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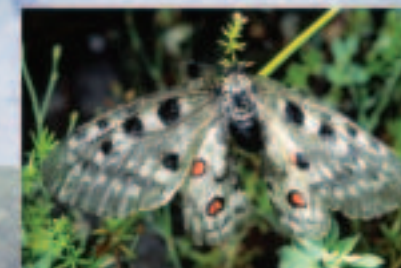
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The Alps: a unique natural heritage

A Common Vision for the Conservation
of their Biodiversity



WWF / Hubert Malin



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Dear readers,

the Alps are the most intensively exploited mountains in the world. And yet they still represent Europe's largest pool of biodiversity, inextricably linked to the quality of life of its inhabitants and visitors, present and future. WWF, in collaboration with ALPARC (Alpine Network of Protected Areas), CIPRA (International Commission for the Protection of the Alps), and ISCAR (International Scientific Committee on Research in the Alps) launched an initiative to determine the Alpine regions which need to be given priority for conservation based on biodiversity values. These regions were identified in the course of a two-year process, culminating in two international workshops with scientists, representatives from NGOs, and institutions. The first workshop was held in May 2002 in Gap, France and the second in September 2002 in Alpbach, Austria. The results of this process, which are published in this booklet, contribute to a better understanding of biodiversity in the Alps and provide a guide to the areas in which priority conservation actions should be undertaken.

The biodiversity initiative of our four organisations makes an important contribution to the Alpine Convention, a treaty among the Alpine states and the European Union which commits members to pursue a policy of sustainable development in

this transnational mountain area. This international public law treaty makes the Alpine area a model for other regions in Europe and across the world. Our joint biodiversity initiative presents for the first time a map of regions in the Alps with high biodiversity value, integrating a diverse set of plants, animals, and habitats. It therefore shows **where** we have to act first, supplementing the Alpine Convention and its protocols which define **which** measures should be applied and **how**. In this way we can integrate biodiversity aspects more closely into planning decisions at local, regional, national, and international levels.

The Alpine Network of Protected Areas is one significant outcome of the Alpine Convention. It is an important instrument for biodiversity conservation. However, while protected areas managers are now building a tight network allowing the exchange of information and experiences, the protected areas themselves are still isolated from each other. They are not adequately connected by ecological corridors, and as islands, are not sufficient to protect our natural heritage. Therefore, we need to emphasise effective and sustainable management practices outside protected areas, especially in the regions with high biodiversity values. The Alpine Convention and especially its protocols "natu-

re protection and landscape conservation" and "regional planning and sustainable development" provide tools for achieving this goal in the medium term.

Building networks

WWF, ALPARC, CIPRA and ISCAR are working together to contribute to the preservation of biodiversity in the Alps. We believe that it is important to concentrate conservation efforts primarily on the identified regions with high biodiversity value. We want to ensure that biodiversity aspects are considered in planning decisions, that appropriate and efficient measures are taken to implement an ecological network of protected areas and that areas outside protected areas are managed in a sustainable way. The four organisations will start to implement projects in cooperation with local people, relevant authorities, and interest groups within the high biodiversity value regions. We would like to call upon the conservation community to follow our example and join us in our effort to protect the natural heritage of the Alps.



Above: Calanda, mountain in the Rhine valley near Chur, Switzerland WWF / Jürgen Deuble
Below: Schreckhorn, Switzerland WWF / Andreas Baumüller



The Alpine Convention and Biodiversity

The "Convention on the Protection of the Alps" (known as the "Alpine Convention"), signed in 1991 and entered into force in 1995, has been the first multilateral treaty specifically devoted to the organisation of inter-regional co-operation in a mountain area and has served as an example for other mountain regions, such as the Carpathians. The Conven-

tion outlines the principles and urgent fields of action in specific environmental, economic and social areas¹.

The nine contracting parties (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, Switzerland and the European Union) highlight the natural and cultural wealth of the Alps, their importance for people living there or visiting the area, the need for the reinforcement of trans-border co-operation and for reconciliation of economic interests with ecological requirements. They recognise the fact that the Alps constitute an essential habitat and last refuge for many endangered species of plants and animals and they are aware that the ever-increasing pressures caused by humans are increasingly threatening the Alpine region and its ecological function. With the Alpine Convention, the contracting parties will pursue a comprehensive policy for the preservation and protection of the Alps. In order to achieve the objectives they will take appropriate measures in twelve priority areas laid down in so-called pro-

ocols. So far eight thematic protocols have been formulated, including "Mountain agriculture", "Energy", "Tourism" and "Transport". Only three member parties, however, have formally ratified all eight protocols.

For the conservation of the biodiversity of the Alps, the two protocols "Nature Protection and Landscape Management" and "Regional Planning and Sustainable Development" are the most important. They entered into force in December 2002. The international treaty could be a powerful instrument if all contracting parties finally ratify and implement the protocols.

¹⁾ The full text of the Alpine Convention and its Protocols is available on the homepages www.alpenkonvention.org or www.cipra.org

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A strategy for Alpine-wide biodiversity conservation

Piz Palü, Switzerland WWF / Jürgen Deuble



The Alps are a true wonder of nature. People have always found the huge variety of different habitats fascinating: warm, large valleys, lush foothills, deep mountain gorges and ice- and rock deserts in the summit regions. The Alps are dominated by natural and sometimes disastrous dynamic processes: Foehn storms, avalanches, rock falls, periodic flooding and harsh winters. These processes are characteristic for the Alps and continuously create new living space for plants and animals. They are the driving force for biological diversity. But they are sometimes also devastating to the human population and provide a great challenge for the coexistence of nature and people. Dynamic processes and a large variety of habitats are the basis for the enormous variety of species making the Alps an ecoregi-

on of international recognition. The Alps belong to the most important ecoregions² in the world, WWF's Global 200 – identified to conserve global biodiversity (see box, p. 7).

The Alps, as well as being the largest natural region left in Central Europe, are also one of the most threatened. The nature of the Alps has been heavily altered and often destroyed by humans.

There has so far been no strategic approach to conserve the biodiversity of the entire Alpine region for present and future generations and there are few initiatives which are concerned with biodiversity in

²⁾ An ecoregion is an ecosystem covering relatively large areas of land or water and containing a geographically distinct assemblage of natural communities

the Alps as a whole. With its ecoregional conservation approach, WWF together with ALPARC, CIPRA and ISCAR has developed a biodiversity vision for the Alps. This vision identifies the areas most important to biodiversity in the Alps, upon which conservation activities should concentrate in the future. A comprehensive action plan will identify conservation activities on an ecoregional as well as on a regional level. Only in this way can we guarantee the long-term conservation of our natural heritage in the Alps.

The gemstones of the Alps

The priority conservation areas represent the “gemstones” of the overall important Alps. They are the most important areas when considered at an ecoregional level.

Thinking in ecoregions – a new conservation strategy

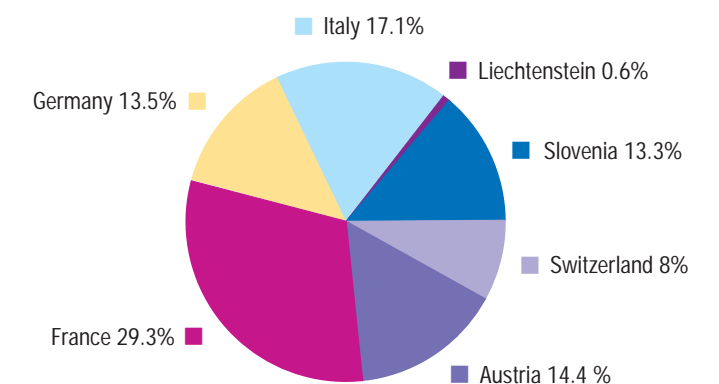
In the 1990s WWF identified 238 priority ecoregions in the world through the Global 200 initiative. The Alps are one of them. Priority ecoregions represent the finest examples of a given major habitat type. If we succeed in protecting the biodiversity of these 238 ecoregions, we will have protected the largest part of the planet's biodiversity. These ecoregions have subsequently been recognised and adopted also by multilateral organisations such as the European Environmental Agency and the World Bank. Other large conservation organisations, such as “The Nature Conservancy” and “Conservation International” also adopted ecoregion conservation as their central conservation strategy.

Ecoregion conservation includes some important steps:

- development of a biodiversity vision,
- identification of priority conservation areas,
- development and implementation of an ecoregion action plan.

