grazing during summer) have created a mosaic of ecosystems like alpine meadows or mountain forest patches. The diversity of the alpine landscape and flora would significantly decline if human use would be completely abandoned. In paragraph 3 it is expressed that the term "ecosystem" does not specify any particular spatial unit or scale but that ecosystem "means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit". In this context, mountain ranges like the Alps can be seen as ecosystems as a whole (because they act as functional units) or as a mosaic of ecosystems (like forests, meadows, rivers, glaciers, bogs). Each of these components influences the others and is influenced or threatened by human use or activity (land-use, tourism, traffic, climatic change). Decision

V/6 expresses that "the ecosystem approach does not exclude other management and conservation approaches, such as biosphere reserves, protected areas, and single-species conservation programmes". All conservation efforts mentioned here are implemented in parts of the Alps.

Box 1: summarises the goals of the ecosystem approach according to decision V/6 of the Conference of the Parties to the CBD (SECRETARIAT OF THE CONVENTION OF BIOLOGICAL DIVERSITY 2000, p. 36).

Description of the ecosystem approach:

1. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
2. An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.
3. This focus on structure, processes, functions and interactions is consistent with the definition of "ecosystem" provided in Article 2 of the Convention on Biological Diversity:
   „Ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."
   This definition does not specify any particular spatial unit or scale, in contrast to the Convention definition of "habitat" . Thus, the term "ecosystem" does not, necessarily, correspond to the terms "biome" or "ecological zone", but can refer to any functioning unit at any scale. Indeed, the scale of analysis and action should be determined by the problem being addressed. It could, for example, be a grain of soil, a pond, a forest, a biome or the entire biosphere.
4. The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of ecosystems and the absence of complete knowledge or understanding of their functioning. Ecosystem processes are often non-linear, and the outcome of such processes often shows time-lags. The result is discontinuities, leading to surprise and uncertainty. Management must be adaptive in order to be able to respond to such uncertainties and contain elements of "learning-by-doing" or research feedback. Measures may need to be taken eyen when some cause-and-effect relationships are not yet fully established scientifically.
5. The ecosystem approach does not preclude other management and conservation approaches, such as biosphere reserves, protected areas, and single-species conservation programmes, as well as other approaches carried out under existing national policy and legislative frameworks, but could, rather, integrate all these approaches and other methodologies to deal with complex situations. There is no single way to implement the ecosystem approach, as it depends on local, provincial, national, regional or global conditions. Indeed, there are many ways in which ecosystem approaches may be used as the framework for delivering the objectives of the Convention in practice.

The twelve principles for the sustainable use of biological diversity defined through the ecosystem approach shall be reviewed by case-studies. The present study will attempt to review the implementation of this approach to German high-mountain ecosystems. This review is based on the experiences made with the conceptual framework of the Alpine Convention and its protocols.

3 Mountains in Germany

Germany is situated in the central part of Middle Europe and covers an area of 357.021 square kilometres. It is inhabited by approximately 82 million people, that is a average of 230 persons per square kilometre (FISCHER 1999).

From a geological point of view, Germany can be divided into three regions, two of which are mountainous: the only region without mountains is the northern coastal plain (Norddeutsches Tiefland). This plain is the westernmost part of the east European plains, morphologically characterised by the influence of the glaciers coming from the north during the ice-ages. The northern plain covers about one third of the area of Germany. In the middle part of Germany a series of mid-elevation mountain ranges arise. None of these ranges is high enough to reach a climatic timber line and thus even the highest summits are naturally covered by forest. There are no glaciers in the mid-elevation ranges of Germany and snow melts in springtime. This zone of mountain ranges covers nearly two thirds of the area of Germany. Only in the extreme south, Germany participates in the high mountain range of the Alps. Here the gradient of temperature causes a series of typical alpine ecosystems (as described below). The highest summit in the German Alps is the Zugspitze with 2963 m.a.s.l..

Although Germany is a highly industrialized nation, 53% of its area are under agricultural use and 30 % are forest. Most of the forest areas are concentrated in the mountain regions, while the northern plain is nearly completely used for agriculture. The German population is not evenly distributed, but there are centres of agglomeration contrasting rural areas. The areas with the highest population densities are situated in the northern plain or at least north of the mountain ranges, e.g. Berlin (the capital), Hamburg, Köln (Cologne), Düsseldorf, or Hannover. Bigger cities in the south are in most cases situated in river valleys crossing the mountain ranges, e.g. Dresden (river Elbe), Frankfurt (river Main), or Stuttgart (river Neckar). Munich, as the biggest city in the south and Bavarian capital, is located in a depression directly north of the Alps. Hence, the higher elevations of the German mountain ranges belong to the areas with the lowest population densities.

In the mountain ranges, traditional economy was mostly based on forests. This included exportation of wood (e.g. to the Netherlands, when fleets were constructed), fabrication of furniture, or production of charcoal. In places, where ore was found, wood was used to fire the ovens (e.g. Black Forest). Especially in the south eastern ranges (Thüringer Wald, Bayrischer Wald, Fichtelgebirge) a local industry of glass production established, also using the forests as source for fire wood. As a consequence, the forest industry favoured reforestation with fast growing spruce instead of deciduous tree species. Although in the last decades forest policy changed back to the practise of propagating mixed forests, wide areas in the mid-elevation mountain ranges are still spruce monocultures (HÄUSLER & SCHERER-LORENZEN 2001).

Today tourism is an economic factor in some mountain ranges in Germany, especially winter tourism. The higher average temperatures in the winters of the last decade and missing snow already endangered this economy in mid-elevations. Summer tourism and selling of traditionally manufactured goods are also of economic importance.

In general, mass agglomerations and large industrial complexes are restricted to the northern plain or river valleys, while the mid-elevation mountain ranges are less dense populated and do depend on forestry and traditional small manufactures.

3.1 The Alps

From a geological point of view the 1000 km long and 200 km broad Alps are a comparatively young mountain range. Although the so called alpine orogenesis started 40 million years ago, the formation of a high mountain range began only 2 million years before today and is still going on. Disregarding all local differentiation, the Alps can be divided into two main regions (GLA 1981): the western Alps (built of limestone) and the eastern Alps (built of silicate material). The climatic conditions vary in a wide range due to altitude and slope, but also between central parts and edges. The central parts are significantly drier, because clouds are forced to rise when they reach the mountain range (REISIGL & KELLER 1994). Thus the northern and southern foothills get more rain than the inner-alpine valleys (e.g. valley of the river Inn). Local weather phenomena like cold falling winds or foehn (a dry wind) create a mosaic of local specialities overlaying the general trend of falling temperature and rising precipitation with rising altitude. Climatic and geological conditions create an enormous variation of different natural ecosystems, each of them hosting a well adapted community of animal and plant species. The influence of different ice ages and the dynamics of glacial and periglacial processes are responsible for great parts of the actual morphology and appearance of recent landscapes.

Next to natural conditions, human influence significantly shaped the alpine landscape. This holds true not only for the last decades of growing tourism and immense traffic. Signs of humans who already bred cattle and grew grain can be followed back until 7.000 years before today. 6.000 years ago men began to use the grasslands above timberline as pasture in summer time, but spent the winter in the valleys. This so called “Tranzhumanz” was practised as a kind of regular, seasonal nomadism until the last century.

2.000 years ago the regular use of alpine pastures became the dominant form of agriculture and resulted in some parts in a drawback of timberline to about 300 meters under the natural limit. This practise of alpine pasture (Almwirtschaft) is responsible for the typical impression that tourists bear in mind if they think of the Alps.

Demographic development in the Alps, based on the first fully documented census from 1871, shows a population growth from 7.8 million to 14.2 million inhabitants (in the area of the Alpine Convention, i.e. without big cities like Munich close to the Alps). But this growth was distributed unevenly. While urban centres in valleys and communities with mass tourism (especially in Bavaria and Switzerland) grew more than average, villages in remoter areas (especially in France and Italy) not only grew slower but lost inhabitants. Lots of farms were completely abandoned so that 24% of the alpine region are without human settlement today (BÄTZING 2002). In Italy, France, Slovenia and Germany the Alps are not only a kind of periphery in a geographical point if view, but in an economic, too. In Liechtenstein, Austria and Switzerland the Alps are in a central geographical and economical position.

Eight states are participating at the mountain range of the Alps: Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland. Figure 1 shows die area of the Alpine Convention, whereas figure 2 shows the percentage each state contributes to this area.

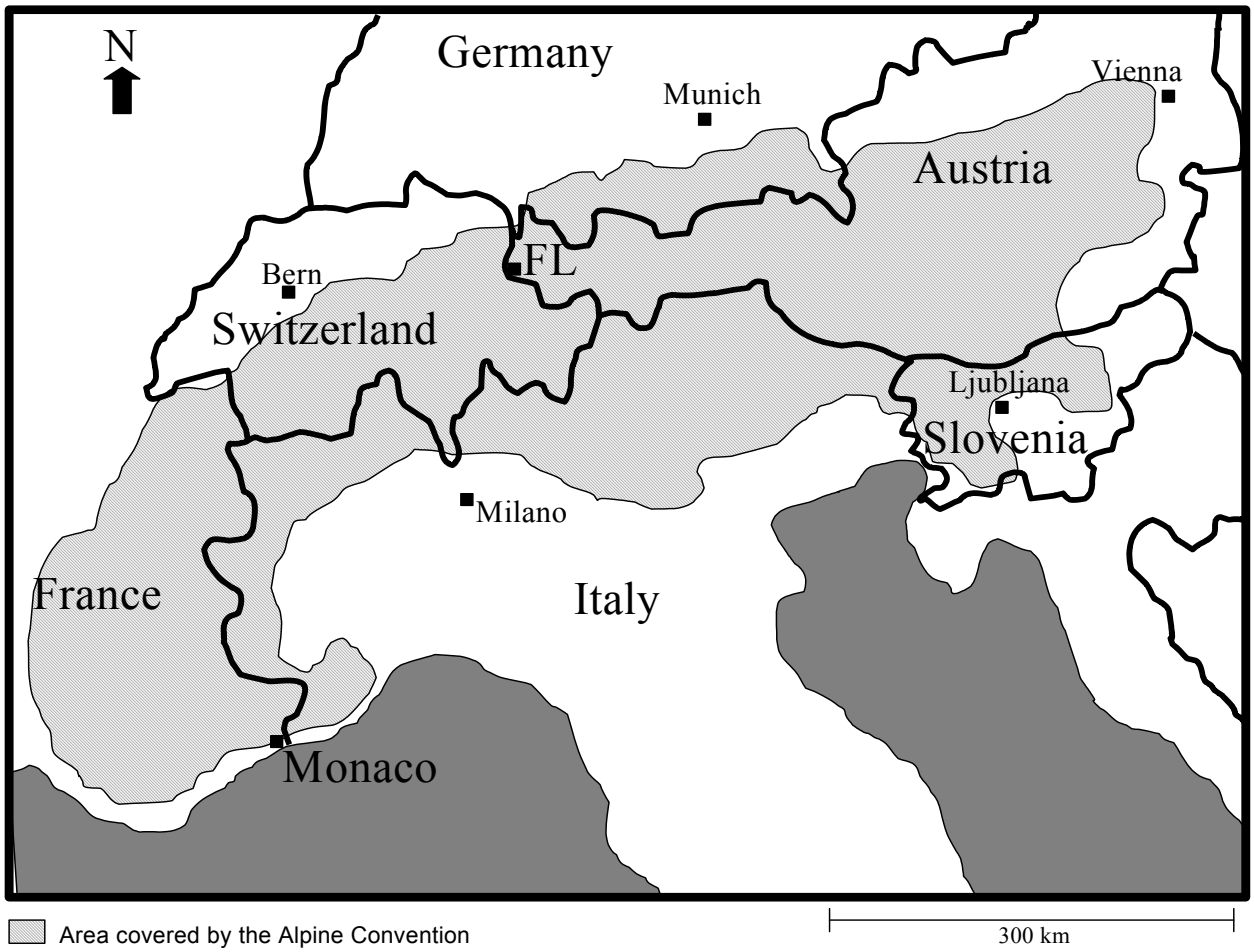

Fig. 1: Area covered by the Alpine Convention

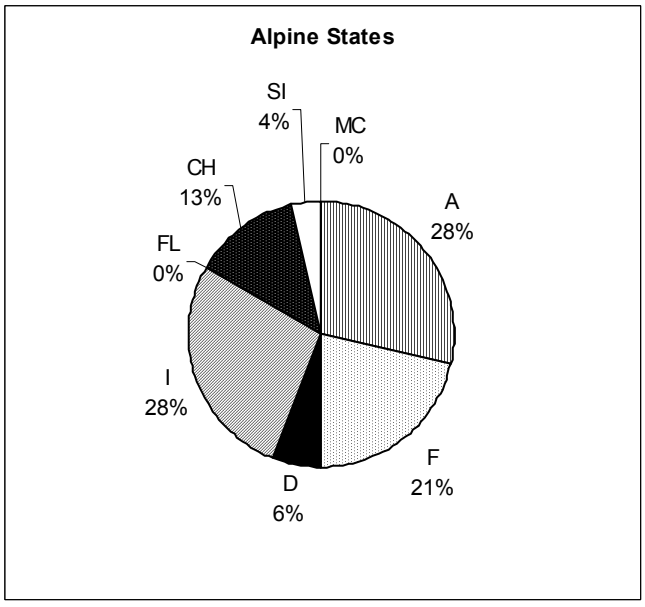

Fig. 2: Participation of alpine states to the area of the Alpine Convention (A= Austria, F= France, D= Germany, I= Italy, FL= Liechtenstein, MC= Monaco, SI= Slovenia, CH= Switzerland), (data from www.CIPRA.org)

At an European scale, the Alps are located in a central position. They have always been a barrier hard to cross, be that for the Roman army in historic times or for goods in the growing economy of the EU nowadays. Every good that is exchanged between Portugal and Austria or Denmark and Greece has to be transported across the Alps. This causes an immense amount of heavy traffic including all negative effects of noise, air pollution and road construction (MORODER 1998).

