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ISCAR

A Biodiversity Vision for the Alps

Proceedings of the work undertaken to define a biodiversity vision for the Alps

Technical Report

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Foreword

In the days following the Gap workshop, the first event organized to develop the biodiversity vision for the Alps, the director of ISCAR wrote to the CEOs of the WWF Alpine organizations:

> In the name of ISCAR – the International Scientific Committee on Research in the Alps, a committee supported by scientific institutions in all Alpine countries to promote scientific cooperation in Alpine research – I would like to congratulate WWF to have started the initiative to promote biodiversity conservation in the Alpine region. To support this initiative, ISCAR agreed to be one of the partners to prepare the Vision Workshop held in Gap (France) recently.
> As one of the facilitators I participated in this WWF workshop. My impression of the workshop is very positive. The results of the workshop are outstanding in different ways:
> - For the first time we [have] now biodiversity maps covering the whole Alpine region including eight countries! This is fundamental for an Alps-wide progression in biodiversity conservation as aimed also by the Alpine Convention.
> - The cooperation of about 60 experts coming from different disciplines and countries was very successful: within two days they could work out and agree to a limited number of priority areas for conservation of biodiversity in the Alps.
> - The method developed by WWF to identify priority areas for conservation of biodiversity in ecoregions is approved!
> - The working process was very efficient due to the application of GIS (and the tremendous work done by specialists before and during the workshop).
>
> The results of the workshop constitute a first and important step on the way to implementation.
> (…) I can assure you that ISCAR will support WWF with all its available competencies. (…)
>
> *(Dr. Thomas Scheurer, Executive Director ISCAR, 3 June 2002.)*

The director of CIPRA International reiterated:

> CIPRA, the International Commission for the Protection of the Alps, had the pleasure to be a partner in the preparation and realization of the WWF workshop on a biodiversity vision in Gap, France, from May15 to 17 of this year.
> CIPRA would like to congratulate WWF to have started the initiative to promote biodiversity conservation in the Alps. My impression as a participant of the workshop was a very good one. The results of the workshop are outstanding in several ways, as Dr. Thomas Scheurer from the International Scientific Committee on Research in the Alps ISCAR already stated very clearly.
> The results of the workshop are a first and important step on the way to implementation. But further work will have to be done if the process shall lead to successful actions.
> For this reason CIPRA would like to encourage WWF to assure the continuity of the process established in Gap and to help the results from Gap to become an important driving factor in the protection of biodiversity in the Alps. (…). I can assure you that CIPRA will "remain in the boat" and contribute to the process as it did in the preparation of the Gap workshop.
>
> *(Andreas Götz, Executive Director CIPRA International, 11 June 2002.)*

This report is an account of the full process, from the first workshop in Gap to the end results.

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PART I – INTRODUCTION

1. Introduction

1.1 Objective of the report

These proceedings provide a technical record of the process undertaken in defining the biodiversity vision for the Alps. The brochure *The Alps: a unique natural heritage* (WWF European Alpine Programme 2004, Annex 1) presented a reader-friendly summary of our results on priority areas; this report covers both priority areas and connection areas (macro-corridors) and presents the detailed information needed by those who are interested in the technical aspects of the process.

The main purpose of this report is to ensure transparency.

This report is intended for:

- those who have participated in the process so far, to document our shared effort
- decision-makers with an impact on the Alps, to explain how the biodiversity vision was created, providing a context for decision making
- conservation experts throughout the Alps, to provide a basis for conservation activities in the Alps
- potential donors, to interest them in the cause of conservation and sustainable development in the Alps
- interested parties of the Alps (local communities, public administrations, users of the Alps), to help devise strategies that meet their needs whilst addressing the needs of conservation
- scientists, hoping that they will want to replicate this process somewhere else and that they will concentrate their research efforts on the areas of the Alps that are most important for biodiversity.

Documenting the process will also facilitate any revision of the results in the future: as time goes by the conservation status of the Alps may change – for better or for worse – and a revision of current conservation priorities may be required. A detailed description of what was done and why will make it easier to repeat the procedure starting from new information (or to change assumptions and procedures).