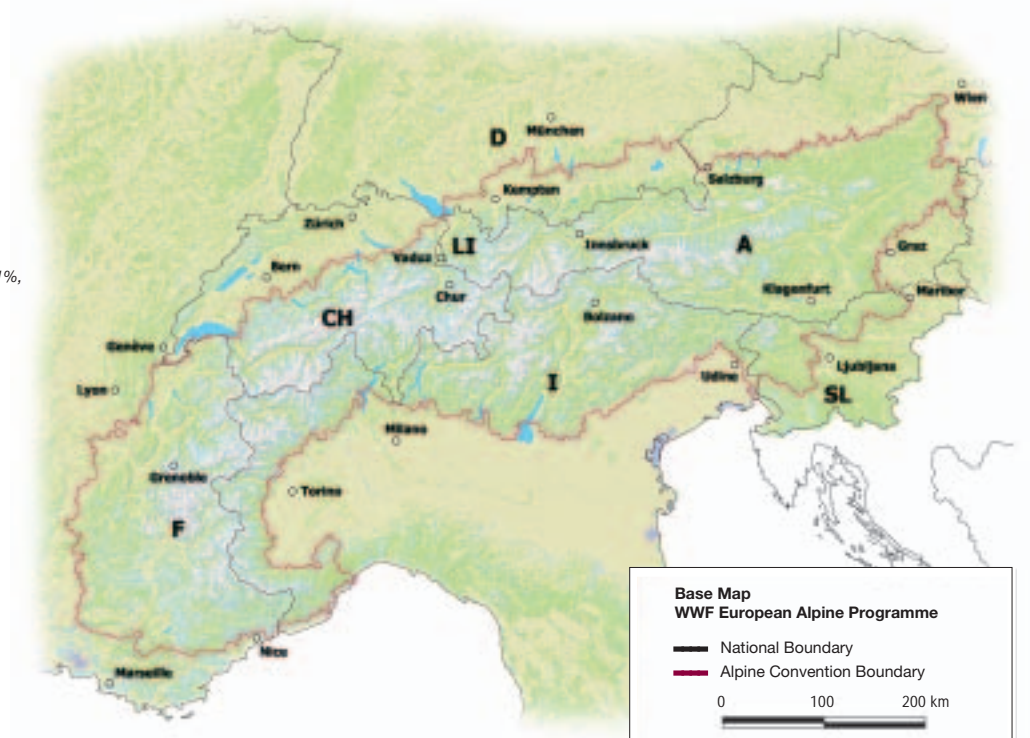
Key features of ecoregion conservation are: large spatial scale (entire ecoregions), long-term vision (50 years), integration of biodiversity and socio-economic factors, scientific base, establishment of partnerships with other actors and involvement of interest groups.

Protected areas relative to the Alpine region of each country (only national parks, regional parks and nature reserves > 100 ha)



That does not mean that the areas outside the priority conservation areas are unimportant but if we want to be most effective with our limited resources we have to concentrate our efforts. Human activities in the priority conservation areas have to be especially considerate. We are all responsible for conserving these Alpine “gemstones” – we cannot afford to lose them!

Map 1: The Alps ecoregion within the borders of the Alpine Convention. Austria occupies 28.5% of the Alps, Italy 27.6%, France 21.4%, Switzerland 13.1%, Germany 5.8%, Slovenia 3.5%, Liechtenstein 0.08%, and Monaco 0.001%.



Ecoregion under pressure

The Alps – one of the last remaining areas with truly wild places in central Europe – are remote. They are breath-taking. They are beautiful. They are one of the last strongholds of nature against the ever increasing demands of humankind to occupy, convert, replace, and often destroy the basis of its own origins and future.

Their mountainous character sets the Alps apart from the surrounding landscapes and separates the Mediterranean region with its dry forests from the central European deciduous forests. The Alps are a labyrinth of mountain chains and valleys, reaching from sea level up to 4800 m (Mont Blanc) and consisting of a huge variety of rock-types and micro-climates.

These are the main reasons for the astonishing diversity of life found there. Listing the bare numbers provides only a glimpse of the “Guinness book of records”-like biodiversity found in the heart of Europe (see box, p. 9)

It is no wonder that the Alps have been selected as a region of global importance by two global biodiversity assessments. The Global 200 Initiative of WWF recognises the Alps as one of the 238 most important ecoregions for conserving a major proportion of the global biodiversity for future generations (see box, p. 7). The study “Centers of plant diversity” by IUCN and WWF identifies the Alps as one of 234 regions with the highest plant diversity in the world.

Humans in the Alps

The Alps are also home to about 14 million people from 8 countries, representing a multitude of different cultures and languages. The Alps, as defined by the Alpine Convention, encompass about 191,000 km², leading to a population density of about 68 inhabitants/km². But this figure is misleading because the population is not evenly distributed across the area. Humans have lived in the Alps since Neolithic times and have struggled to survive in an often harsh environment. Settlements started to grow in places with the least “resistance” from nature: on elevated areas in large valleys and lower mountains, slowly spreading along the valley bottoms and into side valleys. The steep and rugged mountains were mostly unsuitable for permanent human settlements but were often used to graze livestock during the summer months. Long-standing agricultural and livestock grazing activities have resulted in a character-

istic cultural landscape in many parts of the Alps which also plays an important role in maintaining biodiversity. But with increasing industrialisation and globalisation, traditional land management practices are no longer economically feasible. As a result, extensive farming is decreasing throughout the Alps and intensive farming in the valleys is increasing – with devastating effects for biodiversity.

Around 120 million tourists visit the Alps every year, demanding the appropriate infrastructure. Tourism developments affect some of the last remote areas in the Alps, threatening their own economic basis. Additionally, road traffic is a major issue not only due to increasing tourism and recrea-

tional activities but also due to the increasing trade between countries around the Alps and increasing commuter travel to larger cities within the Alps. Other serious threats to biodiversity result from the use of water for drinking, watering crops and generating hydroelectric power. The Alps are the most important water reservoir in Europe and are heavily influenced by outside interests in that respect.

Nature conservation as tradition

Nature conservation has a long history in the Alps. Many important areas have been set aside as protected areas, so that about 20 to 25% of the Alps are protected by law. Protecting areas is a very impor-

tant tool for the conservation of biodiversity and large efforts have been made by Alpine governments for the establishment of different forms of protected areas: national parks, natural and regional parks, nature reserves, biosphere reserves and other complementary forms of nature protection. Nevertheless, protected areas are often isolated from each other and need to be linked by ecological corridors and special management measures outside of protected areas.



Above: Urban sprawl in the valley of Saas, Switzerland WWF / Andreas Weissen
Below: Mountain pastures in Montafon, Austria WWF / Hubert Malln



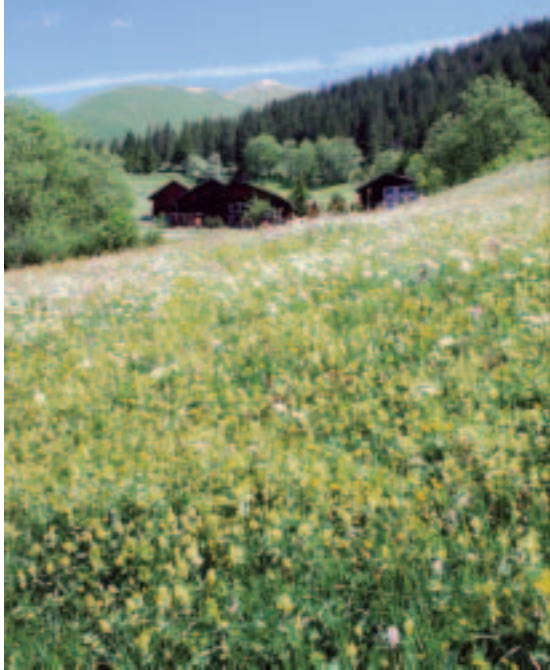
Plant and animal diversity in the Alps

- ca. 30,000 animal species, of which are:
 - ca. 20,000 invertebrate species (number is only a rough estimation)
 - ca. 200 breeding bird species
 - ca. 80 mammal species (includes those which only “touch” the Alps marginally)
 - ca. 80 fish species
 - 21 amphibian species (one of them endemic)
 - 15 reptile species
- ca. 13,000 plant species, of which are:
 - > 5,000 fungus species
 - ca. 4,500 vascular plant species (representing 39% of the European flora; about 400 are endemic.)
 - ca. 2,500 lichen species
 - ca. 800 moss species
 - ca. 300 liverwort species



Biodiversity of the Alps

Biodiversity is the “spice of life”. This relatively new term categorises features which make up life on Earth and which make life on Earth possible. Biodiversity consists of all genes (genetic diversity), all species (species diversity), all ecosystems (ecosystem diversity) and all processes which sustain life on Earth. Describing biodiversity is yet another matter. Even though the Alps are probably the best studied mountain system in the world, we nevertheless have only a very basic knowledge about the different components of their biodiversity. We do not even know all invertebrate species living in the Alps, let alone all genes or processes. This is the reason why most studies talk about biodiversity but limit their work to species and ecosystems – our study is no exception in that regard.