At the same time, the Alps are one of the most frequented tourist regions within Europe, especially in winter. On one hand, tourism is an important economic factor to many alpine communities, on the other hand tourism also causes problems in formerly undisturbed ecosystems. To save at least some areas from heavy impact, 13 national parks were created throughout the Alps. Table 1 shows the distribution and surface of these parks.

Tab. 1: Distribution and surface of alpine national parks (data from GAMBINO 2001)

State	Number of National Parks	Surface (in ha)	Percentage (in %)
Austria	3	215,700	27
Slovenia	1	83,807	10
France	3	213,139	27
Germany	1	20,776	3
Italy	4	248,628	31
Switzerland	1	16,887	2
Sum	13	798,937	100

3.2 Alpine Ecosystems

The Alps consist of a mosaic of different types of ecosystems, that can be described along a vertical gradient of increasing altitude: valley bottoms with river beds, meadows, mountain forests, alpine pastures, alpine grasslands above timberline, and rocks in the summit regions.

Together with the bogs in various altitudes, the Alps host about 3.000 plant species (LAUBER & WAGNER 1998), 400 of which are endemic (GRABHERR 2001). Thus the Alps comprise about one third of the whole European flora.

3.2.1 Valleys

Valleys have always been the preferred places for settlement due to milder climatic conditions and morphological reasons. In contrast to highly inclinated hillsides, valley bottoms can develop deeper and more fertile soils which allow an agriculture based on the production of grain. Breeding cattle was also always common. Valley bottoms were used to produce hay as winter storage while the cattle grazed on alpine pasture in summer. In the last century, industrialisation reached many alpine valleys and production of industrial goods became the most important economic factor. This included connection to traffic lines like railways and motorways. Problems of cross alpine traffic, sealing of larger areas and air pollution especially arise in valleys.

In most cases, valleys were influenced by rivers and had remarkable portions of riverine forest, gravel banks and regularly flooded meadows. As flooding was always seen as an economic loss and danger, measures to regulate river beds were commonly taken. Regulation of river beds and water levels led to a loss of riverine forests and gravel banks including the typical plant communities they bore. The Deutsche

Tamariske (German tamarisk, *Myricaria germanica*), a tree well adapted to flooding and mechanical impact of torrent waters carrying stones, is threatened in large parts of its former habitat. The "Flußschotterheiden" on gravel banks have become rare. Higher nutrient loads caused by agriculture (fertilisers) favour nitrogen indicating plants (like the stinging-nettle) and algae where a regime of cold and nutrient-poor water had dominated. Within the last fifty years the use of hydroelectric power led increased significantly. As a result, nearly 80% of alpine riverbeds are not natural any more (TÖDTER 1998) and consequently fish populations lost up to 50% of their original number (MUHAR et al. 2001).

But the impact of regulation of river beds is not only local. As a consequence of sealing of larger areas and of hindering rivers to flood valleys, a higher runoff directly reaches the foothills and bigger rivers like Rhine and Danube. The regular floods of the Danube in cities like Ulm, Regensburg or Passau (200 km north of the Alps) have part of their origin in the Alps, where the tributaries Iller, Isar and Inn come from.

3.2.2 Meadows

Meadows are grasslands used for hay production. This implies that cattle is not directly grassing on meadows and thus does not re-fertilise them by dung. Depending on altitude, the meadows were traditionally mowed one or twice per year. Due to the relief conditions, mowing was done by hand with scythes. This extensive way of farming created not only a common landscape aspect (meadows with typical small wooden shacks to store the hay), but also gave space to an extremely species-rich grass and herb community. More than 200 plant species can be found in the "Buckelwiesen" (meadows characterised by a relief of small humps) of the Bavarian community of Mittenwald (EU 2001). In the 1950ies, mechanisation reached the alpine agriculture and to make production more efficient, more than 90% of the 36.000 ha of Buckelwiesen in Bavaria were flattened. Even the rest was no longer cultivated due to economic reasons. Fertilisation and mechanic mowing changed the plant community and favoured common lowland species (e.g. *Trifolium* spec. or *Taraxacum* spec.) Recent initiatives try to re-animate farmers to keep up the traditionally mowing to save at least parts of the highly diverse meadows. Economic efforts try to establish a market for the aromatic hay in pet-shops ("Bergwiesenheu" for rabbits, chinchillas and other pets).

Meadows are typical for the submontane region (500-1400 m.a.s.l.).

3.2.3 Mountain Forests

In the montane region (1200-1700 m.a.s.l.) mountain forests are the dominating natural vegetation. More than 40% of the whole area of the Alpine Convention are covered with forests, in the German part of the Alps this means 300.000 ha of forest (i.e. 56% of the alpine region of Bavaria) (KELLER & BRASSEL 2001). The dominating tree species is spruce (*Picea abies*), combined with larch (*Larix decidua*), pine (*Pinus sylvestris, P. mugo, P. nigra, P. cembra*) and fir (*Abies alba*). Deciduous trees are maple (*Acer platanoides, A. pseudo-plantanus*) and beech (*Fagus sylvatica*).

In parts of the Alps, different phases of forest destruction could be observed (TÖDTER 2001): in the 15th – 18th century the exploitation of minerals caused an enormous need of charcoal. In the beginning of the 19th century the growing cities needed large amounts of firewood, while opening of international trade made export of wood attractive. Especially nations with fleets like France or the Netherlands imported wood from Switzerland. This wood was floated down the Rhone and the Rhine. The construction of rail-

ways in the 19th century additionally used wood. These trends did not stop earlier then in the fifties of the 20th century, when oil replaced wood as cheep resource for energy production.

Mountain forests have not only the economical value of the wood they produce, but combine other relevant societal functions that cannot be expressed in figures. They attract tourists and especially protect slopes from soil erosion. This means protection of settlements and traffic lines from mud streams and avalanches. The concept of "Schutzwald" (protection forest), where every kind of logging is abandoned is traditional and widespread. The locations of these protection forests are based on centuries of experience with avalanches. Catastrophes in recent years are partly caused by ignoring these experiences (e.g. construction of houses in areas that have never been used so far because of the high risk of avalanches).

The upper limit of mountain forests in many parts of the Alps is artificially lowered by the practice of alpine pastures. Due to recent abandoning of many mountain farms, the forest is spreading again. In an altitude of 1900-2400 m. a.s.l. climatic conditions enforce the natural timber line. The German expression "Krummholz" (cripple forms of *Pinus mugo, Juniperus communis*, *J. nana*) is used world wide to characterise the subalpine zone, where woody plants can survive the harsh winter conditions only by the help of a (comparatively warm) snow cover (REISIGL & KELLER 1999). This enforces lying growth forms of trees or flattened shapes of bushes (in the Alps *Rhododendron* species and other Ericacea).

3.2.4 Alpine Pastures

Alpine pastures are the result of a traditional way of rising cattle in the montane zone: summer was used to bring cattle up to the grassland at the upper forest limit, while the meadows in the valley were used for hay production. To tend the cattle and to treat directly the milk, houses were build, where the herdsman ("Senn") lived and produced cheese. This practise opened space, where forest had been and established a rich plant community of grasses and herbs. Small scale observation allows distinction of species well adapted to nitrogen input by cow droppings ("Lägerfluren").

In recent decades there is a trend to abandon this traditional form of agricultural practise, because it is economically ineffective (BROGGI 1998). Additionally, the life of a Senn is far from modern ideas of communication and life style. Thus, especially young people leave small villages and mountain farms are given up if the former owner gets to old. To stop this trend at least in part, programmes to support mountain framers were launched in different alpine states. Marketing strategies try to support typical products like cheese.

Some mountain farms have changed into restaurants or basic hotels, especially along hiking routes to famous summits. The open space around the buildings and the possibility to look around make a good deal of the tourist attraction. This would diminish, if the forest would come back.

3.2.5 Alpine grasslands above timberline

In the altitudinal gradient of alpine ecosystems the alpine grasslands follow the Krummholz-region of shrubs in 2400-3000 m.a.s.l. They are characterised by a long snow cover and thus a short vegetation period (only a few weeks between June and September). Soils are shallow and nutrient-poor. Under such conditions only well adapted plants can survive. The grasses are short and hard, often in tussocks. Herbs are small and do not invest much energy in producing great leaves, but try to flower quickly. Hence, the alpine grassland can only be used as pasture for sheep or goats in a short summer period. Many of these plant species are restricted to this zone and will not stand the concurrence of species from lower altitudes,

if climate change causes warmer conditions. The alpine grasslands are the most important habitats for alpine herbivores like chamois, ibex and marmot. Predatory birds like the Golden Eagle need this open terrain to prey e.g. on marmots.

The alpine zone is heavily influenced by tourism. In summer it is the preferred zone for hiking tours or paragliding. Disregarding the destruction of soil by stepping on pathways, the pure presence of humans causes stress to herbivores and forces them further upwards in less favourable regions. Winter tourism has even more drastic impacts: the alpine zone without trees and a guaranteed snow cover is the ideal region for large ski circuits. For that purpose, landscapes have been re-designed, i.e. rocks were removed, hillsides smoothed and lifts installed. Every use of heavier machines causes damage to soil and vegetation cover. To reinstall the vegetation cover of a new ski run, in many cases fast growing grasses were sowed. The resulting grassland is completely different from the original, considering species composition, plant diversity and living conditions for herbivores. Thus, even if a ski run is green in summer, it has little to do with alpine grasslands. The tendency to prolong the skiing season by using artificial snow worsens the situation. A shallow snow cover bears the risk of soil erosion, chemicals in the artificial snow change the nutrient status of soils and a prolonged season shortens the vegetation period.

At their upper limit, alpine grasslands are restricted to sites with comparatively good conditions, thus creating a patchwork of grass patches between the rocks of the subnivale zone.

3.2.6 Rocks

Rocks in different sizes from blocks to small stones are the characteristic underground for vegetation in the subnivale region. Depending on inclination, weather conditions and rock size, this underground is regularly in motion. Plants have not only to be adapted to harsh climatic conditions, but also to mechanical damage and a minimum of soil. Even if the number of species is not very high, each of them is specialised to extreme conditions and restricted to this habitat.

Processes of melting and freezing control the stability of rocky slopes. If climatic change leads to deeper melting of permafrost soils, consequences are unpredictable. Stone avalanches and destabilisation of slopes with the result of mud streams might inflict not only the mountain forest but also settlements or the infrastructure of lifts and cable cars.

3.2.7 Bogs

Independent of altitude, glacial processes created hollows that filled with water after the ice ages. Some are still lakes, other changed into bogs over thousands of years of slow growth of water plants (especially mosses). In the submontane and montane zone of the Alps as well as in the foothills many bogs could be found. Depending on the nutrient status and water regime, they hosted unique plant and animal communities. Bogs can not be used for agriculture and thus the practise of drying them by changing the water regime was common for centuries (not only in the Alps). Peat was used as burning material and medical purposes. Today only few untouched bogs are left and even they suffer from nutrient input from surrounding fields or rain. In some cases, measures to reinstall the original water regime by cutting the drainage are taken, but regeneration is uncertain and slow. A community of specially adapted plants and insects is heavily endangered.