1.2 The Global 200

In order to conserve biodiversity, a comprehensive strategy is necessary, taking various scales of intervention into account.
In the 1990s WWF and The Nature Conservancy (TNC) undertook a comprehensive analysis of the biodiversity of the planet. As part of this exercise WWF identified 867 terrestrial ecoregions within fourteen biomes and eight biogeographic realms (Fig. 1)[1]. Several large conservation organizations have defined an ecoregion as an effective unit for biodiversity conservation. An ecoregion is a relatively large unit of land or water that contains a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions (Dinerstein et al. 2000). A terrestrial ecoregion is characterized by a

[1] www.worldwildlife.org/science/ecoregions/cfm and www.nationalgeographic.org/wildworld/.

dominant vegetation type, which is widely distributed in the region – although not universally present – and gives a unifying character to it. Because the dominant plant species provide most of the physical structure of terrestrial ecosystems, communities of animals also tend to have a unity or characteristic expression throughout the region (Dinerstein et al. 2000).

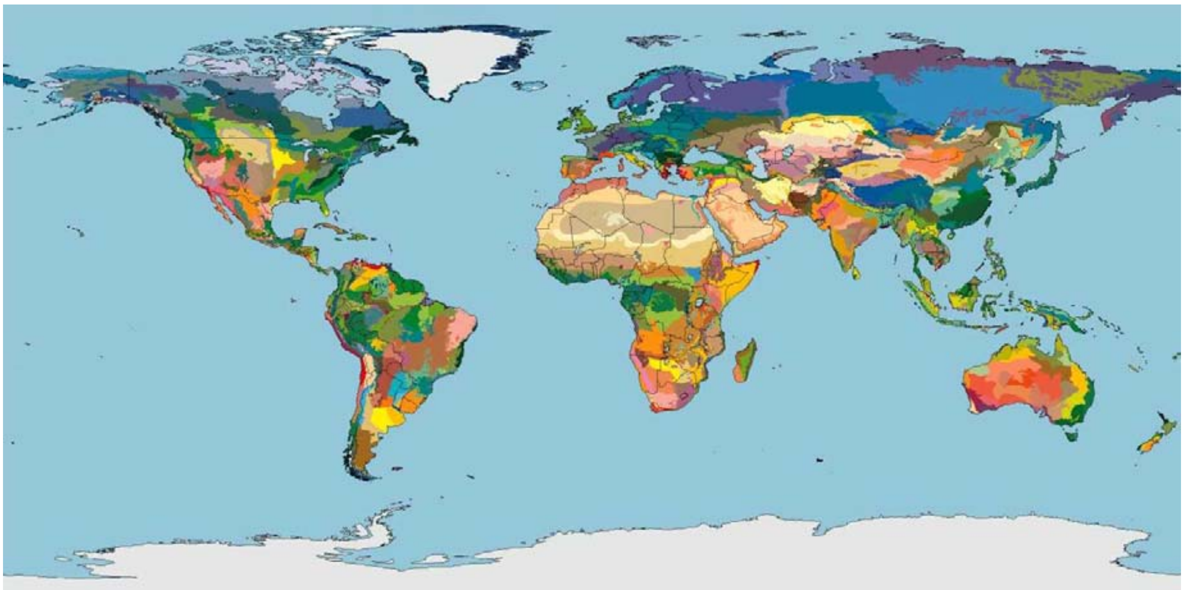

Fig. 1. The 867 terrestrial ecoregions of the planet.

The 867 terrestrial ecoregions were then prioritized and 142 of them were selected as most important at a global level. Additionally, 53 freshwater ecoregions and 43 marine ecoregions were selected. In total, these 238 ecoregions represent the best examples of each major habitat type found on Earth and are under some degree of threat (endangered, vulnerable, etc.). Together the 238 priority ecoregions represent the *Global 200*[2]: they are thought to include about 90% of the biodiversity of the planet (Fig. 2). If we succeed in conserving these 238 ecoregions, we will have conserved the largest part of biodiversity, representing all major habitat types.