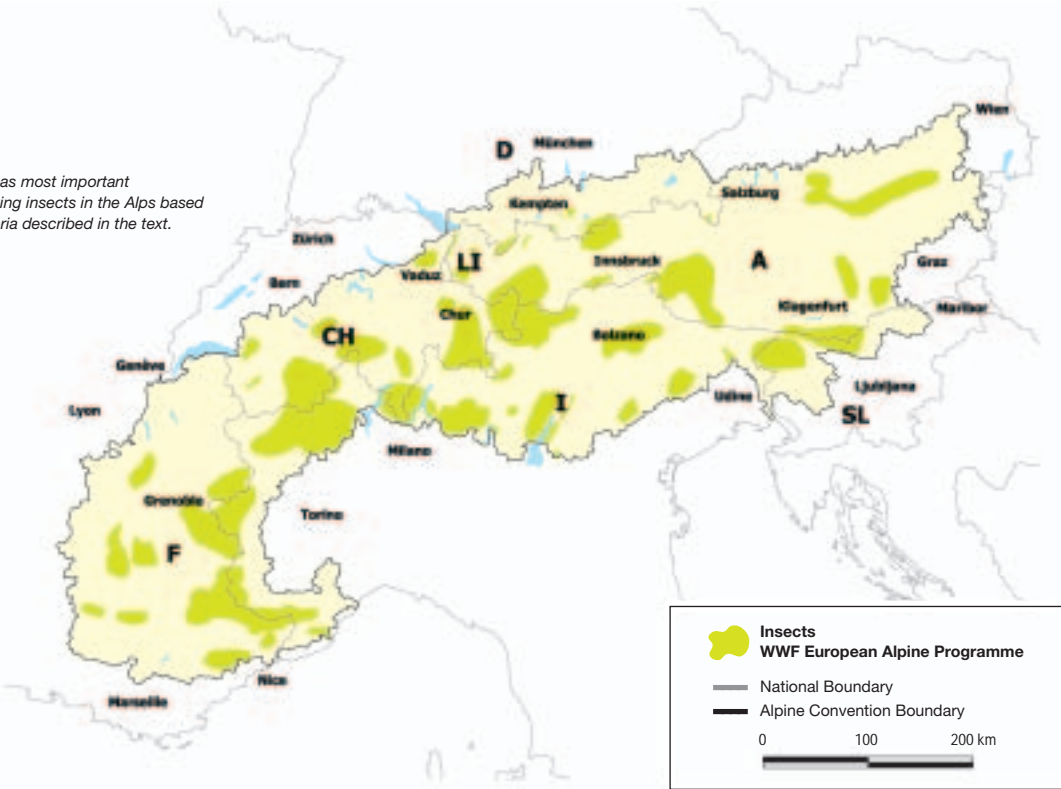


Mountain meadow in the valley of Bsclaber, Austria WWF / Andreas Baumüller

Knowledge about species and ecosystem distribution in the Alps is most often confined regionally and by political boundaries throughout the Alps. Furthermore, methods of data collection and analysis vary greatly between countries and regions. To overcome this obstacle, the WWF European Alpine Programme started to collect data on biodiversity and socio-economic issues available at the same scale for the entire Alps, and to transfer them into a Geographic Information System (GIS). Based on this information and the knowledge of biodiversity experts from all Alpine countries, species and eco-

systems characteristic of the Alps were selected according to their importance with regard to biodiversity and the availability of information about them. The areas most important for each species group (the taxa: flora, insects, reptiles & amphibians, birds, and mammals) and for freshwater ecosystems were drawn by experts on a large scale map of the Alps (maps 2-7).

Map 2: Areas most important for conserving insects in the Alps based on the criteria described in the text.



Insects: inconspicuous but fundamental



Apollo butterfly (*Parnassius apollo*) WWF / Anton Voraue

Invertebrates³ are small and their importance is often overlooked by many people. On the contrary, they represent the majority of species on Earth and the combined weight of all individuals would be far greater than the weight of all vertebrates such as elephants, whales and humans together. But they are the group of animals we know the least about. This is true world-wide and also for the Alps. It is estimated that there are at least 20 times more invertebrate species in the Alps than vertebrates. From Carinthia we know that there are at least 8500 species of

invertebrates⁴. About 33% of these species are threatened, mainly due to habitat loss and destruction.

This study has had to concentrate mainly on butterflies and beetles because they are the only groups of insects with some distributional data consistent throughout the Alps. Areas were selected where many endemic butterflies and beetles can be found as well as areas with a high concentration of butterflies and other insect species.

³) All animals that do not have a spine, e.g. insects, worms, spiders, crustaceans, snails
⁴) All animals that have a spine, e.g. mammals, reptiles, amphibians, fish, birds



Rosalia alpina
Dietmar Nill

Flora: decorative wealth



Edelweiss (*Leontopodium alpinum*), Alpenrose (*Rhododendron ferrugineum* and *R. hirsutum*) and Gentian (*Gentiana acaulis*) are probably the best known Alpine plants. But they are only four of about 4500 species of vascular plants found in the Alps (39% of the European flora), of which about one-sixth are restricted to high altitudes. Additionally, there are about 900 plant community types – characteristic combinations of plant species covering large areas. This enormous diversity made it very difficult to select a number of plant species and vegetation types to focus on in this study. Nevertheless, there are some extraordinary groups of plants and vegetation types that stand out and are typical for the Alps. These were used in this study:

Centers of endemic species: From the 4500 plant species in the Alps, 350 species (8%) only occur in the Alps or part of the Alps and nowhere else in the world. These endemic plants in particular are found at higher altitudes where harsh conditions limit plant growth as well as in areas which were mostly ice-free during the Pleistocene glaciation. The outer ranges of the Alpine arc especially served as refuge for many of these plant species. Here, the largest number of species with very restricted distribution can be found, such as certain saxifrage species (*Saxifraga diapensioides*, *S. tombeanensis*, *S. burseriana*), Zois’ Bellflower (*Campanula zoysii*) or Carniolan Lily (*Lilium carniolicum*).

Centers of rare species: In some regions of the Alps many very rare species are found, e.g. in the Bergamo region or in the Engadine. These regions have a high value from the perspective of plant diversity.

Large, contiguous forest areas: Without the influence of people, most of the vegetation below the timberline in the Alps would consist of deciduous mixed forests in the valleys and coniferous forests at higher altitudes. In many of these mountain forests exploitation was restricted or even banned for centuries because they protect settlements in the valleys from natural hazards such as snow avalanches or rock fall. Many of these forests are considered relatively natural today and serve as important refuges for rare species as well as corridor areas for many others (e.g., capercaillies, large herbivores, large carnivores).

Distinct dry areas with drought-tolerant vegetation: The climate in the Alps varies remarkably from the outer ranges with Atlantic climate to the valleys of the central ranges with continental-like climate. These dry valleys in the central range harbour specific plants such as several grass species from the genus *Stipa* or species of the Pea family such as Milk vetches (*Astragalus* sp., *Oxytropis* sp.), and special grassland communities with *Stipa* or with Fescue (e.g. *Festuca valesiaca*).



Kerner's Alpine Poppy (*Papaver kernerii*) Michael Hesse / Univ. Vienna

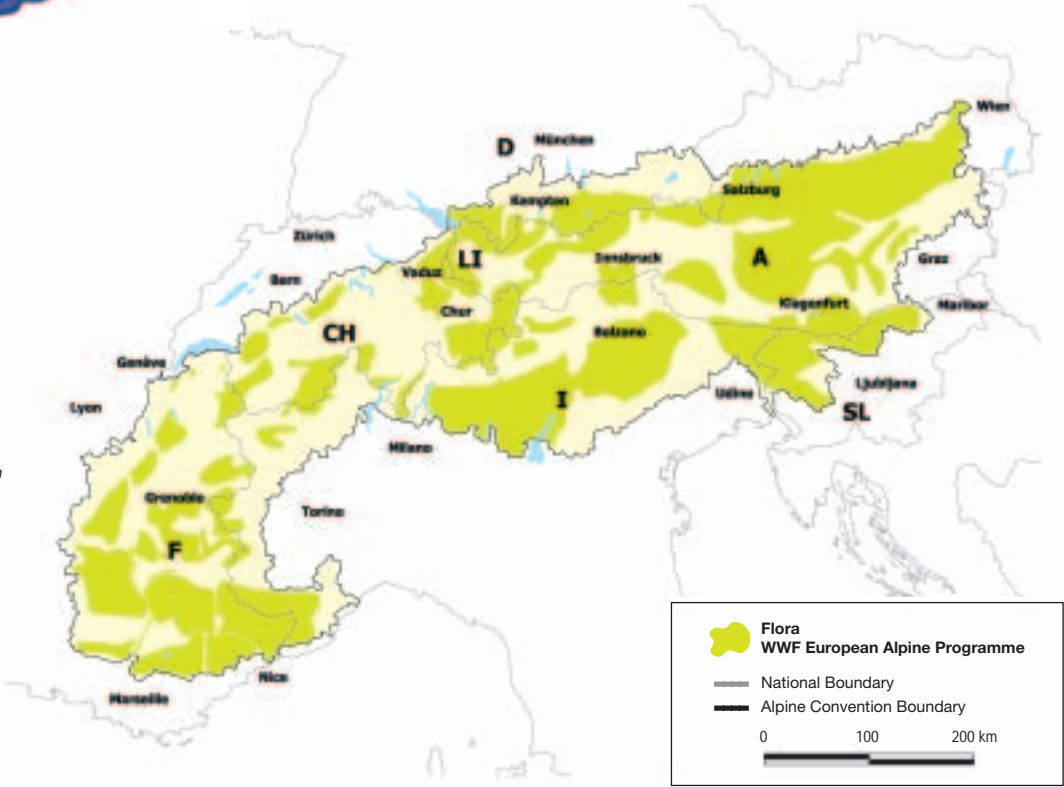


From top:
Berardie (*Berardia subacaulis*) WWF / Andreas Weissen
Zois' Bellflower (*Campanula zoysii*) WWF / Andreas Weissen

Habitats harbouring particular ecological phenomena (selected habitats with special ecological relevance): There are some special habitat types that are characteristic to the Alps and harbour specific ecological phenomena and processes, such as peat bogs or glacier forelands. The value of these habitats lies in their ecological integrity.