3.2.8 Distribution of alpine Ecosystems

The different alpine ecosystems cover different parts of the area of the Alpine Convention. Figure 3 shows the proportional coverage of areas without (or very little) vegetation (i.e. rocks and glaciers), rivers and bogs, settlements (including traffic lines), meadows used for hay production, fields (of different use), alpine pastures and bushes at timberline, and mountain forest for the whole area of the Alpine Convention. (As data were taken from GÜTHLER 2001, Slovenia and Liechtenstein are not included.)

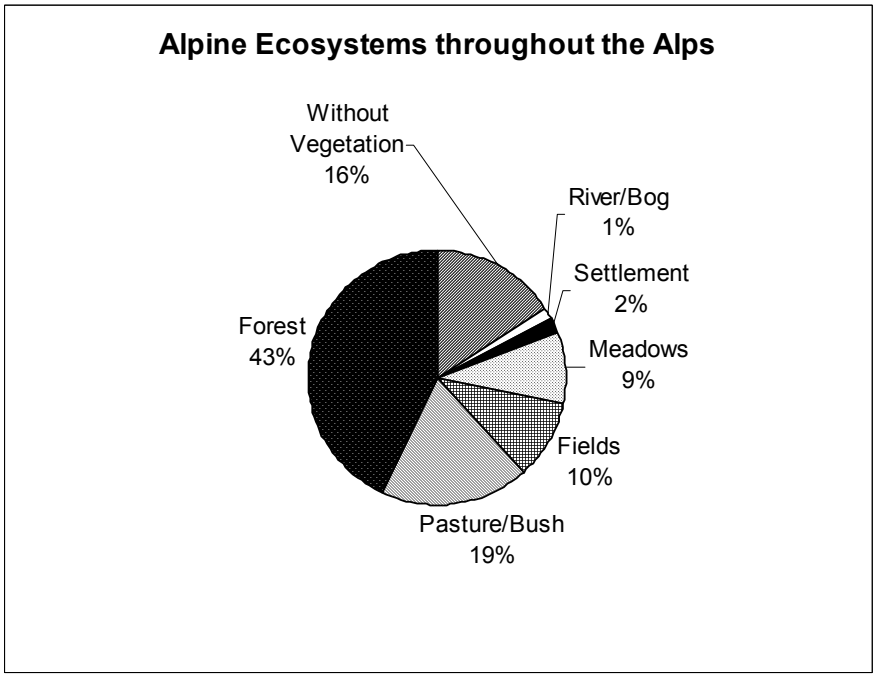

Fig. 3: Alpine Ecosystems throughout the Alps (based on GÜTHLER 2001)

Figure 4 shows the proportional cover of the same ecosystems for the German part of the Alps.

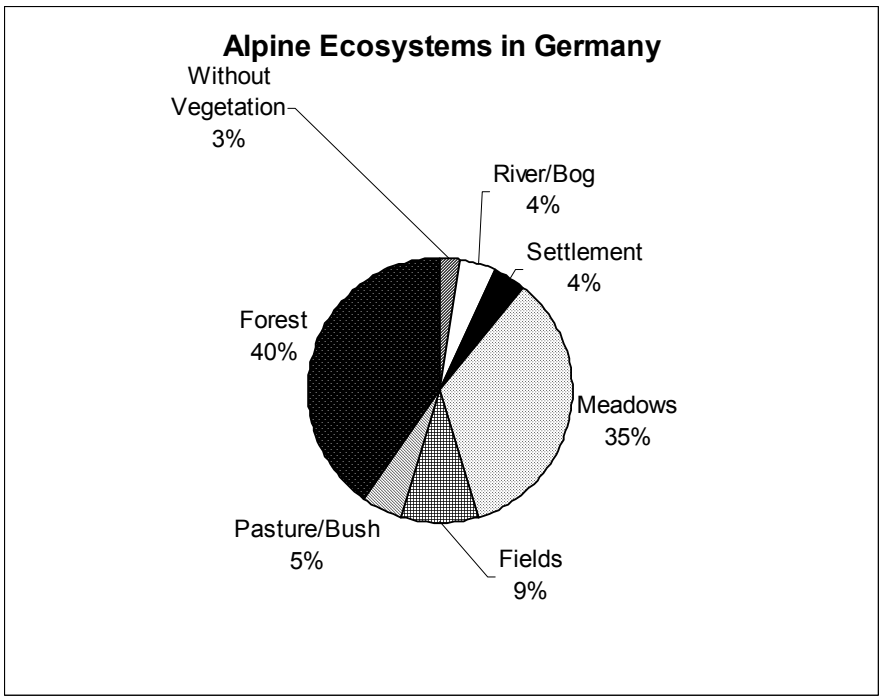

Figure 4: Alpine Ecosystems in Germany (based on GÜTHLER 2001)

Both figures illustrate, that large parts of the Alps are covered with forest. The percentage of forest would even be higher without human influence, because timberline is artificially depressed by grazing cattle. Reduction of traditional farming would decrease the percentage of alpine pastures. Throughout the Alps, the percentage of land, that can be directly used for agriculture and settlements is not much more than 20% (settlement, meadows, fields). These are the valley bottoms. Here, different interest of farmers, communities, tourism industry, traffic planers and nature protection collide. In the German part of the Alps, the percentage of meadows seems to be significantly higher, nevertheless, this is a result of including the foothills into the area covered by the convention (and into the statistics). The same reason leads to a percentage of areas without vegetation in the German Alps lower than throughout the Alps as a whole. Although rivers and bogs host unique species and species communities, they cover only a small percentage of the area. Even small-scale disturbances therefore result in destruction of great parts of these ecosystems.

4 Conceptual framework: The Alpine Convention and its Protocols

The Alpine Convention is a legally binding document signed by all states participating in the mountain range of the Alps. In no other mountain range of the world a comparably binding framework for protection and sustainable use exists for the time being. The Alpine Convention covers and area of 190.912 square kilometres inhabited by 14.2 million people in 8 states, 53 regions and 5800 communities (BUWAL 2000). The signatory parties of the convention are:

The Federal Republic of Germany

The French Republic

The Republic of Italy

The Principality of Liechtenstein

The Principality of Monaco

The Republic of Austria

The Swiss Confederation

The Republic of Slovenia

as well as

The European Community.

The process of developing an agreement on mountain protection started as early as 1951, when the International Commission for the Protection of the Alps (CIPRA) was founded (SPEER 2002). This non-governmental organisation always had the aim to initialise an international alpine convention. In 1987 the German section of CIPRA formulated proposals for such a convention and in 1988 a conference in Lindau (Germany) tried to define the aims of a common environmental policy for the Alps. In 1989 the German minister for environmental affairs Dr. Klaus Töpfer (today president of UNEP) invited his colleagues of all alpine states to a meeting in Berchtesgaden (Bavaria). This meeting resulted in a resolution of 89 points that comprised the basis for the Alpine Convention as such. The convention was signed in 1991 by Germany, France, Italy, Liechtenstein, Austria, Switzerland, and the EU. In 1993 Slovenia joined the convention, while Monaco signed in 1994.

The Alpine Convention consists of a frame and thematic protocols (HAßLACHER 2002). The frame defines the aims of the convention and the formalities of regular meetings and reports. The protocols cover specific thematic issues in depth. For the time being nine protocols have been agreed to:

the Nature Conservation and Landscape Management Protocol in 1994,

the Mountain Agriculture Protocol in 1994,

the Regional Planning and Sustainable Development Protocol in 1994,

the Mountain Forest Protocol in 1996,

the Soil Protection Protocol in 1998,

the Tourism Protocol in 1998,

the Energy Protocol in 1998,

the Traffic Protocol in 2000,

and the Conflict Solving Protocol in 2000.

The possibility of developing further protocols or other means regarding the topics of Population and Culture, Water Management, Air Purity, and Waste Management are mentioned in the Convention (MOHR 2002).

Ratification of the frame convention and entering into force followed 1995 in Germany, Austria, Slovenia and Liechtenstein, 1996 in France, 1998 in the EU, 1999 in Switzerland and in Monaco, and 2000 in Italy. Liechtenstein, Austria and Germany (all in 2002) already ratified all nine protocols. The wording of the protocols says, that each protocol enters into force three months after ratification of at least three members. Hence, all protocols will be binding for the three ratifying states beginning December 2002.

The most important and powerful committee within the Alpine Convention is the Alpine Conference, a meeting of all signatory parties held every other year. The Alpine Conference decides about adoption of protocols or fiscal measures, about formation of working groups and about reception of scientific data and conclusions, as described in Art. 5 and 6. The chairmanship changes every other year between the Parties. Art. 9 declares that the Alpine Conference may decide by consensus on the establishment of a permanent Secretariat. The VII. Alpine Conference decided in November 2002 that the Secretariat will be located in Innsbruck with a branch office at the European Academy in Bozen. It will start its work in 2003. For the next two years Mr. Noël Lebel (France) will act as the Secretary General on an interim basis.

Eleven years after the first signature, the Alpine Convention is discussed as an example for other mountain regions. In 2002, during the International Year of Mountains, a meeting again in Berchtesgaden was held under the motto “The Alpine Experience- an approach for other mountain regions?” Especially representatives of eastern European States and from Asia wanted to share the alpine experience in the attempt to initialise comparable processes in the Carpathians, the Caucasus or the Hindukush-Himalayan region. A conference for “Community development in central Asian mountains” held in September 2002 in Bishkek (Kirgistan) decided to establish a community network for central Asian mountains like the Alliance in the Alps. The timetable set June 2003 as the date for official founding in Tadshikistan (www.cipra. org., alpmedia newsletter 29, 2002). Hence, the Alpine Convention is not only of regional importance for the Alps itself, but is object of world wide interest.

5 The Ecosystem Approach of the CBD

In the following, the 12 principles of the Ecosystem Approach of the CBD will be cited in their original wording. For each principle it will be investigated, how far the ideas and rationales of the principle are considered in the frame of the Alpine Convention and the nine additional thematic protocols. Examples and problems of implementation will be given with focus to Germany but also considering other states sharing the convention.

5.1 Principle 1

The objectives of management of land, water and living resources are a matter of societal choice.

Rationale: *Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.*

Art. 2 (2a) of the Alpine Convention asks the Parties that they shall attain the objective of the Convention with a view toward "insuring the respect, preservation and promotion of the social and cultural identity of the population living in the region, the guarantee of its fundamental resources, notably, the habitat and an economic development respecting the environment; this as well as the encouragement of mutual understanding and cooperative relations between the populations of the Alps and those of extra-Alpine regions."

Thus the Convention provides an institutionalised mechanism of actively involving the relevant alpine regions in decision-making processes. This is further substantiated in the different protocols to the Alpine Convention. Their preamble paragraphs state, that the local population must be entitled to define their ideas of the societal, cultural and economic development on its own and to contribute to their implementation. In special articles on the participation of the local communities every protocol ensures their involvement in the different stages of the preparation and implementation of the policies and actions that are to be met. They are also said to participate in the evaluation of the provisions of the various protocols. The Regional Planning and Sustainable Development Protocol declares that if the communities cannot carry out those policies and actions due to national or international responsibilities, they have to get the chance to effectively depict the interests of their population (Art. 4. 3). Art. 4 (1) of the same protocol asks Parties to remove impediments that hinder local communities from international cooperation. Plans and programmes will be established by or with the responsible local communities under participation of neighbouring communities and harmonized between the different territorial levels (Art. 8).

The Mountain Forest Protocol explicitly obliges the Parties of the Convention to cross-border cooperation of all relevant authorities, especially those of the sub regional and local levels to ensure that the objectives of the protocol are being implemented (Art.4b).

Art. 10 (1) of the Nature Protection and Landscape Management Protocol claims the reduction of impacts and pollutants by consideration of the interests of the local population. Art. 11 (4) asks for the compensation of special efforts of the local population in the context of protected areas.

Thus the Alpine Convention tries to implement principle 1. Nevertheless especially in the alpine region a societal choice is hard to achieve due to the high number of stakeholders and the enormous varieties of interest.