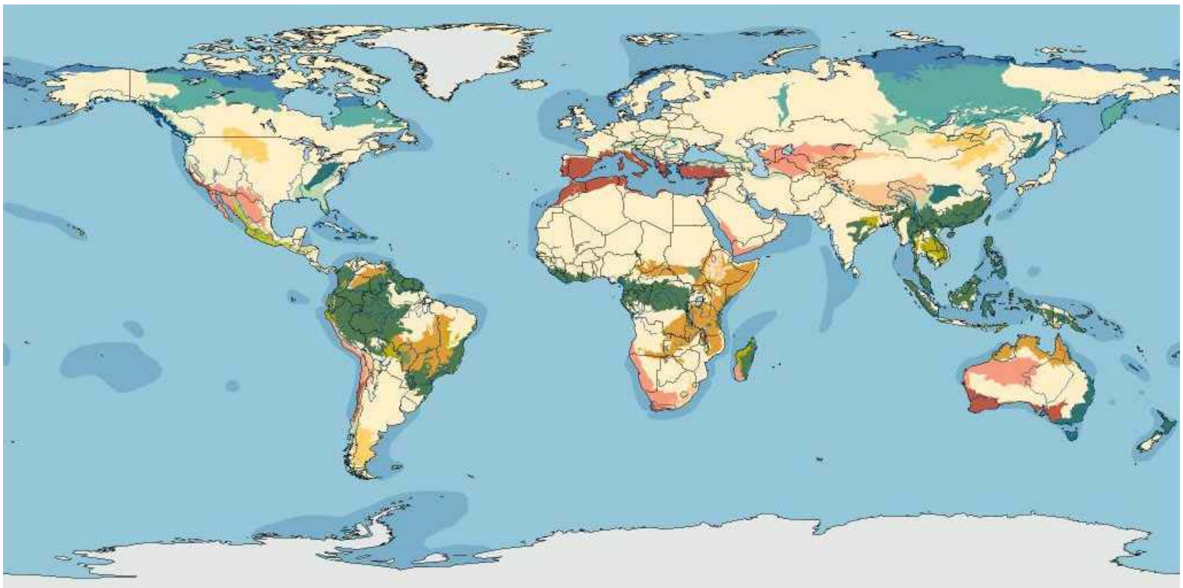

Fig. 2. The Global 200: the 238 priority ecoregions on the planet.

[2] http://www.worldwildlife.org/science/ecoregions/g200.cfm and http://www.nationalgeographic.org/wildworld/.

In Europe, the list of priority ecoregions is also accepted/shared by the European Environmental Agency (Fig. 3).