Gentian (*Gentiana acaulis*)
Michael Hesse / Univ. Vienna



Carniolan Lily (*Lilium carniolicum*) Michael Hesse / Univ. Vienna





Dotterel (*Charadrius morinellus*) A. Jordi

Grey-headed woodpecker (*Picus canus*) Manfred Delpho

Hoopoe (*Upupa epops*) SVS / Zürich

Capercaillie (*Tetrao urogallus*) SVS, Zürich / Tero niemi

Birds: at home in the Alps or just passing through

There are about 200 species of birds breeding in the Alps with about 200 additional species which migrate through this region. No birds are endemic to the Alps. Birds of prey, such as the golden eagle (*Aquila chrysaetos*), the peregrine falcon (*Falco peregrinus*), and the bearded vulture (*Gypaetus barbatus*) have suffered severely from human persecution. Today, the population of golden eagle has recovered due to international conservation efforts. The bearded vulture – extinct in the Alps at the beginning of the 20th century – has been successfully reintroduced in what is probably the most ambitious restoration project for an extinct species in Europe. Peregrine falcons also show an encouraging increase in numbers. Nevertheless, habitat destruction is a problem especially for migrating birds and waterfowl. The following criteria were considered in this study:

Important Bird Areas (IBA): Areas which are important for birds around the world have been identified by BirdLife Inter-

national with the participation of many specialists and are called “Important Bird Areas” (IBA). A site is recognised as an IBA only if it meets specific criteria: it either has significant numbers of one or more globally threatened species, or is part of a number of sites that together harbour species that are restricted in range or biome, or shelters exceptionally large numbers of migratory or gregarious species. Most often, IBAs are important for many species at the same time, making them the obvious choice for a priority setting for birds.

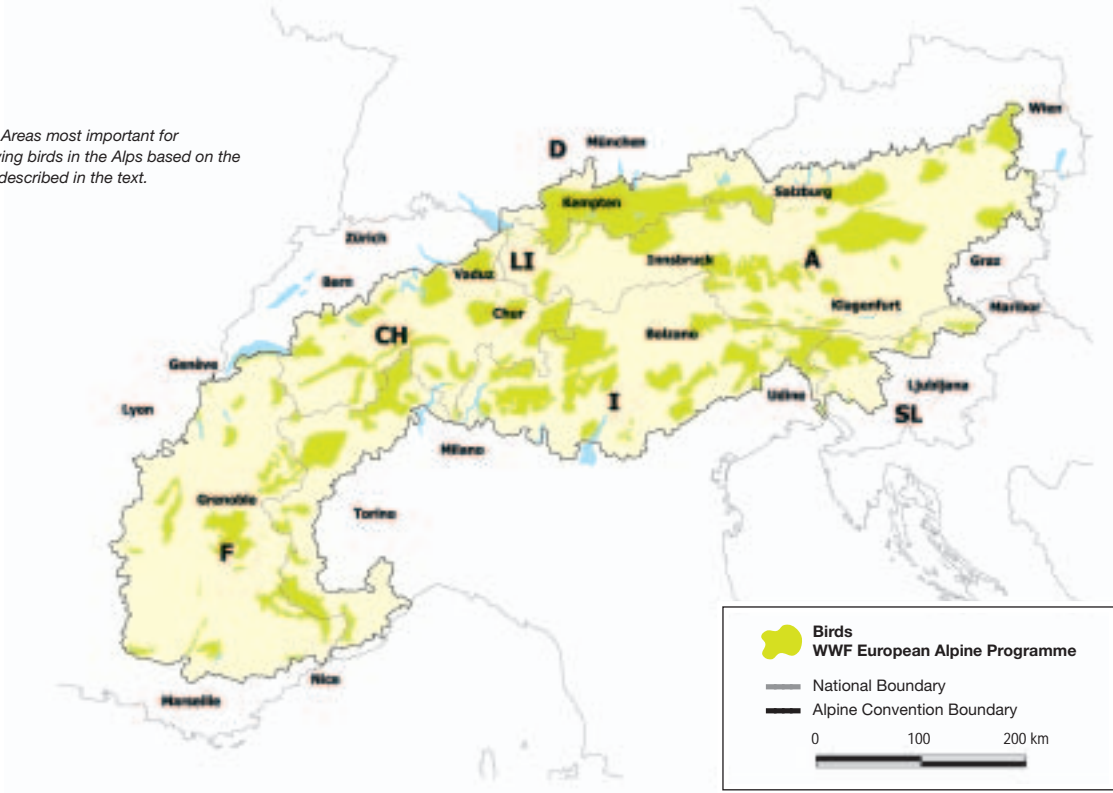
Areas of high value for typical Alpine birds: Most birds live at lower altitudes and only about 50 species can be found breeding above 2000 m. Far fewer than 50 species can be considered as truly alpine birds (meaning that they live predominantly in the alpine environment above the tree-line) and these include the rock partridge (*Alectoris graeca*), and dotterel (*Charadrius morinellus*). Other remarkable species are restricted to a particular

habitat, e.g. to the montane forests, such as capercaillie (*Tetrao urogallus*), three-toed woodpecker (*Picoides tridactylus*), and citril finch (*Serinus citrinella*), or live along the Alpine rivers such as common sandpiper (*Actitis hypoleucos*). Species that are generally rare, and of scattered distribution within the Alps are the rock partridge, and rock thrush (*Monticola saxatilis*). These bird species (and some others) deserve special attention at the Alpine scale. Additional areas were selected for these species if the experts believed the IBAs did not adequately represent them.



Rock Partridge (*Alectoris graeca*) SVS, Zürich

Map 4: Areas most important for conserving birds in the Alps based on the criteria described in the text.





Brown bear (*Ursus arctos*) WWF-Canon / Kevin SCHAFER

Mammals: from Alpine mouse to wolf

Thinking about wildlife in the Alps, most people automatically think about large mammals such as brown bears, ibex or red deer. Besides these very conspicuous and attractive mammals there are many more which are hardly noted due to their small size and secretive life style. About 80 mammal species live in the Alps and the majority are shrews, mice, voles or bats. A few mammals are endemic to the Alps: the Bavarian vole (*Microtus bavari-cus*), the Alpine mouse (*Apodemus alpi-cola*) and the chamois of the Chartreuse mountains (*Rupicapra rupicapra cartu-siana*). In this study, special attention was given to the following groups:

Large carnivores: The return of the wolf (*Canis lupus*), lynx (*Lynx lynx*) and brown bear (*Ursus arctos*) is one of the remarkable success stories for nature conservation in the Alps, even though there are still many prejudices against these animals to be rectified. Nevertheless, they always were and still are an integral part of nature in the Alps. Looking at western and central Europe, the Alps are an important foothold for large carnivores and will play a major role in guaranteeing their future survival and dispersal to other

Alpine mouse (*Apodemus alpicola*)
WWF / Aldo Fluri

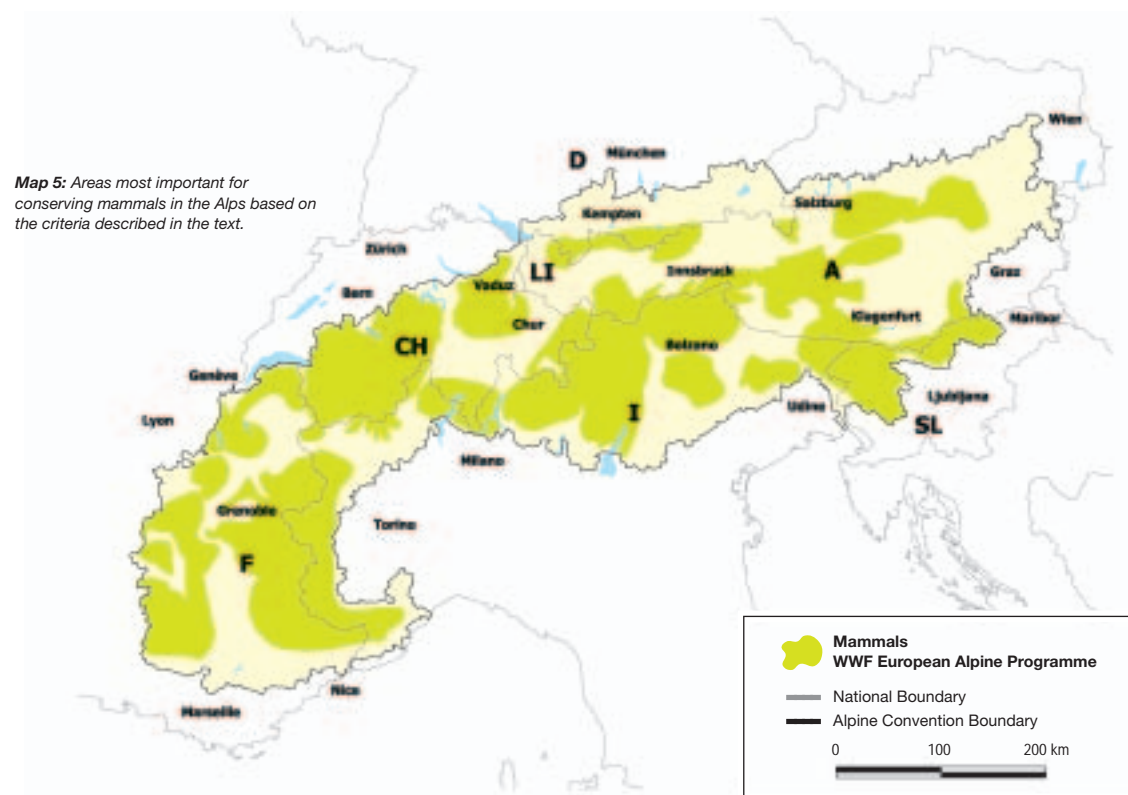


regions. Areas where large carnivores currently live and reproduce and areas where there is a high potential for them in the future were selected by experts for this study.