The fact that the Alps are the largest barrier to traffic within the European Union results in a conflict of interests of the EU as a stakeholder on one side and people living next to main traffic lines or local communities who want to attract tourists on the other side. Considering these conflicts and the destructive effects of traffic the Traffic Protocol to the Alpine Convention obliges Parties not to build any new main roads for through traffic (Art. 11) but optimise and modernize railway systems and combined systems (Art. 10) to match the challenges of growing traffic within the EU.

Due to the richness of different landscapes and ecosystems the Alps are one of the main tourist attractions within Europe. This holds true in every season but extraordinarily during winter time when ski tourism is the most important economic factor in many alpine regions. The understandable economic interests of local communities are confronting the interests of nature conservation, especially when artificial snow is used to prolong the skiing season, when hillsides are re-designed to optimise skiing conditions or when helicopters are used to reach even remote areas (KNÜSEL 1998). The Tourism Protocol to the Alpine Convention obliges Parties to mark zones where any form of tourism is banned (Art. 10). Nevertheless the protocol does not forbid hillside design but only urges Parties to abstain as far as possible from such measures (Art. 14. 1). Helicopter skiing as well is not forbidden but Parties should reduce it as far as possible (Art. 16). These articles allow interpretation and thus are not clearly binding. Production of artificial snow is allowed during cold periods (Art. 14. 2), but there is no criterion to define what "cold" means.

With respect to the management of ecosystems for their intrinsic values and their tangible and intangible benefits for humans, one central conflict overlays the management decision. A good part of the alpine biodiversity-rich ecosystems has been established by man and an adaptive agricultural practice of mowing and grazing. With an economically and structurally induced decline of the alpine agriculture, the question arises, if alpine meadows and other man-made biotopes that are no longer subject to use, should be left to succession or saved by landscape management ('Landschaftspflege') practices to keep the traditional landscape pattern. Many people regard the return from a cultural to a natural landscape as a backlash. In the Mountain Agriculture Protocol the Parties agree on the aim to keep up traditional farming systems, especially cattle grazing (Art. 10. 1), to ensure genetic diversity of local races of domestic animals and useful plants (Art. 10. 3), and to support this financially (Art. 7).

The Alpine Convention provides a framework that corresponds well with principle 1 of the ecosystem approach. Nevertheless a societal choice for a region as diverse as the Alps is hard to find.

5.2 Principle 2

Management should be decentralized to the lowest appropriate level.

Rationale: *Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge*.

The Alpine Convention can be seen as a new model of regionalization: one geographical supra-region delineated by physical criteria with several cultures and ethnia but with common problems and interests. The Alpine Convention is a response to centralizing tendencies in Europe.

To put the objectives of the Alpine Convention into practice, different structural and political levels have to be involved, e.g. the levels of the Convention, of countries, regions, communities. The Alpine Convention and its protocols ask the Parties to decentralize management to the lowest hierarchical level (e.g. Art. 7 (1) Regional Planning and Sustainable Development Protocol or Art. 3 (2) Nature Conservation and Landscape Management Protocol). So according to subsidiary, Art. 2 (a and b) of the Regional Planning and Sustainable Development Protocol asks the Parties to strengthen the capability of acting of local communities and to develop specific regional structures and strategies. Art. 8 (2) obliges Parties to develop plans and programmes at the level of the relevant local communities.

Stakeholders at national level are the signatory nations with all their respective administrative subordinated governmental administrations and planning authorities on national, regional and local level. In Germany the administrative units of the territory of the Alpine Convention are in Oberbayern (Upper Bavaria): the city of Rosenheim, the districts of Tölz-Wolfratshausen, Berchtesgadener Land, Garmisch-Partenkirchen, Miesbach, Rosenheim, Traunstein, Weilheim-Schongau and in Schwaben (Swabia) the cities of Kaufbeuern, Kempten, Lindau (Lake Constance) and the districts Oberallgäu and Ostallgäu.

The protocols to the Alpine Convention try to take into account the rationale of principle 2 that local interests have to be balanced with wider public interests. Although extension of public transport facilities is defined as a public interest in the Traffic Protocol (Art. 9), Art. 11 of the same protocol guarantees sufficient possibilities for individual traffic in regions where public transport is inefficient due to geographic conditions or settlement structure.

In its preamble the Mountain Forest Protocol recognizes that mountain forest is the kind of vegetation that most effectively protects settlements from avalanches, erosion, and mud streams and therefore has to be treated with extreme caution. This public interest may confront the economic interests of private forest owners. As a balance Art. 11 (2 and 3) obliges Parties to compensate the disadvantages of forest owners.

Art. 4 of the Mountain Agriculture Protocol states the important role of agriculture in the creation of the highly diverse landscape mosaic throughout centuries. To conserve this mosaic, Art. 7 promises financial support to an extensive form of agriculture (cattle grazing and mowing) and in Art. 11 Parties document their will to encourage marketing strategies for agricultural goods produced in a sustainable way, e.g. by creating quality labels.

As a pilot project to verify, how the provisions and objectives of the Alpine Convention and its protocols can be put into practice on the community level, the CIPRA has established as a pilot project the community-network ‘Alliance in the Alps’. This network started with 27 pilot communities in seven countries and now has grown to 55 members representing 141 alpine communities (ALLIANZ IN DEN ALPEN 2002). Methodically this project follows the rules of the EC eco-auditing for enterprises (EU-VO 1836/93), that for the first time is being tested for its applicability on the community level. The eco-auditing process comprised the setting up of an environmental policy, environmental assessment, the fixing of practical actions in an environmental programme, and the working out of an environmental management system.

The 27 pilot communities have built up a communication network concerning the issues of environmental protection and sustainable use. Guidelines were decided to support, inter alia, some sustainable use projects, e.g. the introduction of an eco-label for tourist enterprises, the creation of markets for regional products of sustainable agriculture, the establishment of a decentralized monitoring and information exchange system as an essential building block to guarantee the continuity in the transfer process of the Alpine Convention.

In Germany, six members joined the network (Bad Reichenhall, Großweil, Mittenwald, Oberammergau, Oberstaufen, Schliersee), representing nearly 50.000 inhabitants and an area of more than 40.000 hectares (ALLIANZ IN DEN ALPEN 2002).

The Alpine Convention and its protocols try to enable a decentralization and to balance different interests. Nevertheless, the Alpine Convention is kind of a top-down approach and therefore might be refused by some local stakeholders seeing their personal interests endangered.

5.3 Principle 3

Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Rationale: *Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises*.

No ecosystem is independent of surrounding ecosystems, every system is connected to others. This might be direct spatial contact, connection via migrating animals or large scale connection via water and nutrient cycles. In a mountain range with such a high relief energy as in the Alps every system is directly connected to and influenced by the neighbouring system uphill. Glaciers from the summit regions, stone and snow avalanches from steep flanks heavily influence mountain forests in mid elevations, while soil erosion from deforested hillsides transports material to valley bottoms. Management of rivers (e.g. barrages and water reservoirs) has direct consequences on the riverside forests downstream. Nutrient input from agriculture is a substantial threat to bogs. Tourism not only touches the region itself but has large scale effects by directing traffic. Traffic jams hundreds of kilometres north of the Alps each weekend in winter time are a consequence of intense ski tourism attracting people from as far away as the Netherlands.

There are some well documented examples of how biodiversity management interventions have caused unwanted biodiversity ecosystem effects. For instance, since decades a natural rejuvenescence of the alpine fir population cannot take place in consequence of increased roe deer and chamois populations. Also by the traditional alpine forest pasture often greater proportions of deciduous trees have been selected out of natural mixed deciduous-coniferous forest. Especially in nutrient-poor habitats ruminants are responsible for additional nutrient run-offs out of the ecosystem.

Further examples are provided by water construction: dams and water intakes in the Alps have reduced the boulder delivery and heavily changed the water regime. For instance, the Isar river in its lower and middle course but also large parts of the upper course have been heavily impacted by water construction and water intakes for water power plants. The “Pupplinger Au”, the “Ascholdinger Au” (Wolfratshausen) and the nearly 20 km long river section between Krün and the Sylvenstein reservoir are the three last lar-

ger by-passes on the upper Isar. Although the water conduit has been reduced the Deutsche Tamariske (German tamarisk, *Myricaria germanica*) can already be found here in all age classes; below the reservoir it nearly has become extinct.

Since 1990 at the Krün barrage the Isar river gets a rest water amount of 3 to 4,8 cbm/s in summertime. Thereby, the partly dried up Isar regained a full time superficial water supply. But this management action has also proven problematic. The amounts have not sufficient force to rearrange the gravel banks. Moreover, the nutrient load of the water is high and produces an overproduction of algae. The river bed, until 1990 marked by nutrient-poor conditions, is now threatened to become rapidly overgrown by herbs, grasses and shrubs. The nitrogen indicator stinging-nettle (*Urtica dioica*) is rapidly spreading. The typical flora is getting suppressed and the water regime heavily changed.

The planned construction of water power plants in the Lech river tributaries does not only threaten the singular river landscape of the Austrian upper course; moreover, all ongoing restoration efforts for the German middle and lower course would become in vain. The Lech river still shows the whole habitat spectrum of a boulder rich Alpine river. The Lech river (upper Lech together with the "Litzauer Schleife" in the middle course and the "Flußschotterheiden" of the lower Lech) forms the Lech biotope bridge between the Alps and the secondary chains of mountains that harbours four plant kinships (TÖDTER 1998):

> plants that have their main distribution in the Alps but spread along the Lech river wide into the promontory
>
> plants, that invade the Alps along the Lech river from the calcarous hills of the "Schwäbische Alb" and "Fränkische Alb";
>
> plant populations whose habitats in the Alps and in the "Alb" are connected by the Lech river;
>
> plants that have their central european distribution focus in the Lech river valley.

With different provisions the Alpine Convention and its protocols demand that ecosystem management should take into account the effects of their activities.

The Energy Protocol demands in Art. 7 (1) that any management practices in the context of water power plants have to ensure the ecological functional capacity of the running water system and should minimize landscape damage. Passages for migrating organisms have to be guaranteed. Parties agree in Art. 13 to cooperate and consult each other if management activities have cross border consequences. Art. 8 urges Parties to use the best available techniques to reduce emissions from fossil fuel energy plants.

Art. 11 (3) (protected areas) of the Nature Conservation and Landscape Management Protocol asks for the establishment of special protection zones that allow undisturbed ecological processes to take place; all management impacts should be avoided that counteract the ecological processes in these zones. Art. 12 (ecological networks) asks Parties to establish a national and trans-national network of protected areas, biotopes and other protected and protectable objects and to harmonize the management efforts for the preservation of that network. Art. 13 (1) (conservation of biotope types) asks for those management interventions that ensure the conservation of natural and near-natural types of biotopes in sufficient extent and in a functional spatial distribution. In Art. 16 the Parties agree to support the re-introduction of native plant and animal species, subspecies and ecotypes, if this does not imply intolerable impacts for nature and landscape.

Parties recognize in the preamble to the Soil Conservation Protocol that soil conservation has consequences to a lot of other policies and thus has to be coordinated between different resorts. Art. 11 of the protocol asks for an ecosystem management that repairs effects of former adverse management activities on ecosystems by restoring areas that are endangered by erosion. Art. 12 and Art. 13 oblige the Parties to agricultural, grazing and silvicultural practices that prevent erosion and other damages to the soil ecosystem while Art. 14 (1) urges Parties to manage tourist activities in a way that does not affect the soils. Art. 14 (2) regulates that artificial snow may not contain any chemical ingredients which might influence soils negatively. Art. 1 of the Mountain Forest Protocol asks for sustainable forest practices that prevent soil erosion. In both protocols the interlinkage of the ecosystem components soil and forest is clearly expressed and management practises are urged to consider the consequences in each direction.

In the preamble to the Tourism Protocol Parties state that tourism is the main economic factor in many alpine regions. Parties also recognize that to keep this factor sustainable, tourism management has to consider conservation interest and landscape management (Art. 6. 1). As expressed in the preamble, Parties know that a basis for alpine tourism is the mosaic of different landscapes and specific cultural features. Thus, any management activity has to keep in mind the linkage between the policies of tourism, traffic, agriculture, forest management and energy (Art. 3).

Hence, the protocols and the convention itself urge ecosystem mangers to consider effects of implemented measures on adjacent ecosystems. Nevertheless, examples from the Alps show that the consideration of negative effects was often neglected in the past.

5.4 Principle 4

Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

(a) Reduce those market distortions that adversely affect biological diversity;

(b) Align incentives to promote biodiversity conservation and sustainable use;

(c) Internalise costs and benefits in the given ecosystem to the extent feasible.