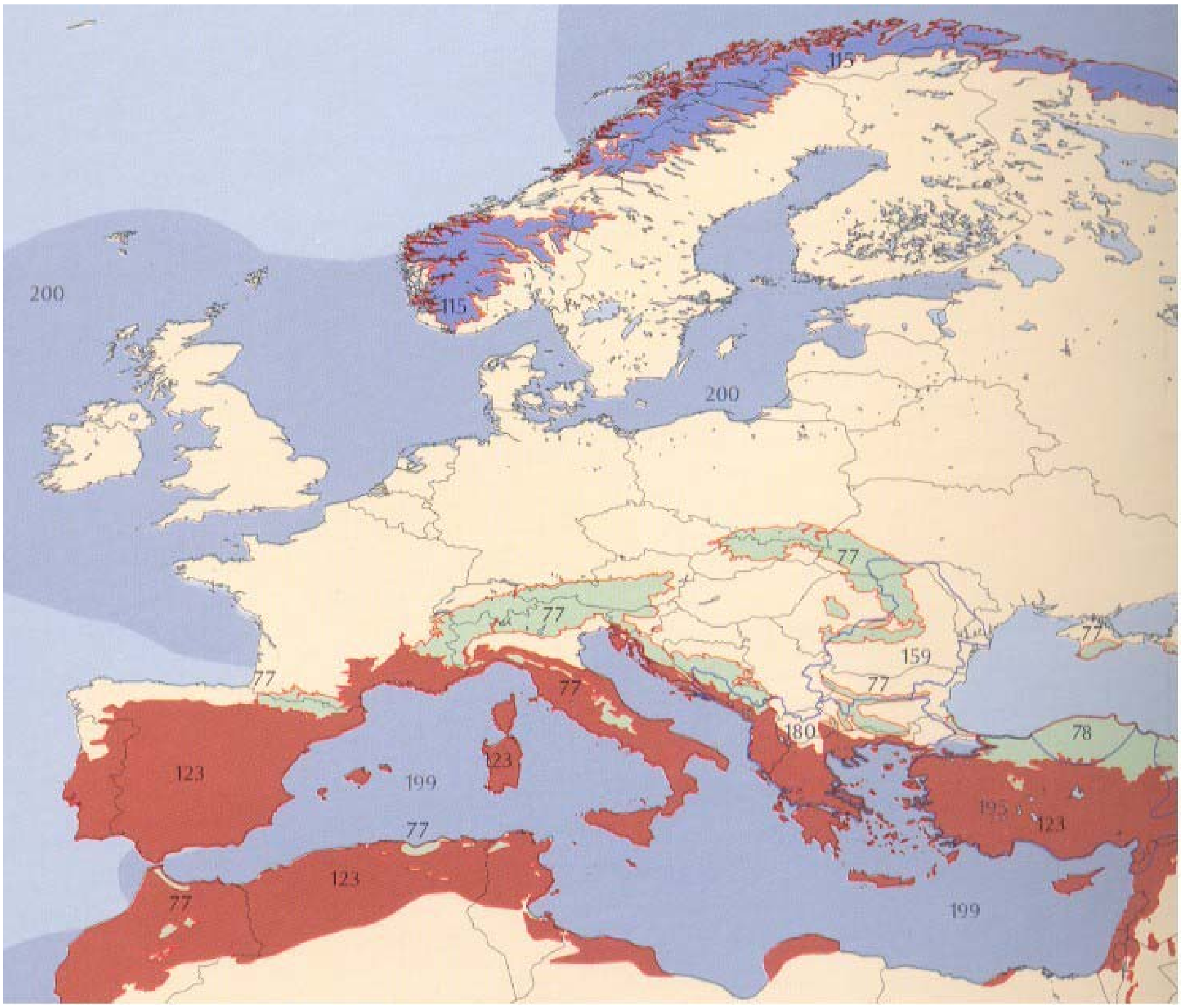

Fig. 3. Priority ecoregions in Eurasia. Ecoregion no. 77 corresponds to European-Mediterranean montane mixed forests and includes the Alps, the Carpathians, the Dinaric Arc, the Pyrenees and other regions with the same major vegetation type. Ecoregion no. 78 is Caucasus-Anatolian-Hyrcanian Temperate Forests. Ecoregion no. 115 is Fenno-Scandia Alpine Tundra and Taiga. Ecoregion no. 123 is Mediterranean Forests, Woodlands and Scrub. Ecoregion no. 159 is the Danube River Delta. Ecoregion no. 180 is Balkan Rivers and Streams. Ecoregion no. 195 is Anatolian Freshwater. Ecoregion no. 199 is the Mediterranean Sea. Ecoregion no. 200 is the Northeast Atlantic Marine Shelf.

Ecoregions are most suitable units for conservation planning because their scale is such that they:

- include the main driving ecological and evolutionary processes that create and maintain biodiversity;
- ensure the maintenance of vital populations of the species that need the largest spatial areas, an element of biodiversity that cannot be accommodated at the site scale;
- encompass a set of biogeographically-related and distinct communities for representation analyses;
- host a wide spectrum of socio-economic factors that together influence the status of biodiversity; and

- enable us to determine – within each ecoregion – the best places on which to focus conservation efforts, and to better understand the role that specific projects can and should play in the conservation of biodiversity over the long term (conservation priorities).

"Act locally, think globally" is a useful motto because, although we invariably have to act locally, without thinking more broadly at a global or regional scale, we lack a context (biological, social and economic) for specific local actions that will produce long-term conservation benefits (Dinerstein et al. 2000).

1.3 Ecoregion conservation

Ecoregion conservation is an approach developed by WWF, TNC and Conservation International (CI) to work in ecoregions. It can be thought of as an advanced ecosystem approach. It consists of four main steps.