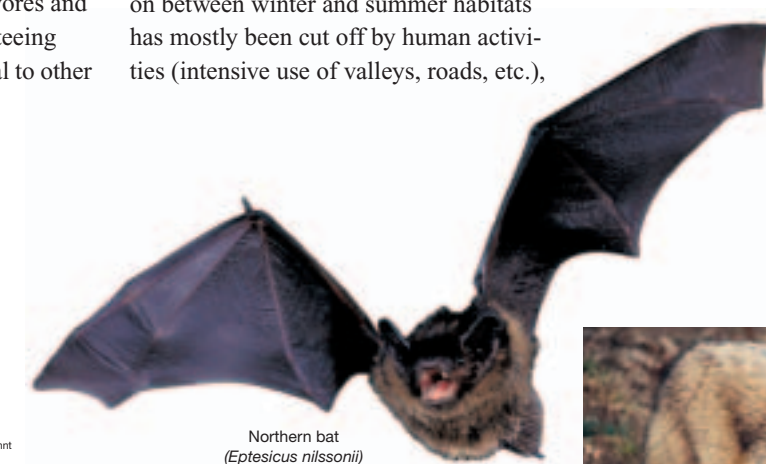
Large herbivores: The Alpine ibex was once on the brink of extinction, mainly due to hunting pressure. After its protection in the 19th century and its subsequent re-introduction the population recovered and is currently considered secure. The Alpine chamois (*Rupicapra rupicapra*) as well as the red deer (*Cervus elaphus*) are two other characteristic herbivore species in the Alps. The Chamois is well-established and widespread. The red deer represents an important management issue in the Alps. Their traditional migration between winter and summer habitats has mostly been cut off by human activities (intensive use of valleys, roads, etc.),

and their natural winter feeding habitat has become critical. Forced into sub-optimal habitat and due to bad management, red deer can damage forests and decrease the capacity of forests to protect humans against avalanches and mud-slides. Areas where all three species are found together and areas with optimal habitat for these ungulate species were mainly selected for this study.

Small and medium mammals: Besides the above mentioned endemic Alpine mouse and Bavarian vole, special attention was given to bats. The northern bat (*Eptesicus nilssonii*) is a typical bat species in the Alps (even if also found throughout northern Europe). The horseshoe bats (*Rhinolophus euryale*, *R. ferrumequinum*, *R. hipposideros*) depend on caves for roosting and are very vulnerable to disturbance. They mostly populate valleys up to 1000 m. Last but not least, the otter (*Lutra lutra*) indicates good quality habitat and has a very localised distribution in the Alps. Areas important for these species were selected for this study.



Young lynx (*Lynx lynx*) Autor unbekannt



Northern bat
(*Eptesicus nilssonii*)
Dietmar Nill



Wolf (*Canis lupus*) WWF / Aldo Fluri

Freshwater: source of life

The Alps are Europe’s most important water reservoir: even the Rhône, Rhine and Po rivers, with their large basins mostly located outside of the Alps, originate in the Alpine region. There are about 80 fish species living in Alpine lakes and rivers, and species richness decreases rapidly with increasing elevation. The types of fish living in large rivers such as the Danube, Rhine, Rhône, and Po and their Alpine tributaries are very much determined by the fish fauna of their destination and are therefore very distinct in this regard. The Danube fish fauna is related to the Black Sea region, that of the Rhine to the North Sea where salmon migration was once spectacular. Those of the Rhône and the Po reflect the fish fauna of the Mediterranean Sea. Many of the small lakes in the Alps were naturally almost free of fish and harboured only a few, specialised fish species. These two aspects – the convergence of fish fauna from distant sea regions in Alpine rivers and a highly specialised fish fauna in small lakes and rivers – make rivers and lakes very unique in the Alps.

Furthermore, rivers and streams in the Alps naturally transport large amounts of



Brown trout (*Salmo trutta fario*) Stefano Porcellotti

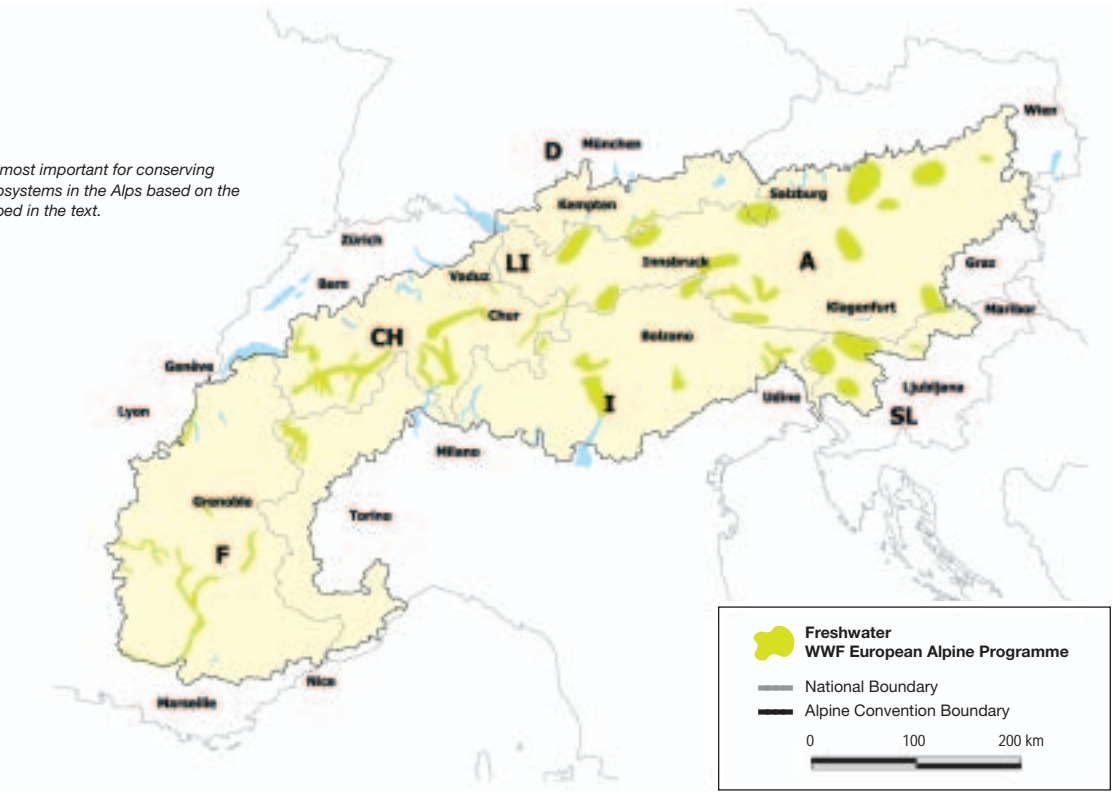
rock and gravel which periodically destroy old and create new habitats. This makes natural rivers and streams highly dynamic systems which are very important for and typical to the Alps. Intact rivers and streams also serve as important bio-corridors within the Alps as well as towards their surrounding area.

Since medieval times, fishermen have tried to establish fish populations in Alpine lakes and running waters, disturbing the highly specialised and endemic invertebrate fauna and the local populations of trout (*Salmo trutta fario*, *S. trutta marmorata*). This introduction of exotic species into many Alpine water bodies is one of the most disastrous impacts of humans on fauna in the Alps. Furthermore, many rivers have been dammed for

hydroelectric power production. Riparian areas were cut off from river dynamics and destroyed, causing large problems downstream with flooding during the spring melting season. About 90% of Alpine rivers have lost their natural state.

This dramatic situation makes the conservation of the last remaining, natural rivers even more pressing (e.g., the Tagliamento river). In this study experts selected the last rivers with intact floodplains and lower stretches of rivers which are still in natural or nearly natural condition.

Map 6: Areas most important for conserving freshwater ecosystems in the Alps based on the criteria described in the text.



One of the last wild rivers in the Alps: the Tagliamento, Italy Arno Mohl



Goosander (*Mergus merganser*) SVS, Zürich



Mountain stream near Kühtai, Austria WWF / Anton Voraue

Amphibians and reptiles: secretive lives

Amphibians and reptiles are very special animals because there are only a handful of species which require very specific places to live. Extreme in that sense for example is the cave salamander (*Speleomantes strinatii*) which lives – as the name already says – in caves. In total, there are 21 species of amphibians and 15 species of reptiles living in the Alps. One amphibian, a salamander (*Salamandra lanzai*) is endemic and restricted to a small area in the Coatian Alps. None of the species are strictly Alpine, though the Alpine salamander (*Salamandra atra*) and the common viper (*Vipera berus*) prefer montane and low alpine habitats. Most amphibians are severely threatened by the destruction of their habitats, change in traditional agriculture, desiccation of wetlands, and interruption of migration routes.