Rationale: *The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems. Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.*

The economic use of the alpine forestry and agriculture is clearly limited by geomorphological constraints as referred to by Art. 2 (g and h) of the Alpine Convention. The mountain farmers have to spend more time to get lower revenues in a shorter season than their colleagues in agriculturally more favoured landscapes. However, in coping with the difficult conditions they created unique biodiversity-rich alpine biotopes. These man-made biotopes and the diverse cultural alpine landscapes they form are one of the major reasons that attract millions of tourists every year. Although the mountain farmers therefore massively

contribute to the profit of the alpine region, they are financially disadvantaged. As a consequence many alpine farms have been abandoned or lack successors.

As mentioned in the rational of principle 4, a threat to biological diversity lies in the replacement of sustainable and traditional forms of land use by economically more attractive forms. In many alpine regions skiing tourism is the most important economic factor and construction of ski runs, lifts, and hotels has not only destructed parts of mountain forests but renders traditional farming even less attractive.

To counteract this market failure, the Alpine Convention protocols for Mountain Agriculture, Nature Conservation and Landscape Management, Regional Planning and Sustainable Use, and Mountain Forest suggest strategies to integrate economic interests and ecological necessities.

Art. 1 (h) of the Regional Planning and Sustainable Development Protocol demands prices for the use of resources that correspond to their "real" values. Art. 9 (b) asks for actions that favour economic diversity to abolish structural weaknesses and the dangers of a monostructure. Art. 11 asks the Parties to examine if the users of alpine resources can be induced to pay market prices that include the costs of the provision of resources (a), that reimburse the services that have been carried out in the public interest (b), and that compensate natural production obstacles especially of mountain agriculture and forestry (c). Art. 12 (1) asks for the subsidy of a sustainable development by additional financial and economic means.

The Mountain Forest Protocol (Art. 6) expresses the protecting function of mountain forests for settlements, infrastructure, and soil and declares conservation of forests as an aim. Art. 7 (1) of the protocol asks for procedures to support mountain silviculture as a source of job and income for the local population. In Art. 11 (1) Parties recognize the aggravating circumstances of mountain silviculture and promise incentive measures to compensate economical disadvantages especially for private forest owners (2).

Art. 2 (3) of the soil conservation protocol asks for fiscal or financial means to support the soil conservation provisions of the protocol.

Art. 10 (2 and 3) of the Nature Conservation and Landscape Management Protocol rules out, that market instruments, e.g. incentives or repayments should be considered in supporting adaptive agricultural and forestry management practices that enhance nature conservation and landscape management objectives. With Art. 3 of the Mountain Agriculture Protocol the Parties agree to subsidy a sustainable mountain agriculture and their functions by socio-political, structural, environmental and agro-political actions to ensure adequate life conditions in the mountain areas and to stop effectively the abandonment of mountain farms and alpine pastures. Art. 7 obliges for a differentiated policy with regard to natural habitat disadvantages.

The Mountain Agriculture Protocol clearly states that productive agricultural work is indispensable for maintaining the alpine region as an economic and living space on its own managed according to the principles of sustainability. An essential aspect for the future of the mountain area is seen in the further development of self-sufficient economic and life forms that clearly obey the economic and ecological carrying capacity (e.g. eco-labelling for products, services and landscapes).

Therefore, by an alignment of incentives, the Bavarian state government allows those who control the resource to benefit. The 'Bayerische Alpen- und Mittelgebirgsprogramm' (programme for the Bavarian Alps and Bavaria´s secondary chain of mountains) had been created to support farmers who suffer from

aggravating circumstances. It gave rise to the ’Bergbauernprogramm’ (mountain farmers programme), financed by the federal government, the state government, and the European Community. Its subsidies of over 20 million EUR a year provide an indispensable aid for about 11.000 small scaled mountain farms.

The ‘Bayerisches Kulturlandschaftsprogramm’ provides another example of how subsidies favour those farmers who sustainable use alpine biological resources. Part A supports the permanent pastorate of mountain pastures (50.- EUR/ha; 1500.- EUR/shepherd); Part B finances investive actions of an extensive pasture economy (50 – 100 % of the attributable costs); Part C supports landscape management actions comprising several farms (up to 70 % of the costs).

Art. 14 of the traffic protocol asks for a better way of charging the true traffic costs to gain a traffic control effect. The precautionary principle is to be applied. The Parties agree to develop an accounting system to determine extern costs. Step by step, traffic specific levy systems will be introduced that allow to cover, in an equitable way, the true traffic costs. These systems shall favour the environmental-friendly traffic systems and means, and a more balanced use of traffic infrastructures; they also shall offer incentives to use more frequently potentials of ecological and socio-economic impact reducing with structural and regional planning methods of traffic management.

The Alpine Convention and the protocols recognize that protection of alpine diversity can only be achieved, if economic aspects are considered and traditional ways of land-use that created a high diversity can be practised in an economically sustainable way. The Bavarian government runs programmes to support traditional farming in the Alps.

5.5 Principle 5

Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Rationale: *Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species*.

In the preamble to the Alpine Convention the Parties recognize that the Alps constitute one of the greatest natural areas in Europe; an economic, cultural, and recreational space and environment at the heart of Europe, where numerous peoples and states joint together; a region distinguished by nature, culture, and history that are both specific and varied. Parties consider that the alpine area and its ecology are increasingly threatened by growing human exploitation, and that reversing harm, where it is possible, can be accomplished only through intense effort, high costs, and, generally, only the long term. Thus the Alpine Convention not only aims at conserving threatened species but tries to ensure conservation of ecosystem structure, functioning, and services, as expressed in principle 5 of the Ecosystem Approach. To reach this aim Art. 2 (c-f and i-l) of the Alpine Convention asks Parties to attain the objective of the Convention

(c) with a view toward obtaining a drastic reduction of polluting emissions

(d) with a view toward reducing quantitative and qualitative harms to the soil

(e) with a view toward conserving or re-establishing the natural quantity, and in particular, preserving the quality of waters in hydrosystems

(f) with a view toward assuring the protection, management, and the restoration of nature and the countryside in such a way as to guarantee the lasting functioning of ecosystems, the preservation of flora and fauna and their habitats, the regenerative power and long-term production of the natural patrimony, as well as the diversity, originality and beauty of nature and the landscape generally

(i) with a view toward assuring the harmonization of leisure and tourist activities with social and ecological exigencies by limiting leisure and tourist activities that harm the environment

(j) with a view toward reducing the hazards and harms caused by inter-alpine and trans-alpine transport to a level tolerable for humans, flora and fauna, as well as their habitats and environment, notably, through a transfer of traffic to rail

(k) with a view toward subjecting the production, distribution and utilization of energy to a respect for nature, the countryside and the environment

(l) with a view toward providing a system of collection, re-cycling and treatment of waste.

In addition to these provisions, the objectives of Art. 1 of the Nature Conservation and Landscape Management Protocol are the conservation, the management and, as far as necessary, the restoration of nature and landscape in such a manner, that the functional capacity of ecosystems, the conservation of landscape elements and of wild animal and plant species and their natural habitats, the regeneration capacity and sustaining functional capacity of nature goods and the diversity, singularity and beauty of the natural and cultural landscape as a whole will be sustained. In Art. 11 of this protocol Parties commit themselves to conserve or restore or even create new conservation areas (1), national parks (2) and quiet zones, where protection of plants and animals has priority over all other interest. In Art. 13, Parties agree to build up a network of conservation areas that coordinates aims and measures. This "Network of Alpine Conservation Areas" was created in 1998 (NETZWERK ALPINER SCHUTZGEBIETE 2001). It hosts 15 working-groups (e.g. reintroduction of predatory birds, inventories of botanical diversity, control of mass tourism) which operate in all signatory states simultaneously. For example, standardised datasheets are used in all national parks to register the success of attempts to reintroduce the Bearded Vulture (*Gypeatus barbatus*) (BUWAL 2000). In Germany especially the National Park Berchtesgaden and the Biosphere Reserve Berchtesgaden are active members of the network.

Art. 7 of the Energy Protocol obliges the Parties to ensure the full ecological functional capacity of rheological ecosystems and the intactness of landscapes when running or building power plants. There are, however, no more completely untouched wild rivers in the Alps. But some few Alpine rivers still have sections where the natural forces of the rivers and their ecological processes can take place in an undisturbed manner (cf. principle 3).

Art. 1 (2 and 5) of the Soil Conservation Protocol asks to maintain the soil ecosystem in its natural functions. Herewith the precautionary principle, that includes the protection of the functional capacity and usability of soils for different purposes and their availability for future generations with respect of a sustainable development is of outmost importance. The Parties obligate themselves (Art. 13) to grant priority to the protection of those mountain forests that are of eminent importance for ecosystem functions (e.g.

by preventing soil erosion) and to carry out sustainable forestry management practices subdue to that conservation objective.

Art. 1 (1) and Art. 8 of the Mountain Forest Protocol demand the conservation or, if necessary, development, melioration or restoration of the ecological functions of mountain forests. Art. 6 assigns priority to the protection effects of mountain forests.

The Mountain Agriculture Protocol underlines the necessity to optimise the multifunctional services of mountain agriculture. Its main objective is the maintenance of an adaptive and sustainable mountain agriculture that fully contributes to the conservation of the ecosystem functions and services (Art. 1). Mountain agriculture has fully to accommodate itself to the conservation, sustainable use and recreation functions as well as the ecological and biogenetic functions of the mountain forest and to ensure a balanced proportion of mountain agriculture and forest areas.

In applying the provisions of the Alpine Convention it is being demanded to experiment with greater natural dynamics and to "laisser faire" an undisturbed natural development (wilderness) to protect biological diversity, to ensure natural dynamics as well as to get reference areas for used ecosystems.

The Alpine Convention as a whole takes into account that protection of the functioning of ecosystems is of greater significance for the long-term maintenance than just protection of species.

5.6 Principle 6

Ecosystems must be managed within the limits of their functioning.

Rationale: *In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious*.

Mountain ecosystems are less productive and more vulnerable than hillsides or plains. This holds especially true for mountain ranges in higher latitudes like the Alps, where climatic conditions are harsh even in valleys and higher elevations are snow-covered throughout most of the year. Cold conditions and highly inclinated sites hinder development of deep soils and thus create unfavourable conditions for plant growth in a shortened vegetation period. Continues movement of rocks and soil keep wide areas in a kind of everlasting successional or pioneer stage of soil and vegetation development. Extreme opposites between temperatures even in a small scale (sun or shadow side of a rock) hinder establishment of a continues vegetation cover (but, on the other hand, create high rates of endemism of well adapted plant species). Impacts on shallow soils with a low buffer capacity (especially above the tree line) are often irreversible, regeneration processes of disturbed vegetation are extremely slow.

As temperature often is the limiting factor of mountain ecosystems, even slight changes in climatic conditions can have visible effects. If the rise of mean annual temperatures goes on like in the last decade, experts expect dramatic changes not only for the alpine vegetation, but for tourism and safety of alpine communities (INTERNATIONALE ALPENSCHUTZKOMMISSION CIPRA 2001). Higher temperature results in deeper melting of permafrost soils and will lead to mass movement of rock and soil (KING & HARZ 2001). Climatic change is held responsible for catastrophic soil movements in recent years (DRAMIS et al.

1995). Botanists observe an uphill movement of alpine plants and fear the loss of endemic species which are adapted to extreme conditions on summits (GRABHERR 2001).

The melting of glaciers creates new lakes that threaten villages by over-boarding. In July 2002, the level of a new glacier lake in the Italian Monte Rosa region had to be lowered and the water to be pumped in neighbouring creeks, in order to protect a village. The costs of this intervention were enormous and the long-term effect is in doubt.

Many alpine communities economically depend on winter tourism and have to face less reliable snow covers. The tendency to expand skiing areas on glaciers will destroy some of the last untouched regions in the summit zone (INTERNATIONALE ALPENSCHUTZKOMMISSION CIPRA 2001).

In the preamble paragraphs of the Soil Protection Protocol Parties recognize that development and regeneration of soils in mountain regions is extremely slow and that due to geomorphological conditions high amounts of soil erosion have to be expected. In Art. 10 (1) Parties agree to map areas that bear a high risk of mass movements, avalanches or floods due to geological or hydrological conditions. Parties also agree to define best practise for land use and nutrient input according to natural site conditions (Art. 12. 2).