1) The reconnaissance phase: to clarify the context and assess the feasibility and the appropriateness of launching an ecoregion initiative (this is where initiatives already in place are reviewed). If at the end of this phase the conclusion is that an ecoregion initiative is not appropriate, the process will stop here. If, on the contrary, the conclusion is that an ecoregion initiative is warranted, the process will proceed with the next three steps;

2) the biodiversity vision: to develop a desired scenario for biodiversity at least 50 years into the future, which will guide the strategies and actions for the conservation of biodiversity in the ecoregion. The biodiversity vision includes the identification of the priority areas important for the biodiversity of the ecoregion as well as the corridors among them and from the ecoregion to adjacent regions (connection areas or macro-corridors). The vision is the very innovative element of ecoregion conservation compared with the ecosystem approach;

3) the ecoregion conservation plan: to identify and design the actions and programmes needed to conserve the biodiversity of the ecoregion in the face of the trends, the threats and the needs of the human population. This plan addresses both ecoregional themes (issues valid at an ecoregional scale) and the needs of the priority areas and the macro-corridors. Such a plan needs to be reviewed periodically against changed conditions and priorities, or based on the results of monitoring and evaluation;

4) the implementation of the conservation plan: to put into effect the actions and the programmes identified in the ecoregion conservation plan. This phase will take as long as needed, up to several decades. The implementation programme also needs to be reviewed on the basis of the results of monitoring and evaluation. Several organizations can take responsibility for different components of the conservation plan.

It is important to note that concrete, on-the-ground activities can be implemented during this process, even before the biodiversity vision and the ecoregion conservation plan are developed. These activities should be in response to urgent needs, immediate threats or existing important opportunities. They are therefore not permanent: they end when the reason for their existence expires; they are launched or modified when the situation changes or new information becomes available.

Two of the most important components of ecoregion conservation are monitoring and evaluation: the effectiveness of the actions implemented should be kept under check and plans modified according to the results of evaluation. Ecoregion conservation is thus based on adaptive management.

Other crucial components are partnerships and collaboration with other parties. Throughout the four phases of the process it is important to work together with others: if there is an animator, this animator has to extensively involve others in all steps. Forming partnerships and involving interested parties depend upon the individual phase of the process and on the local situation. Without the participation of these parties, ecoregion conservation does not have a solid basis, and cannot exist.

1.4 Biodiversity components according to ecoregion conservation

For a biodiversity conservation strategy to be effective it should address the fundamental goals of biodiversity conservation (modified from Noss 1992):

Goal 1: Representation of all distinct natural communities within conservation landscapes and protected areas networks;

Goal 2: Maintenance/restoration of viable populations[3] of all native species within their natural communities;

Goal 3: Maintenance/restoration of ecological and evolutionary processes that create and sustain biodiversity;

Goal 4: Conservation of blocks of natural habitat large enough to be resilient to large-scale stochastic and deterministic disturbances and long-term changes.

Goals 1 to 4 are also considered the “pillars” – or “components” – of biodiversity conservation. The biodiversity vision of the Alps was developed according to these components.

WWF and other international conservation NGOs have developed a methodology to meet these goals for biodiversity conservation within ecoregions. The methodology is called *ecoregion conservation* and it draws on existing knowledge of biodiversity in the ecoregion and on the involvement of the conservation community within the region. Although it is rapidly evolving from its original template, the main traits of the methodology have remained the same. The procedure applied to the Alps is outlined in this report.

1.5 The biodiversity vision

The biodiversity vision is the articulation of common goals among stakeholders. It is a strategic approach, moving from the global to the local. Technically, the biodiversity vision is not a map, but a map helps to envision it. In fact, the biodiversity vision should include the identification (the map) of the priority conservation areas and the connection areas, a vision statement and a conservation plan.

[3] “Viable” means the species population is large enough to have a high probability of surviving within the next 100-200 years.

While the biodiversity vision is biologically based, actions are guided by socio-economic reality. Actions towards the achievement the biodiversity vision for the Alps are described in the first *Ecoregion Conservation Plan for the Alps*, 2005, while this report will focus on the identification of the geographic priorities without dwelling on the conservation plan.

Conservation priorities should be identified purely on their biological value; the first step is to gather as much information as possible into an overall biodiversity picture of the region. Socio-economic factors will be considered later and should be used to select appropriate or possible actions where conservation is most possible. As a consequence, biodiversity experts should be involved in the identification of biological priorities, while socio-economic experts should be engaged in the development of strategies for their conservation.

Priority areas and connection areas are areas to focus on, for the conservation and sustainable development. For this reason, the map of priority areas and connection areas can also be called the biological priority map, or the map of conservation priorities.