Areas were selected for this study where amphibians and reptiles are either endemic or where rare species occur. Additionally, areas with high density of different amphibians and reptiles, such as the lower Ticino or the Rhône valley were selected, making these areas prime candidates for conservation.



Smooth snake (*Coronella austriaca*) Franco Andreone

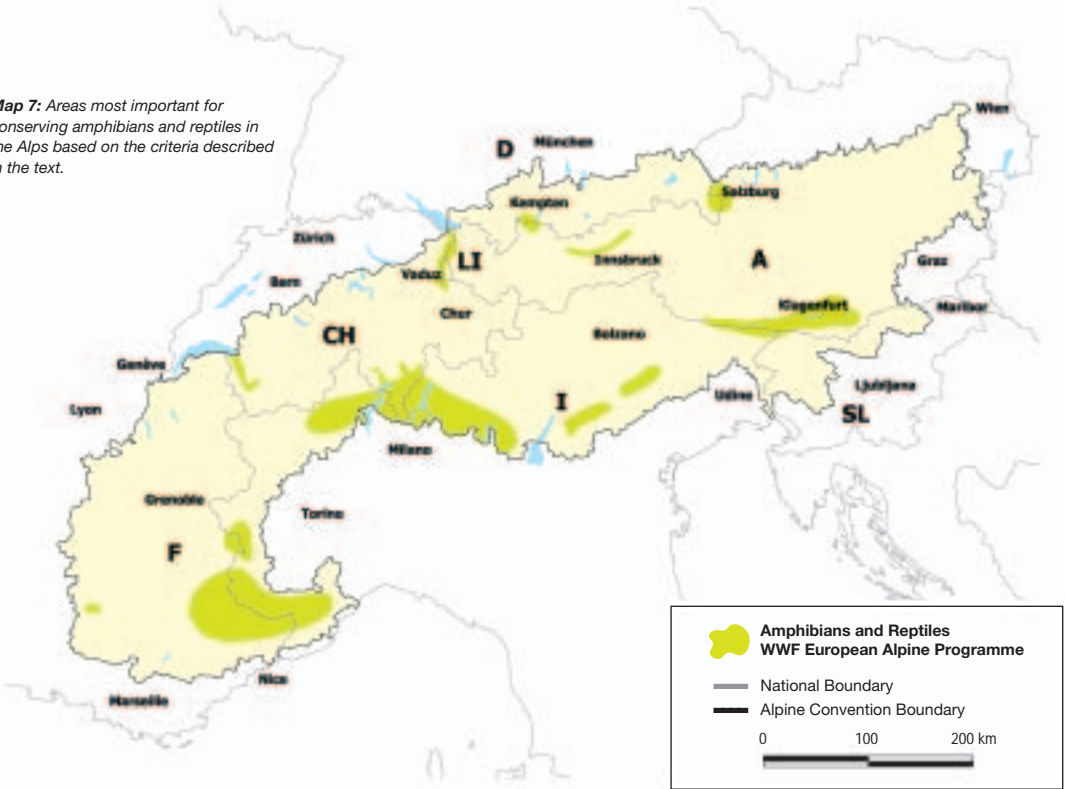


Cave salamander (*Speleomantes strinatii*) Enrico Lana

Alpine salamander (*Salamandra atra*) WWF / Anton Vorauser



Map 7: Areas most important for conserving amphibians and reptiles in the Alps based on the criteria described in the text.



Remote areas: wilderness pure

The Alps include some of the last remaining remote, wild places in central Europe. Remoteness from human infrastructure becomes an increasingly scarce resource and as such is worth protecting. But how remote are the Alps really, considering that they are also home to about 14 million people and are visited each year by another 120 million?

A recent study⁵ on areas in the Alps that are not affected by any kind of human infrastructure (roads, railways, cities, industrial areas, power lines, pipelines, etc.) found a total of 831 remote areas (average size: 32 km², minimum size: 0.04 km², maximum size: 1387 km²), of which 69 are larger than 100 km². Most of these remote areas are found in high, inaccessible mountain zones.

These remote areas were not considered in the same way as the other biodiversity maps in identifying priority areas because they do not indicate biodiversity quality per se. However, this information was used while defining the rough boundaries around biodiversity-rich areas indicated

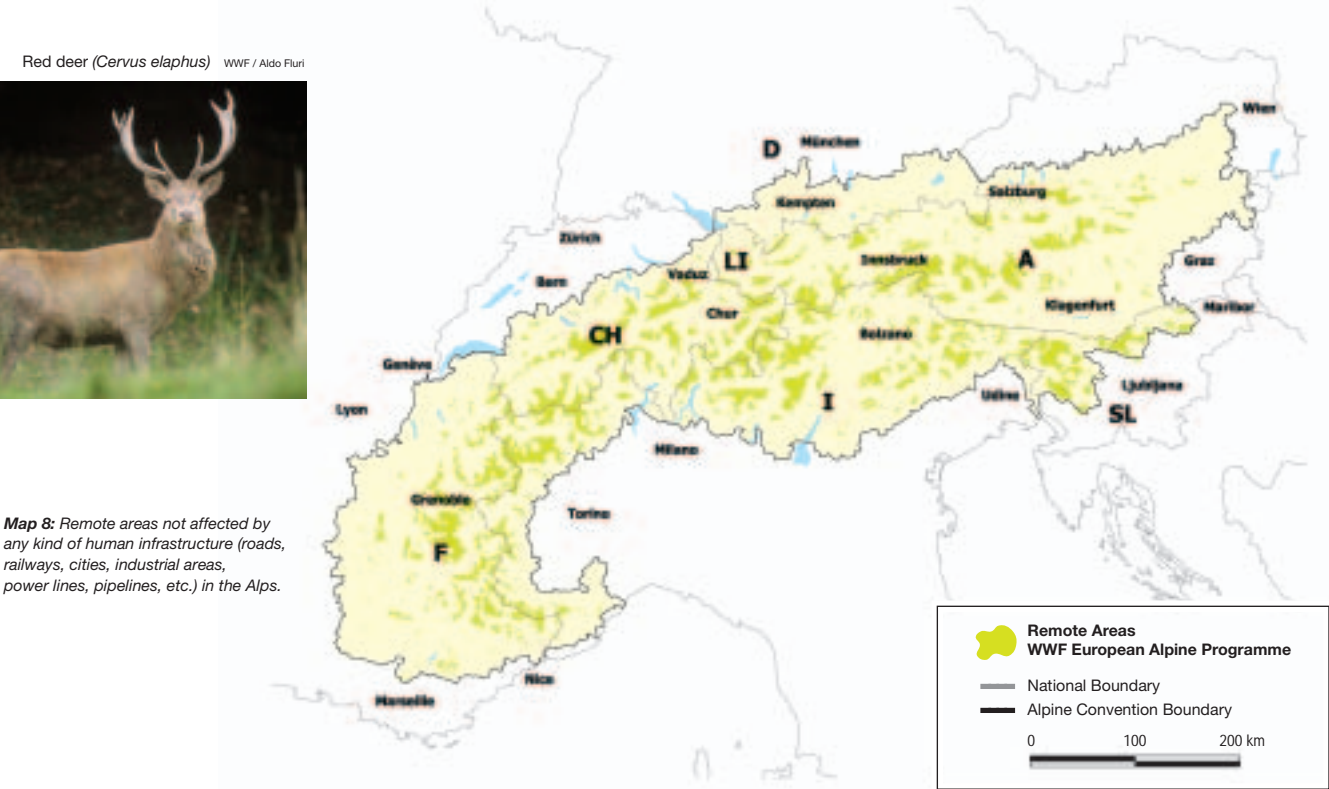
by the overlay of all the other biodiversity maps. A remote area was generally included in the boundary of the priority area if it was close to a biodiversity centre.

⁵⁾ Kaissl 2002: Mapping the wilderness of the Alps – a GIS-based approach, Univ. Vienna

Red deer (*Cervus elaphus*) WWF / Aldo Fluri



Map 8: Remote areas not affected by any kind of human infrastructure (roads, railways, cities, industrial areas, power lines, pipelines, etc.) in the Alps.



Human influence on biodiversity in the Alps

Any strategy for biodiversity conservation which wants to have at least some likelihood of success needs to consider economic, social and political developments in the region of concern. Some issues, such as land use patterns directly affect biodiversity. The effect of other issues, such as national and international policy and recreational trends of people visiting the area might be more indirect but not less important.

It is especially difficult to generalise socio-economic and political trends in such a culturally diverse region as the Alps. Some issues are very different in different regions, such as agriculture and tourism and some affect the Alps as an entity, e.g. traffic and climate change. The following factors have the most devastating effects on biodiversity in the Alps.



From top:
Grenoble, France WWF / Jürgen Deuble
Apple plantation in Meran, Italy WILDLIFE / O. Diez
Wood harvest in the forest WWF-Canon / Edward Parker

Development & demography – valleys beyond hope

Elevated areas in the main Alpine valleys were the first places settled by humans because they were most easily accessible and offered the best conditions for housing and agriculture. Settlements grew along these large valleys and slowly spread to side valleys. These easily accessible valleys of the Rhône, Rhine, Inn and Adige have already lost most of their biodiversity values. The continuing expansion of cities, towns, villages and hamlets has led to an urbanisation and degradation of the countryside threatening the very last natural relicts in the valley bottoms. Highly urbanised valleys with their transport infrastructure (highways, etc.) present a major barrier for many species and prevent the establishment of ecological networks.