The preamble of the Regional Planning and Sustainable Use Protocol underlines the natural space limits and the special sensitivity of the alpine ecosystems. According to the preamble to the Tourism Protocol the limits of adaptability of alpine ecosystems have especially to be regarded. The Energy Protocol refers to the ecological vulnerability of the Alps and asks for sustainable management practices that respect the limited ecological carrying capacity (Art. 1). Energy production has to take into account the specific impacts of airborne immissions on mountains and valleys because of the special geomorphology of the Alps (Art. 5. 1c). These geomorphological limits are also referred to in the preamble paragraph of the Mountain Agriculture Protocol. Parties also recognize that extensive and traditional farming has a central function in creating optimal living conditions for a great part of alpine flora and fauna. In Art. 8 (1) of the Mountain Agriculture Protocol Parties agree to take into account the specific limiting ecological conditions of the mountain areas. In Art 7 (1) Parties document their will to differentiate measures of agricultural policies according to different site conditions and to support especially those farms which guarantee a minimum use of extreme sites.

The Mountain Forest Protocol (Art. 11. 1) also documents the limited conditions of forest use in mountain regions.

The convention is well aware of the limits of functioning of alpine ecosystems. Nevertheless, there is a lack of definitions of carrying capacity or critical loads. Monitoring systems to effectively control loads or inputs as well as effects on the ecosystems are still not implemented.

5.7 Principle 7

The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

Rationale: *The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical na-*

ture of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Thanks to the fact that all states of the Alps joined the Alpine Convention, this agreement covers the whole mountain range from its extreme west (France) to its extreme east (Austria, Slovenia). Thus the largest spatial scale is defined. Nevertheless, geological, climatic, political, and economical conditions vary in a wide range and therefore regional and local scales have to be defined to solve problems of sustainable development. The population of the Alps has grown from 7.8 Million in 1871 to 14.2 Million in 2002 (82%) (BÄTZING 2002). This population growth was not evenly distributed, but concentrated on larger cities in valleys, while remoter areas where more and more abandoned. Today 24% of the alpine region are without human population, while 30% are characterized by urban structures (BÄTZING 2002). Hence, problems and needs highly depend on the local situation and measures have to be taken in an appropriate spatial and temporal scale. Urban regions or communities with a high frequency of tourists face traffic problems while remote areas try to support traditional farmers to hinder them from abandoning their farms (Mountain Agriculture Protocol). In Bavaria, 19 communities which are labelled to be special tourist attractions, formed an initiative to keep individual traffic out of their town centres (EU 2001).

The Bavarian community of Mittenwald launched a project on the local scale to re-intensify traditional mowing of "Buckelwiesen" which host several endangered plant species. The mowing was abandoned in the last decades due to economic reasons (EU 2001). The Mountain Agriculture Protocol demands the preservation and restoration of such traditional cultural landscape elements (Art. 8) as does the Nature Conservation and Landscape Management Protocol (preamble, Art. 1). In these cases, the ecosystem approach has to be applied at small spatial scales.

National borders are not always suitable to define appropriate spatial scales and Parties recognize that several problems can only be solved by multinational efforts (preamble paragraphs of every protocol).

Many alpine rivers in the northern part of the Alps originate from Switzerland or Austria, but cross the border into Germany to join the rivers Rhine or Danube. Any project of water management (barrages) has to define the whole river system as spatial scale (Energy Protocol, Art. 7. 1).

The Mountain Forest Protocol (Art. 2b) defines as an aim to favour reintroduction of larger predators to control damage to young trees caused by deer. The spatial scale of such a measure has to be far wider than local, because migration and territorial needs of larger mammals and birds of prey have to be taken into account. The temporal scale has at least to be measured in decades, due to the life history of the involved species. The "Network of Alpine Conservation Areas" coordinates these measures at a multinational scale.

Although some measures have to be taken on the local scale (e.g. support of farmers in unfavourable sites), a wider regional scale has be considered due to economic interactions. A quality label for products of sustainable farming has to be introduced regional to be economically useful, because local products always have to face competition from products from the whole EU. In the Italian Alps, a co-operative of 50 farmers agreed on cheese production from traditionally managed farms and pastures. They integrated sales-structures, tourism, and restaurants on a regional level and now are economically successful (BUWAL 2000).

To measure the effects of climatic changes, long term observation has to be undergone. Though on a small spatial scale (some square metres or hectares), permanent plots have to be observed for decades. For example, the flora of the Piz Linard summit was regularly documented beginning in 1835, when only one plant species was found. Up to today 10 species are established on that summit, due to warmer conditions (GRABHERR 2001).

Taking into account, that the new formation of soils is taking place at a very slow speed the Soil Protection Protocol asks for a spatially holistic soil protection approach. It further argues for the demarcation of special soil protection areas (Art. 6) and for the mapping of avalanche and erosion endangered areas (Art. 10 and 11). Special attention has to be given to mountain forests that are protecting in a high degree settlements, agricultural areas etc. (Art. 13). The same provision is lined out in Art. 6 of the Mountain Forest Protocol. Art. 10 asks for the demarcation of natural forest reserves in sufficient extension and number and their long-term protection by an effective "Vertragsnaturschutz" (contract nature conservation).

The Alpine Convention as a multinational agreement allows measures in any appropriate scale. Examples show that local initiatives as well as international efforts are taken to implement the aims of the convention.

5.8 Principle 8

Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Rationale: *Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones*.

A main constitutive element of the Alpine Convention and its various protocols is the notion of "sustainability" or "sustainable use". Sustainable use means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity; thereby maintaining its potential to met the needs and aspirations of present and future generations.

This definition is clearly ecosystem-oriented. "Sustainability" or "sustainable use" under the Alpine Convention and its protocols implicitly means that ecosystem management will be set for the long term, so that the alpine ecosystem and resources can be sustained indefinitely and are not caused to decline significantly.

The Convention and its protocols do not define concrete time frames for their goals, but Parties realize that management objectives have to be set for the long term.

The programmes for the reintroduction of the Bearded Vulture date back as far as 1986 (MÜLLER 1998) and long-time monitoring of marked individuals is still a central task of the "Network of Conservation Areas" (BUWAL 2000).

The Bavarian community of Hindelang launched an initiative in 1990 (Hindelang- Natur und Kultur) to integrate traditional agriculture, tourism, conservation and sustainable development of the community itself (HAID 1998). In 1993, 86 of 97 local farmers had joined the initiative and a label for regional products was introduced. Traditional operating farms were integrated in a tourism concept and 85% of the area are under protection. The approach gained several prizes on the European level (EU 2001).

5.9 Principle 9

Management must recognize that change is inevitable.

Rationale: *Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.*

As pointed out under principle 6, the Alps are more drastically subject to the consequences of climate change than probably all other central European ecosystems. Hence, *nolens volens*, management must adapt to these changes. Nevertheless, as climatic change will result in increased rock and soil movements, management efforts must take precautions against catastrophic damage, e.g. by planting forests in endangered sites like urged in the Mountain Forest Protocol (Art. 6. 1 and 2). But the climate changes are by no means the only ones the Alps are confronted with. Structural causes have already induced massive changes in the alpine ecosystem composition. The Alpine Convention and its protocols even provide the examples to cater for such changes and events by adaptive management practices.

Sometimes the provisions of the Alpine Convention are for the maintenance of the cultural landscape or of elements of it. At a first glance this seems to be contradictory to the notion of accepting the inevitability of change. But actually the conservation of cultural landscape does not mean the "tinning" of landscape, the freezing of a static ecosystem state. Also the cultural landscape has steadily changed under different uses and changing technologies or practices of a single use. What is necessary, is to influence these changes into a preferred direction by setting an appropriate framework. Some of the regionally typical landscape elements and characteristics should therefore be conserved by taking new techniques and production methods into consideration.

Natural disturbance regimes are common in the summit regions, where periglacial processes of melting and freezing keep rocks and soil in motion. Taking these natural changes into account, tourism management (of climbing, hiking, skiing) has to be aware of potential dangers and should prevent construction of tourist facilities in endangered sites.

In many cases, changes to alpine ecosystems are anthropogenic and thus not inevitable. Moorlands and bogs that have been partly destroyed by drainage should be restored as far as possible by re-installing the natural water regime. Their loss means a loss of biodiversity and of highly adapted plant and animal species. In the Bavarian region of Südostoberbayern an initiative funded by the EU-Life-Programme tried to restore bogs of the Chiemgau, where 140 species of the Bavarian red list were registered (EU 2001).

The natural destructive power of many alpine rivers carrying a heavy load of bolders was broken by the construction of water reservoirs and by regulation of water levels. This change is also not inevitable and

should not be accepted, as it causes the loss of extremely well adapted plant communities ("Flußschotterheiden").

In the case of the traditional forest grazing, creating with the forest pastures typical culture landscape elements, however, there is heavily argued to abandon these forest pastures because they are seen as ecologically detrimental and of missing economic necessity.

The biggest change, the Alps have undergone in the last 100 years is the development of mass tourism (HAMELE et al. 1998), bearing dramatic consequences for the economic situation, traditional living and human presence in formerly remote areas. Today, many alpine regions depend on tourism to a degree, that the changes have to be excepted as "inevitable" in the sense, that turning back to the former situation is impossible and unwanted. Nevertheless, the trend of growing expansion of tourist facilities has to be halted, as the carrying capacity of many regions is already reached and alpine diversity heavily endangered. The Tourism Protocol tries to favour sustainable ways of tourism, but has not the strictness to effectively hinder e.g. the use of artificial snow, heli-skiing or the expansion of ski-runs.

If some changes to ecosystems are inevitable, at least avoidable man-made changes should be minimized by management measures.

5.10 Principle 10

The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Rationale: *Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.*

For 7,000 years man has lived and managed in the Alps and has impacted and changed ecosystems and ecological processes. Steadily growing spatial and functional claims – not only of the regional population but of Europe as a whole – are concentrating on the alpine space. The adaptation to the narrow nature space has generated small and smallest settlement and management structures. Therefore, the recipes and norms of the plain lands cannot be transferred 1:1 to the mountains. In Europe an understanding of this particularity is even gradually beginning to germ. The International Year of Mountains 2002 supports this process of a growing alpine consciousness.

Because of their economic, ecological and geomorphological particularities in an European context the Alps are especially predestined for a regional sustainable development concept. Such a concept has to integrate the notions of use and conservation and of do and leave. It aims at a stabilisation of economically and ecologically meaningful cycles that form the core of sustainable use.

The Alpine Convention provides the tool for this concept of harmonizing conservation and sustainable use, of balancing economy and ecology, as can be exemplified by quoting the following articles:

Art.2 (1): using resources wisely and exploiting them in a sustainable way,

Art. 2 (2b): the Parties shall attain the objective of the Convention with a view toward assuring an economic and rational utilization of the land and a healthy and harmonious development of the territory, based on a thorough identification and evaluation of the utilization needs of the alpine area and a prospective and integrated planning with harmonization of the standards involved; this while taking natural hazards particularly into account, preventing over-concentration and over-density, and seeing to the preservation and restoration of natural environments,

Art. 2 (2g and h): the Parties shall attain the objective of the Convention

(g) with a view toward assuring in the general interest the conservation, management and promotion of the traditional rural countryside and an agriculture adapted to its site and compatible with the environment,

(h) with a view toward preserving, strengthening and re-establishing forestry activities, and particularly, protection, through management that respects nature, increases the resilience of natural ecosystems, and avoids harmful use of the forest.

In addition, the different protocols to the Alpine Convention further stress the balance between conservation and sustainable use.

Art. 1 of the Energy Protocol defines the aim of a sustainable way of production, transport, and use of energy considering the specific limits of alpine ecosystems. In Art. 7 (3) Parties agree to not interfere with the water regime of protected areas and buffer zones even in cases where hydroelectric power is used.

According to Art. 3 of the Regional Planning and Sustainable Development Protocol, Parties try to find policy solutions that are congruent with the conservation of the environment and the sustainable use of natural resources. All spatial relevant uses have to be carried out in a nature and landscape friendly manner. Conservation, preservation and management of near natural and protection-worth biotopes should be reached by adaptive agriculture and forestry management practices.

In Art. 7 (1) of the Nature Conservation and Landscape Management Protocol, Parties have decided to establish concepts, programmes and/or plans for the conservation, management and development of the landscape. In Art. 4 of the Mountain Agriculture Protocol, Parties have stated that especially in the mountain areas agriculture has formed the landscape and lent historical character as well as cultural value. Therefore mountain agriculture plays a crucial role for the conservation and management of both the natural and cultural alpine landscape.