The ecoregion conservation method used to identify priority areas and connection areas is based on the knowledge already existing in and about the ecoregion. At this point in defining the biodiversity vision no new data collection is recommended, given that this step relies on a rough (i.e., non-detailed) scale. New data collection is more appropriate at a later stage, when priority areas and connection areas are identified and further analyses are needed at the landscape or site level).

1.6 History of the WWF European Alpine Programme

At the end of 1999 the five WWF organizations of the Alps (WWF Austria, France, Germany, Italy and Switzerland) decided to work together to assess the feasibility of launching an ecoregion conservation initiative for the Alps. Moral and technical support was provided by the team then working on the Carpathian ecoregion.

Several WWF projects were already underway in the Alps, but these were mainly constrained within national boundaries and were rarely coordinated between the various countries. Other organizations or agencies had also attempted to address issues at the pan-Alpine scale (one was the Alpine Convention), but such initiatives were the exception rather than the rule. Thus, the situation at the time justified an assessment of the potential of a pan-Alpine initiative by WWF.

For the next year and a half the Alpine WWF organizations – with the contribution of independent experts – undertook a survey of current work in the Alps, by whom, with what results, and of the trends of biodiversity loss and socio-economic development. This survey (called *Reconnaissance*) also included four rapid assessments: of biodiversity, of the socio-economic factors and decision-making levels, of the international policies with an impact on the biodiversity of the Alps (Annex 2, Annex 3 and Annex 4), and of the interested parties in the region. The results of the survey were summarized in the Final Reconnaissance Report of June 2001 (Annex 5), which was peer-reviewed by the directors of three key pan-Alpine organizations: the International Commission for the Protection of the Alps (CIPRA International), the Network of Alpine Protected Areas (ALPARC) and the International Scientific Committee for Alpine Research (ISCAR). These three organizations had been identified during the assessment of interested parties as the most knowledgeable, reputable and influential at an Alpine scale.

The conclusion of the Reconnaissance Phase was that a pan-Alpine initiative of WWF according to the principles of ecoregion conservation would indeed be advantageous and would significantly contribute to the conservation of biodiversity in the Alps.

The next step was the development of a biodiversity vision: the desired scenario for the biodiversity of the Alps 50 years on, which was completed in 2006 (in 2003 for the identification of priority areas; in 2006 for the identification of connection areas). Such a vision would guide future strategies and projects. When CIPRA, ALPARC and ISCAR were asked whether they would be interested in developing a biodiversity vision with WWF and other experts, they accepted with enthusiasm, agreeing that a vision for the biodiversity of the Alps was indeed an innovative and necessary concept.

The four organizations together refined the methodology for defining the vision, invited experts to contribute to this exercise, identified the organizations for technical support, held the scientific meetings needed to draft the vision and circulated the results. More than a hundred people representing ninety different organizations contributed to the identification of priority areas; fifty people representing thirty-five organizations contributed to the identification of the main ecological corridors (see *Acknowledgments*). This makes the vision a *shared* one.

Throughout this process WWF was the main animator while CIPRA, ALPARC and ISCAR were irreplaceable partners. This report is about the process of developing the biodiversity vision.

2. Description of the Alps Ecoregion

The dominant vegetation type characterizing the Alps ecoregion is the European-Mediterranean montane mixed forests. Other mountain regions in this part of the world share the same dominant vegetation type, for example – but not exclusively – the Carpathians, the Pyrenees and the Dinaric Alps. In the Global 200 classification they together constitute ecoregion no. 77.

According to the analysis of the Global 200 campaign, the status of the Alps is considered "vulnerable/endangered". This threatened status makes it urgent to address conservation in the Alps at the ecoregion scale.

Table 1. Description of the Alps ecoregion according to WWF International.