On the other side, the south-western and southern Alps (Drôme, Piedmont, Liguria, Friuli, Slovenian Alps) have experienced mass migration into cities in easily accessible valleys, leaving large depopulated areas. With most Alpine communities located below 1000 m there are only a few cities occurring at higher altitudes. These are the constantly-growing tourism centres, such as Chamonix and Davos.

Agriculture – intensive versus extensive

Agriculture is still the most important type of land use in the Alps. Intensive agriculture is increasingly applied in broad valleys and on easily accessible mountain slopes causing large losses to biodiversity especially with the massive use of fertilisers. In the inner Alpine dry zones, vegetables, fruits and grapes are cultivated intensively. The mostly forested and more remote mountain slopes are not used for agriculture. In the high mountains extensive animal husbandry dominates. Traditional, labour-intensive farming on alpine pastures is dying out as the older generation disappears and can not be replaced by organic farming. Many alpine pastures are already abandoned, which often leads to a loss of biodiversity because species-rich meadows naturally become reforested.

Forestry – mountain forests as the last bastion

Forestry is the second most important type of land use in the Alps. However, most forests in valleys, including especially valuable forests in riparian areas, have already been lost to settlements, infrastructure and river regulation. The remaining forest areas are mainly restricted to mountain slopes where they still cover large areas. These forests are used throughout the Alps, but special care is taken to maintain them as protection against avalanches and rock slides, even though natural dynamics are excluded to maintain their protective function. They are in a relatively natural state, although easily accessible through an intense forest road network. The few, pristine forests left in the Alps (total about 665 ha) can mostly be found in remote areas where it is still too expensive to build forest roads.



Above: Deer forage station in the winter, Austria WWF
Right side: Hay harvest in Tyrol, Austria WWF / Andreas Baumüller





Paragliding
WWF / Anton Voraue

Tourism – unsustainable amusement

A total of 120 million tourists visit the Alps every year and there are more than 5 million beds for accommodation throughout the Alps. In the last years there has been a trend towards more “fun and recreation”, such as mountain biking, canyoning, snowboarding, paragliding, etc. These recreation types often affect more remote locations which are also very valuable for nature conservation. The ecologically most devastating form of tourism is winter ski tourism. Currently there are about 300 ski areas throughout the Alps with a trend towards larger concentrations (mass tourism). About 10,000 transport facilities serve more than 3400 km² of ski area. Many additional areas are planned. The construction of ski runs causes irreparable damage to the landscape. The increasing use of snow cannons causes additional ecological and environmental problems due to their use of water, energy and – in some countries like Switzerland – chemical and biological additives.

Water is life

Rivers and streams in the Alps have been intensively altered and degraded. Only about 10% of all rivers are at least partly in a natural or near-natural condition. Rivers and streams have been dammed, straightened, and regulated. Riparian areas as their natural flood regulation have been cut off and converted to agricultural fields or urban areas. The water is used for drinking, watering crops, and generating hydroelectric power. All these measures have devastating effects for the unique and specialised freshwater biodiversity. Additionally, the Alps are the most important water reservoir in Europe and in that function they are heavily influenced by outside interests. Restoration projects have been launched in the last decade by regional and national authorities after disastrous floods; e.g. the Drau in Austria and Rhône in Switzerland. These projects will provide more space for Alpine rivers and streams and will better protect the human population from flooding.

Transport – the burden of traffic

The mountain range of the Alps presents a natural barrier especially to transit traffic. Nearly 150 million people cross the Alps every year, 83% by road and only 17% by rail. Of these, transit traffic by cars covers 70 billion km/year, whereas trucks cover 1.3 billion km/year. Within the next 20 years transit traffic is expected to increase by 100% for freight and by 50% for passenger transport. Currently, only 50% of the capacity for freight transport by rail in the Alps is used. Additionally, inner Alpine traffic is increasing due to more commuting to larger cities as well as recreational activities, and already causes more traffic than transit. Tourism also causes a high amount of traffic throughout the Alps, especially to remote areas. Between 1963 and 1993, the number of areas in the Alps larger than 1500 km² not touched by major transport infrastructure decreased from 31 to 14.

Climate change – the heat is rising

The global warming observed over the last century has already caused all Alpine glaciers to recede and has led to an upward migration of Alpine plants at a rate of 0.5 – 4 m per decade. In the long term, Alpine plants will be displaced to ever higher altitudes by lowland plants until they will have nowhere to go at all. Many of these highly specialised and often endemic plants will then become extinct. Other expected impacts of climate change are the expansion of exotic species and the invasion of pathogens from the south to which the Alps will be no longer a barrier. The former can already be seen in the Ticino region where evergreen trees (even palms) are invading the natural forests. Furthermore, the species composition of plant communities might change with yet unknown consequences for the whole food chain depending on these plants.

In addition to increasing temperatures, changes in rainfall and snowfall patterns and more frequent extreme events, such as floods and avalanches are likely. Higher temperatures also reduce permafrost areas and foster slope processes such as rock falls and landslides.

Melting Aletsch glacier, Switzerland WWF / Andreas Weissen



From top:
Dam in the Maritime Alps, France WWF / Andreas Weissen
"Ski circus" in front of the Matterhorn, Switzerland WWF / Andreas Weissen

Traffic jam on the Brenner highway, Austria/Italy Gesellschaft für ökologische Forschung / Oswald Baumeister



Conservation priority areas in the Alps

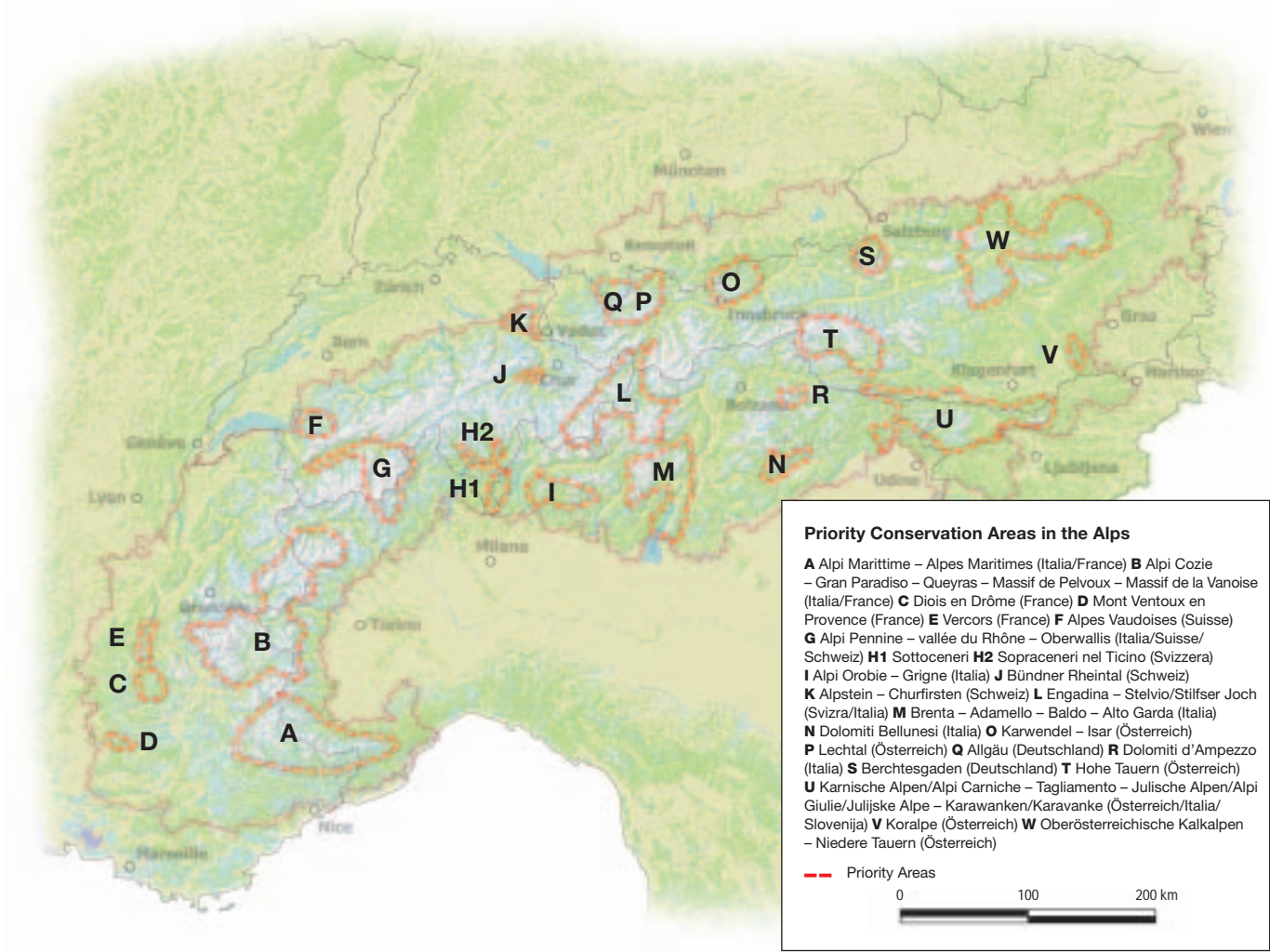
Biodiversity conservation is always important for the entire area of a region. Nevertheless, limited resources make it necessary to prioritise conservation actions. The following map (map 9) should be used as an indication of where conservation action is most important from the perspective of the entire Alps. The areas outside these priority areas are also important - for one group of animals or another, for certain plants and ecosystems, or as corridors. But the priority conservation areas are areas important for the largest number of animals, plants and ecosystems (as far as they are known today). They are the gemstones among the overall valuable Alps.