At present in the Bavarian Alps there are still 13.000 farms. Some of these farms manage the about 1.300 acknowledged mountain pastures with about 39.000 hectares. About 250.000 ha of the Bavarian Alps (i.e. about the half) are forested; 150.000 hectares of it are ‘Schutzwald’ (protecting forest). Historically, as part of the Northern Alps the Bavarian alpine mountain agriculture is determined by cattle breeding (whereas in the southern Alps plant cultivation is predominating).

The traditional form of the forest pasture provides an example of an unbalanced relation between conservation and sustainable use. By grazing larger amounts of deciduous trees have been selected out of natural mixed coniferous-deciduous forests. Especially on nutrient-poor sites grazing ruminants cause a considerable nutrient run-off of the mountain forest ecosystem.

Apart from the conflicts around forest pastures, alpine agriculture provides an excellent example of multi-functionality: conservation of ecological processes by adaptive management practices and sustainable use.

Nevertheless, concerted action is needed to push conservation issues ahead, because an unsustainable use is endangering the – up to now – more or less isolated conservation approaches. It has become necessary to create a network of large protected areas because the existing protection areas cannot longer stand the pressure and growth of traffic, infrastructure and tourism. This network should be backboned by "Trittsteinbiotope" (stepping stone biotopes) and ecological corridors (e.g. river courses, forests, wilderness areas); that diminish isolation effects and facilitate population migrations and extensions. Those protected area networks should be composed of both natural and cultural landscapes.

In Bavaria the "Arten- und Biotopschutzprogramm" (ABSP, species and biotope protection programme) and the "Landschaftspflegekonzept" (LPK, landscape management concept) provide further guidance for the putting into practice of such an ecosystem network system. They are complemented by the "Landschaftsentwicklungskonzept" (LEK, landscape development concept). The bulk of the Bavarian nature protecting areas is found in the alpine region (mostly mixed forest ecosystems).

The ABSP is an expert concept that - since 1985 – has been developed for all 71 Bavarian districts and the 25 autonomous Bavarian towns. Based on an inventory of the biotopes, higher plants, vertebrates and the most relevant invertebrate groups of each of these districts and towns ABSPs with concise recommendations for the conservation and management of the various components of biodiversity in each of these districts and towns have been worked out. Therefore, for all districts within the Bavarian Alps ABSPs – composed each of a text volume and a map volume - are available. The ABSPs have been worked out by an expert group under the supervision of the Bavarian State Ministry of Environment and Landscape Development and in close cooperation with the district nature protection administrations. The ABSPs have not been harmonised, however, with the interests of other land users (agriculture, forest, traffic etc.).

The LPK is a first comprehensive concept for the management and development of the different types of Bavaria's cultural landscape. It compiles and evaluates all relevant experiences for the management and development of ecologically valuable habitats and biotopes that have been evolved by traditional and sustainable agricultural or forestry management practices; many of them are located in the Bavarian Forest region. The LPK recommends sustainable management practices for these landscape types and develops 'Leitbilder' (orientation aids) for a scientifically founded and societally accepted landscape development. Established primarily as a management aid for the nature protection administration the LPK will foster the cooperation between all stakeholders and experts that actively use the landscape.

The LEK compiles ecologically relevant information about natural resources, biotope corridors, recreation and tourism, infrastructure etc. of a Bavarian planning region to support ecologically sound and sustainable development and planning decisions.

Hence, in the Bavarian Alps there is a continuum from strictly protected areas to parts, where human influence dominates.

5.11 Principle 11

The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Rationale: *Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders*.

The Alpine Convention and its protocols contain a lot of provisions to consider all forms of relevant information to support the conservation and sustainable use of alpine ecosystems. In Art. 3 and 4, the Alpine Convention imposes the obligation on its contracting Parties to coordinate their activities and to undertake joint actions in the areas of alpine observation and research relating to all 12 themes covered by the Convention. For this purpose, a system for observation of and information on the Alps was defined and established. Art. 4 of the Convention explicitly concerns the exchange of legal, scientific, economic and technical data and information. This issue is further substantiated in the various protocols, that all contain obligations to promote training and education and the information of the public with regard to their objectives, actions, obligations and implementation, to exchange information and data and build up and harmonize own database and information exchange systems. The Mountain Agriculture Protocol specifically also considers the cooperation of research and education institutions (Art. 6c). As ruled out in the Nature Conservation and Landscape Management Protocol, Parties develop common or complementary programmes for ecosystem analyses and assessments aiming at scientifically sound knowledge and insights that further advance the actions to be taken (Art. 20, 2 and 3). The Parties care for the confluence of the results of national research and systematic monitoring into a common system of long-term monitoring and information (see also Art. 13 Mountain Forest Protocol). This monitoring and information system, ABIS, has already been established and provides information, inter alia, about the current state of the Alpine ecosystems and their further development.

In 1999 the signatory Parties founded the International Scientific Committee for Alpine Research (Internationales Wissenschaftliches Komitee zur Alpenforschung) as a central institution for scientific projects, competence, and information (SCHEURER 2001).

5.12 Principle 12

The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Rationale: *Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate*.

In Art. 3 of the Convention the contracting Parties agree to undertake cooperative efforts in research and scientific study, establish shared or mutually complementary programmes aimed at systematic monitoring, harmonized research, observation and the gathering of relevant data. This obligation of involving the scientific sector is further substantiated in the protocols to the Convention, that all explicitly ask in sepa-

rate articles about research and monitoring for the integration of scientists and the carrying out of research and monitoring programmes that further advance the implementation of the Convention.

The Convention and its protocols also provide a strong basis for the integration of local communities into the decision and implementation processes of the Convention (compare principle 1).

Article 4 of the Alpine Convention states that "the Contracting Parties shall co-operate with international governmental and non-governmental organisations, where necessary, to ensure the effective implementation of the Convention and the Protocols to which they are a Contracting Party."

In more general terms, stakeholders of the International Convention on the protection of the Alps are the contracting Parties (EU and the 8 Member States of the Convention) and the international observers. On national level the subordinated governmental institutions and administrations, planning authorities at regional and local level (e.g. environment, forestry, agriculture, tourism, traffic, energy etc.) and various non governmental institutions are the key players.

On an international level various international organisations and institutions have an observer status with the convention. The latter can be subdivided into organs which are explicitly approved by the Alpine Convention and other institutions which incorporate the principles of the Alpine Convention. The highest organ of the community of the contracting parties is the Conference of Contracting Parties, the Alpine Conference, being convened every two years. Among other executive functions, the Alpine Conference shall make the necessary financial decisions.

International NGO's officially approved by the Alpine Convention are - to name but a few – the following: CIPRA: The International Commission for the Protection of the Alps, EUROMONTANA: (European Association for Cooperation between Mountain Regions, AEM: (European Association of Elected Representatives from Mountain Areas, FIANET: (International Federation of National Associations of Cable Car Operators), IUCN: (International Union for the Preservation of Nature and of Natural Resources).

Further important international NGO's are the Alpine "ARGE's", i.e. the ARGE ALP, the ARGE Alpen-Adria and COTRAO.

In 2002, the International Year of Mountains, an international scientific meeting took place in Berchtesgaden (where in 1989 the process of the Alpine Convention started) under the headline: "The Alpine Experience - an approach for other mountain regions?". The experience of the alpine process was discussed in detail with representatives of governments and non-governmental organisations from eastern European and Asian states. Creation of conventions for the Carpathians, the Caucasus, Pamir and Tien Shan and the Hindukush-Himalayan region are planned. Politicians and scientists seek intense contact to the members of the Alpine Convention. Thus, the Alpine Convention is discussed as a promising approach in a world wide context.

5.13 Resume

As outlined in the introductional chapter, the Convention on Biological Diversity (CBD) pursues three fundamental, interconnected objectives:

the conservation of biological diversity

the sustainable use of its components, and

the fair and equitable sharing of the benefits arising from the use of genetic resources.

Although the Alpine Convention was formulated not under the impression of the Rio summit in 1992, but years before the invention of the CBD and the Ecosystem Approach, it covers in its frame convention and the protocols the aims of the CBD, especially the conservation of biological diversity and the sustainable use of its components.

Principle 1 and 2 of the Ecosystem Approach demand, that management objectives should be a matter of societal choice and management should be decentralized to an appropriate level. The Alpine Convention clearly considers these demands in a sufficient way. Nevertheless there is a fundamental implementation problem: in the federal political system of Germany (and other signatory states of the Alpine Convention) the federal government is responsible for international policy and conventions, while the implementation of concrete measures in agriculture or land-use management is under responsibility of the "Länder", the states within the Federal Republic of Germany. In the case of the Alps, only one state within Germany (i.e. Bavaria) has a share of this mountain range. Although sustainable use is nowadays discussed at all political levels and Germany agreed on a National Strategy for Sustainable Development, there is still a high fragmentation of power and competence between different ministries (environment, traffic, agriculture, science) on both, the national level and the Bavarian level. This results in a need of vertical cooperation from the national ministries via the state ministries to the community level on the one hand, and a horizontal cooperation between different sectors on each level. This task is still not solved completely and the fragmentation of responsibility renders the implementation of managing measures long lasting and partly complicated. The ratification of all protocols of the Alpine Convention in 2002 in Germany might initiate additional efforts to facilitate cooperation in the vertical and the horizontal dimension.

Principle 3 demands managers to consider the effects (actual or potential) of their activities on adjacent and other ecosystems. This demand is clearly formulated in the Alpine Convention and the protocols. Nevertheless, consideration has sometimes been neglected in the past, as could be shown at different examples. Additionally, there is a fundamental lack: if effects of management efforts on the managed ecosystem and adjacent systems should be considered in a reasonable way, they have to be measured and monitored. Unfortunately, effective monitoring systems are still lacking and are often not even demanded. But to control the success of any managing effort, monitoring is inevitable, if doubling of mistakes is to be avoided and advice for best practice should be given. This monitoring must consider effects on an ecosystem base, no matter if borders of nations or districts have to be crossed. A first step to a monitoring system was taken with the founding of the "Alpenbeobachtungs- und Informationssystem ABIS" (Alpine Watch and Information System) in 1997, a decentralized network that aims to collect and manage relevant scientific data throughout the Alps. The ABIS tries to find biological and non-biological indicators to describe the status quo and changes in alpine ecosystems (NASCHI 1998).

Principle 4 demands that economic considerations have to be integrated in management efforts and Principle 10 calls for a balance between conservation efforts and sustainable use. The meaning of both principles is fundamentally integrated in the Alpine Convention and the protocols, as it is explicitly the aim of the Alpine Convention to protect and sustainable use alpine diversity. The different protocols recommend financial support for traditional and sustainable ways of land-use, forestry and agriculture if the overall market situation renders these ways less profitable. With respect to tourism as a main economic factor and main course of environmental problems, a balance between strict protection and more or less intense use has to be found. This perception initiated the Tourism Protocol.

In Bavaria, there are different programmes to support sustainable production and there is a continuum of regions under different protection status: the Berchtesgaden Nationalpark (national park) is an area, where use is strictly limited and protection of undisturbed ecosystems has highest priority. In the Biosphärenreservat Berchtesgaden (biosphere reserve), that functions as a buffer zone around the national park, integration of protection and use is the main goal. In other parts, economic (mostly touristic) use is dominant.

Principle 5 calls for the protection of ecosystem functioning. The Alpine Convention as a whole takes into account that protection of the functioning of ecosystems is of greater significance for the long-term maintenance than just protection of species. The connection of alpine national parks into a network of protected areas expresses the understanding, that ecosystems have to be protected as a whole. Nevertheless, measures to strengthen or rebuild populations of single species threatened by extinction are added to the efforts.

Principle 6 demands that management has to be appropriately cautious and must respect the limits of ecosystem functioning. The Alpine Convention and its protocols agree on respecting these limits, knowing that mountain ecosystems are even more vulnerable and take longer to recover than other systems. Despite the consensus of respecting the limits, there is a lack of defining the carrying capacity and limits of mountain ecosystems and again a lack of monitoring concepts to guarantee the keeping of environmental standards. Without adequate control mechanisms it cannot be decided how cautious management has to be.