GENERAL OUTLINE FOR ECOREGION DESCRIPTIONS

Ecoregion Name: Alps conifer and mixed forests
Major Habitat Type: Temperate Coniferous and Mixed Forests
Ecoregion Number: 77
Political Unit(s): France, Italy, Germany, Austria, Slovenia, Switzerland, Liechtenstein, Monaco

Location and General Description

The Alps represent one of the most important biodiversity hot spots in Europe. An ecotonal mountain system, placed between the Eurosiberian and the Mediterranean biogeographyc regions in Europe, divided in three major sectors: the western one influenced by the mild and humid Atlantic air streams, the central and continental one, and the eastern one Mediterranean they cover an area that is about 1200 km long, and belongs to seven different countries, with a total population of 11.1 million people. They are a rather young mountain system, whose "steplike" morphology was contoured by the Pleistoceneic glaciation. Alpine bedrocks can be divided into two major groups: calcareous rocks and siliceous material. The climate is mainly cold and temperate, with slight local variations (e.g., in border "Mediterranean character" areas).
Three relevant ecological patterns can be identified:
1) deep valleys, rich of different habitats and important migration corridors (their potential natural vegetation is deciduous forest - *Quercus robur, Q. petraea, Q. pubescens* and other broad-leaved trees; sclerophyllous evergreen Mediterranean trees occur in the above mentioned "Mediterranean" border areas); 2) mountain forests: mixed beech (*Fagus sylvatica*) and silver fir (*Abies alba*) forests, pure spruce (*Picea abies*) forests or prostrate pine (*Pinus mugo*) forests in the outer regions. Larch (*Larix decidua*) and arolla pine (*Pinus cembra*) and scotch pine (*Pinus sylvestris*) in the inner parts); 3) "strictly" alpine zones, hosting many relict species (within a belt of alpine grasslands). There are also some major river systems that influence (and are influenced by) the Alpine ecosystems: Rhine, Rhone, Danube, Po. The Alps are representative of the high habitat diversity that can be found in mountains, as 200 habitat types can be classified throughout the mountain range.

Outstanding or Distinctive Biodiversity Features

The Alps are an interzonal mountain system (orobiome), a "transition area" between Central and Mediterranean Europe, with a still high degree of naturalness and large almost pristine areas. About 4500 species of vascular plants (up to 400 of which are endemic – genera Campanula, Draba, Pedicularis, Phyteuma, Primula, Ranunculus, Saxifraga and Viola), 800 species of mosses, 300 liverworts, 2500 lichens and more than 5000 fungi can be found. Mammalians (most of them small ones) belong to about 80 species, none of which is "strictly" endemic; large carnivore populations have been reduced in size or fragmented in small remaining groups. Large herbivores are largely distributed. About 200 breeding bird species can be identified, and as many migratory species. Only one species of amphibian in 21 is endemic (*Salamandra lanzai*); reptiles are present with 15 species, while invertebrates' diversity overrules that of the vertebrate species by a factor of almost twenty (about one third of invertebrate species are considered as threatened).

Status and Threats

Wilderness areas can still be found almost all over the Alpine territory: the main problem is their excessive fragmentation and loss of habitats and populations. This threatens mainly the permanence of large carnivores (who are naturally returning or are being reintroduced in the Alps). Moreover, Alpine conservation has not only to do with difficulties in protecting a rather big area, but also with the necessity of dealing with an area that is inhabited and exploited by man (through tourism, agriculture, power plants/industry) and where the air and water pollution factor becomes more and more dangerous. Conservation policies must therefore deal with trends such as the decreasing importance of traditional agriculture, the high intensity of tourism, the expansion of urban centres and the development of commuter systems. This means that any conservation action will have to have many facets (topics dealing with wilderness, education, ecological networks).

Characteristic and Focal Species: Large carnivores (lynx, wolf, brown bear).

More information on the Alps ecoregion can be found in the *Ecoregion Conservation Plan for the Alps* (Annex 6).

2.1 Boundaries of the Alps ecoregion

In the Global 200 classification, ecoregion boundaries are approximately identified according to the distribution of the dominant vegetation type, with no detailed boundaries. In fact, one of the first recommended tasks for an ecoregional team is to identify more closely the boundaries of the ecoregion. For the Alps, early in the process it was decided that the ecoregion boundaries should reflect the area of application of the Alpine Convention (Fig. 4).