How the map was derived

The map (map 9) has been derived by overlaying all separate taxon biodiversity maps described before (see maps 2-7) and identifying the areas with the greatest overlap (see map 10). The locations of remote areas (map 8) have been incorporated into priority areas whenever they were located close to the areas of greatest overlay of taxon biodiversity maps. The resulting conservation priority areas have been analysed to see if they adequately represent all biogeographic regions of the Alps as well as all (potential) vegetation zones. Both analyses showed adequate representation within the conservation priority areas.

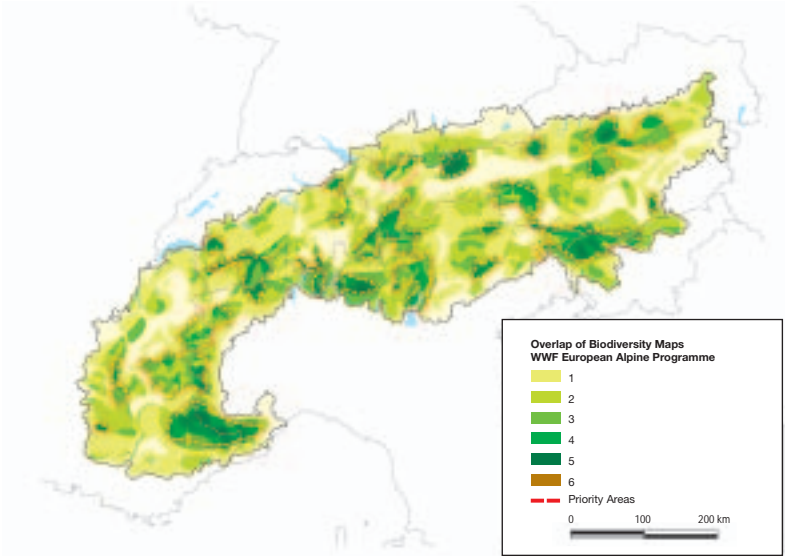
A vision for the future

The vision of WWF and its partners is to conserve the extraordinary biodiversity of the Alps for future generations. We believe this is possible. The map presented here (map 9) provides a concrete means of achieving this end. The intention is not to create protected areas wherever there is a priority conservation area. There are a multitude of other tools available to nature conservation to conserve the most important aspects of biodiversity within priority regions. These tools include measures like the development of responsible tourism, ecologically sound agri-



Map 9: Conservation priority areas in the Alps – these areas represent the “gemstones” among the overall valuable Alps on a pan-Alpine level. Conservation actions should be focussed primarily here.

culture, sustainable forestry, developing markets for regional products, restoration of destroyed habitats as well as the establishment of new and the improvement of existing protected areas. A detailed analysis together with all interested groups in each priority area should clarify the detailed actions needed on a regional and local scale for the conservation of these areas. This analysis also has to identify the detailed boundary of the respective priority area. The areas shown on the map only give a rough idea of the general location of priorities. Their boundaries should not, therefore, be considered final at a finer scale.



Map 10: Deriving conservation priority areas. The map shows an overlay of all priority areas for the various taxon groups (maps 2-7). Regions where more than one taxon area is located appear darker. The darkest areas represent the core areas of the conservation priority areas, being most important for many or all taxon groups.

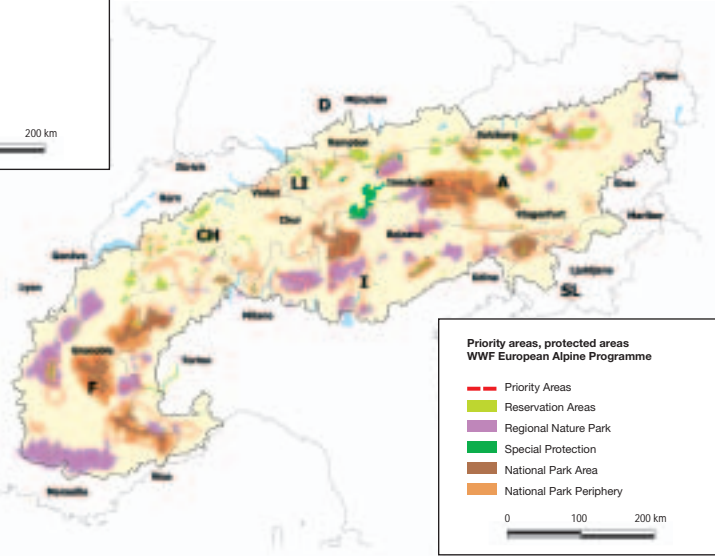
Verdon gorge, France WWF / Andreas Baumüller



Winter landscape in the Regional park Vercors, France WWF / Jürgen Deuble



Map 11: Protection of priority areas – Protected areas play a very important role in conserving biodiversity, even though there are many other possibilities (see above). Protected areas have not been used as a criterion in identifying priority areas. Nevertheless, 59% of the conservation priority areas are under some type of protection, 14% as national parks.



Outlook: Future Conservation in the Alps

Looking ahead 30 to 50 years, what will the Alps look like? Will they still be a place of exceptional beauty? Will we still see ibex, chamois and red deer on an early morning walk? Will we be so fortunate as to catch a glimpse of a wolf crossing our path and disappearing in the forest or a bearded vulture flying majestically over the valley? Will we still be able to find peace and solitude in these mountains to reflect upon our busy and hectic everyday life? Will there still be small villages, mountain farmers and local breeds of domestic animals? Is there a sustainable future for the Alps?

The clear answer of WWF and its partners is: yes! The Alps have a sustainable future if we start to act now. Sustainability is not a theoretical concept known only in academic circles or to environmental non-governmental groups (NGOs). Sustainability is the only way in which humankind – our children, grand- and great grandchildren – can survive in the long-

term. It therefore requires the involvement and action of all groups of society across political and cultural boundaries. Sustainability is the recognition that not only are economic and social considerations important but we also need to balance these issues with ecological necessities.

As a first step, this initiative aims to define these ecological necessities geographically by outlining areas of high biodiversity value throughout the Alps. However, it is important to reiterate that the areas outside these priority areas are also very important. We have to consider both for a coherent environmental policy. We have to be especially careful in managing development in priority areas, such as new infrastructure, housing and industry, tourism centers, etc and at times we will have to give ecological concerns precedence over economic and social concerns. We might have to create new protected areas, to strengthen and connect existing ones, to adopt sustainable forestry in a state forest, to encourage organic agriculture, to reduce traffic, to change EU policies, to educate school children and adults as to the advantages of certain practices, to generate benefits for local communities, etc. There are many different tools available to achieve sustainability. In some areas all tools need to be employed, in other areas only a few.

This initiative identifies areas of special concern for biodiversity. It does not identify concrete actions to be undertaken in specific priority areas. The next step will be a thorough analysis of all priority areas to identify the most pressing issues for biodiversity conservation and to develop concrete actions. But this is something that WWF and its partners cannot and will not do alone. This next step requires the engagement of all interested groups and individuals in the relevant areas: local politicians, land users, tourist as-

sociations, scientists, NGOs, protected area managers – to name just a few.

WWF and its partners are convinced that the maps and information presented here will provide a useful framework, invaluable also to other initiatives which aim to conserve biodiversity in the Alps, and that the vision described here will be adopted by decision makers on local, regional, national and international levels. The biodiversity vision and maps are a contribution to the implementation of the conservation goals of the Alpine Convention, one of the most promising international agreements for the sustainable future of the Alps. We will proceed with conservation actions in selected priority areas. Let's do it together!



Sheep wool production in Innervillgraten, Austria
Gesellschaft für ökologische Forschung / Oswald Baumeister

Columbine (*Aquilegia einseleana*)
WWF / Andreas Weissen

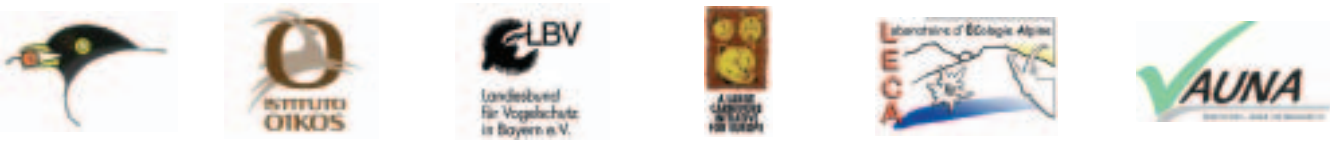


Mountain pastures in Austria
Gesellschaft für ökologische Forschung / Oswald Baumeister

Bluethroat (*Luscinia svecica*)
SVS, Zürich



Milking goats in Switzerland
Gesellschaft für ökologische Forschung / Oswald Baumeister



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