Principle 7 demands to take measures in an appropriate temporal and spatial scale. As all states partitioning at the mountain range of the Alps are members of the Alpine Convention, it can be seen as a perfect example of guaranteeing the adequate spatial scale for any measure, because the whole bundle of alpine ecosystems is part of the area, the convention covers. The convention as well as the protocols argues, that measures have to be taken for ecosystems as a whole with no respect to national borders. Projects and networks throughout the Alps show, that initiative is taken on a local scale as well as on a national or a regional scale. Nevertheless, speed of progress and will to ratify all protocols is not uniform in all member states. This renders cross-border projects still complicated (e.g. implementation of traffic limits).

With respect to the temporal scale, short-time measures (e.g. giving financial help to farmers, who change from intensive to extensive production methods) as well as long-term programmes (e.g. reintroduction and monitoring of predator species) are implemented.

Principle 8 mentions that objectives for ecosystem management should be set for the long term. As the Alpine Convention explicitly defines sustainability as main goal, the long-term approach is fundamental. The rationale to Principle 8 further expresses the experience that short-time gains often dominate over long-term considerations. Despite the signing of the Alpine Convention there can be cited examples from every member state, where the long-term perspective was sacrificed for immediate gains or where use was practised in an unsustainable way (e.g. extension of skiing areas into remote areas). Here the hope is to be expressed that ratification of all protocols and further implementation of control and monitoring systems will help to stop over-exploitation in a sense of true sustainability.

Principle 9 warns that change in ecosystems is inevitable and management has to cope with long-term changes, as e.g. climatic change. The Alpine Convention is well aware of the fact, that climatic change will have more dramatic effects in the Alps than in lowlands and urges parties to prevent soil erosion and

avalanches by planting and protection of forests. Many changes that occurred in alpine systems in the last decades are man-made and hence not inevitable. The convention sees the need to stop these changes (e.g. by limiting road construction or expansion of skiing areas, by supporting traditional farmers).

If the global warming should lead to a lack of sufficient amounts of snow in areas where winter tourism is booming nowadays, then management measures must consider that tourism facilities cannot just be shifted further uphill in even more vulnerable and steeper parts. A long-term management should already today open alternative economic perspectives to mass winter tourism.

As already mentioned above (Principle 4), the Alpine Convention seeks a balance between protection and sustainable use of mountain ecosystems as demanded in Principle 10 of the Ecosystem Approach. This balance is one of the fundamental objectives of the Alpine Convention.

Principle 11 and 12 demand to integrate all kind of knowledge and experience from all stakeholders into management measures. The convention and the protocols call for sharing of experience between all Parties and different data networks are already implemented. Participation of non-governmental organisations was essential in formulating the convention and protocol text and still is in coordinating measures and spreading information. Nevertheless, an announced protocol "People and Culture" is still missing. This protocol might then help to gather even more traditional knowledge and prevent traditional techniques from vanishing. With respect to scientific knowledge, the basic information about species and species communities is available. Investigation of ecosystem functioning and development of monitoring systems has to be improved.

As a result it can be observed that the Alpine Convention and the protocols consider nearly completely the demands formulated in the 12 Principles of the Ecosystem Approach of the CBD. Hence, the conceptual framework offers all possibilities to implement management measures that help to protect and sustainable use mountain diversity. As in so many cases, implementation of direct measures follows only slowly after agreeing on a common strategy or convention. Although the Alpine Convention can be presented as an example for other mountain regions as well, the process of implementation is quite slow (GÖTZ 1998). Ten years after signing the convention, still only three signatory parties have ratified all protocols (Liechtenstein, Austria and Germany in 2002). Furthermore, protocols for such important fields like "People and Culture", "Air Purity", "Water Household" and "Waste Management" are still missing although they were planned from the start. Especially a protocol for air purity is of immediate importance with respect to the discussion of climatic change. The Alps for centuries have been a traditional recreation area for patients suffering from diseases of the respiratory tract due to their unpolluted air. To keep this quality un-endangered, pollution by industry and traffic has to be faced. A protocol to regulate waste management also is strongly needed, as mass tourism delivers unexpected amounts of waste to remote alpine communities, which have to deal with the disposal. Small alpine valleys normally are not suitable for waste disposal plants, therefore waste has to be transported. The result is growing heavy traffic. Even remote alpine huts in high mountain areas are in summer time frequented by so many tourists, that sewage disposal is problematic and formerly clear mountain creeks get polluted (EHM 1998). These problems should be coped with in the still missing protocols (e.g. water household). Efforts to formulate and sign these protocols have to be taken immediately.

The political will to a more consequent implementation of the goals of the convention and the effort to facilitate cooperation in the vertical and the horizontal dimension of political institutions have to be strengthened. Then the promising beginnings and the remarkable concept of the Alpine Convention might lead to real protection and sustainable use of alpine ecosystems. All nine existing protocols coming into effect in December 2002 (after ratification by the three states Liechtenstein, Austria and Germany) will hopefully fasten the implementation process.

6 Consideration of the Ecosystem Approach

The Ecosystem Approach with 12 principles and 5 operational guidelines was adopted by COP 5 (Nairobi, in 2000), requesting the CBD's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to compile case studies and lessons learned as a basis for the further elaboration of the approach. COP 6 (The Hague, in 2002) ascertained the demand for further elaboration and improvement. The case study presented here investigates how far the principles of the Ecosystem Approach are manifested in the international agreement of the Alpine Convention and its protocols. Although the Alpine Convention was formulated before the CBD was developed, nearly all fundamental ideas and goals of the Ecosystem Approach are integrated. Nevertheless, implementation of the Alpine Convention and ratification of the protocols are slow and have to deal with many political obstacles (see chapter Resume).

The Ecosystem Approach itself bears some implicit problems that render the implementation difficult: First of all, the wording of the principles and the guidelines is held so general that it can not be used as a direct modus operandi to implementation. Here, a need of concrete rules for action (or restraint from action) is obvious. Of course, such rules can not be postulated for all ecosystems worldwide (as the CBD is), but have to be modulated for regions and ecosystem types. Research efforts in this direction have to be strengthened. The same is true for the goals of the approach and the CBD as a whole: there are no concrete figures or dates, which goals should be achieved when. Even the Johannesburg Declaration of the World Summit in 2002 agreed only on slowing down the process of species extinction until 2015 “significantly”. A further definition of the word “significantly” is not given. If it is impossible to formulate concrete worldwide goals, at least every signatory party should be urged to formulate national goals and report on the success.

Secondly, the Ecosystem Approach (Principle 1, societal choice, and Principle 2, decentralization) requires more or less democratic structures. Unfortunately, these structures are not given everywhere, sometimes especially not in areas with high biodiversity. The demand for decentralization bears another problem, which is an everyday-obstacle in practical implementation of management measures: the more political institutions, political levels and local stakeholders are involved, the more complicated it is to come to a decision. As outlined in the Resume chapter, the sectoral responsibility of different ministries for different parts of the same ecosystem (ministries of environment, traffic, economy, land-use, health) calls for centralization of competence and power in one hand. This centralization-decentralization paradox is a basic problem of democratic structures. Moreover, the call for flexibility (Principle 9) of managing measures should include a call for more flexibility at all political levels and in every bureaucracy.

Third, the Ecosystem Approach calls for an appropriate balance between conservation efforts and use in managing measures (Principle 10). This principle allows wide interpretation inasmuch as the need to use ecosystems (or to change and destruct them) directly depends on the economic needs of the state hosting the ecosystem under question. An “appropriate balance” of conservation and use of mountain ecosystems in the Alps in a developed country like Germany means completely different things than an “appropriate balance” for mountain ecosystems in a developing country, where the economic needs force people to use even unattractive sites with a high risk of causing irreversible damage. In Principle 10, a clear commitment to set areas under protection and leave them completely untouched is missing and the danger of justifying destruction of biodiversity by economic needs is not banned.

Principle 9 remarks, that change in ecosystems is inevitable. Of course, this is true and there has always been and will always be a kind of natural change in number of species, composition of species, and the mosaic of ecosystems, driven by changes in climatic or geologic (e.g. volcanism) conditions. Evolution and extinction of species work hand in hand. Nevertheless, the acceptance of changes needs a definition of the word "inevitable". Climatic change in recent (and future) decades might not be inevitable inasmuch as human production of gases intensifying the greenhouse effect could be reduced, if the political will to do so was world wide (or at least would include all highly industrialized nations who are responsible for most of the production). The rational of Principle 9 mentions natural disturbance regimes as inevitable changes in ecosystems. Of course, in the Alps avalanches and mud streams are natural phenomena, but frequency and intense are strongly influenced by human measures like construction of ski-runs, deforestation of steep hillsides or simply skiing offside marked skiing grounds. Hence, the natural disturbance by avalanches can not just be defined as inevitable.

The same is true for floods (as became obvious in central Europe in summer 2002). High amounts of rain and the resulting rising of rivers with an enormous destructive power might be inevitable. But regulating riverbeds and hindering the rivers to flood natural depressions worsened the flood to reach catastrophic dimensions. Therefore, the word "inevitable change" needs a clearer definition.

The Ecosystem Approach sees humans as a part of most ecosystems and demands cautious management of ecosystems (Principle 6). Nevertheless, it must be accepted, that in some ecosystems the functioning can not be guaranteed (as demanded in Principle 5), if humans try to use the system or to become part of it. An alpine sphagnum bog can not be used without causing destruction, not even by cautious tourists. Here, an appropriate balance can only mean exclusion of humans and strict conservation. (Switzerland even integrated the protection of bogs into its constitution (KÜTTEL 1998)).

Principle 8 demands to consider future benefits and to favour long-term gains instead of immediate but unsustainable uses. Unfortunately, in many cases, those who renounce from immediate benefits can not be sure to benefit from future gains in a long term perspective or can not afford to abstain from immediate use due to vital economic needs. Signatory states must seek solutions that enable people to economize in a long-term perspective (e.g. by balancing losses and supporting long-term efforts or guaranteeing land-ownership). The CBD itself claims the goal of fair and equal benefit sharing between all stakeholders. Nevertheless, there is no further definition, what fair and equal means and who is to be seen as a stakeholder. Here, case studies for the implementation of a benefit sharing model are needed.

Furthermore, there is no easy way to define the benefits itself in an economic context. If a mountain farmer in the Alps hinders avalanches by leaving protection forests untouched, he helps to avoid economic losses by damage. But how can this economic long-term gain be put into figures and rewarded in a fair manner? Here, policy is asked to give economic value to measures that protect from avalanches, floods or desertification or guarantee purity of air and water. Principles 4 mentions incentive measures, but case studies, which investigate how to give economic value to protective ecosystem functions are needed. In Austria, a model to certificate the quality of mountain forests and reward good results is actually tested (SCHEIRING 2001).

Principle 11 and 12 kind of overlap in their rationales: “considering all forms of relevant information, including scientific and indigenous and local knowledge” (Principle 11) more or less implies to “involve all relevant sectors of society and scientific disciplines” (Principle 12).

To improve the Ecosystem Approach, some ideas could be added or adopted:

First, the agreement on how to report about the status of biodiversity and the results of managing measures for all signatory states (CBD Decision II/17) should include a passage that encourages parties to report about failures and bad experiences, too. Multilateral discussions (e.g. between neighbours in one region or members that have one kind of ecosystem in common) would help to learn from mistakes or successes made elsewhere. Reports from independent scientists should also be accepted as additional documentation of status quo.

Second, many states which host biodiversity hotspots lack coordinated management of scientific data within the state, let alone between the state and the world-wide scientific community. Despite the agreement of the Clearing House Mechanism (CHM) that urges parties to sum up the status quo of their actual knowledge, there is no agreement about the manner in which scientific data should be gained, handled, published or shared. The Global Taxonomy Initiative (GTI) of the CBD is a first step for the documentation of diversity, but maybe also the Ecosystem Approach should include a recommendation how to handle “all forms of relevant information” that should be considered following Principle 11.

Third, there should be a call not only to register biodiversity (like the GTI does), but also to identify indicator organisms to monitor changes in ecosystems and success or failure of management measures. Monitor systems must be set for the long-term and not only in managed areas but also in untouched areas, to have a reference to compare natural processes and alterations with human-induced changes. These monitor systems should refer to all three levels of biodiversity, i.e. species, ecosystems and genes.

To sum up, the ecosystem approach should be understood as a basic guideline for the integrated management of ecosystems but not as a *modus operandi*. Due to its highly theoretical organization, it is not adequate as guidance for concrete measures.

Nevertheless, it is certainly possible to successfully employ the approach for introducing the concerns of the CBD into relevant areas of politics.

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