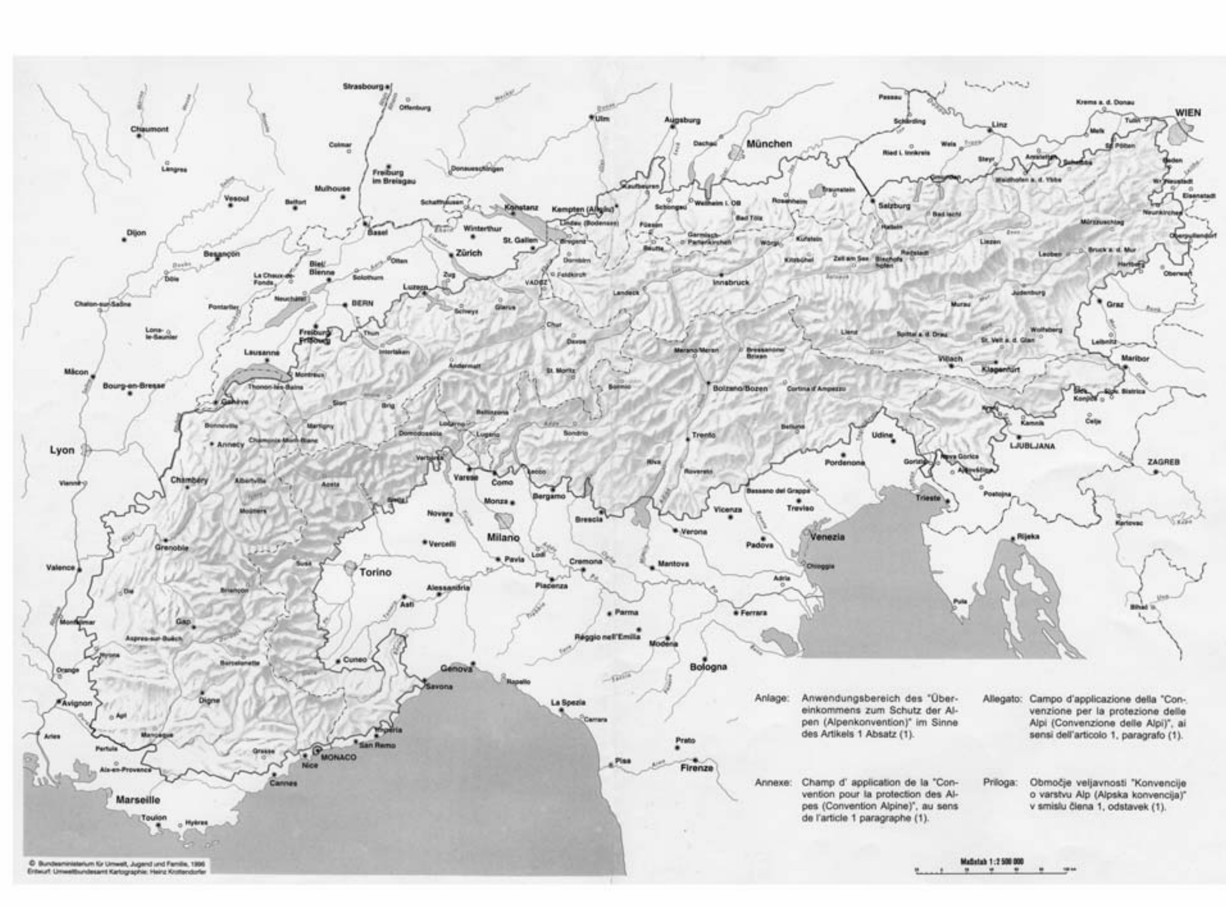

Fig. 4. The boundaries of the Alps region according to the Alpine Convention.

2.2 The Alpine Convention

The Alpine Convention is the only existing policy tool covering the entire Alps, and solely the Alps. The framework convention was signed between 1991 and 1993 by the eight Alpine countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia, Switzerland) and the European Union. It includes several thematic protocols: spatial planning, conservation of nature and the countryside, mountain farming, mountain forests, soil conservation, tourism, energy, transport[4].

[4] www.convenzionedellealpi.org, www.conventionalpine.org, www.alpenkonvention.org, www.alpskakonvencija.org.

The Alpine Convention provides an official frame for ecoregional work and a good opportunity for synergies on a political level. Adapting the biodiversity vision to the boundaries of the Alpine Convention would ensure higher political acceptance of the results and an appropriate forum for their implementation.

In addition, under the auspices of the Alpine Convention, several studies have already been conducted and data collected for the entire Alps region.

2.3 Identifying a biodiversity vision for the Alps: brief description of the general process

The main events in the development of the biodiversity vision for the Alps were a three-day workshop held in Gap, France, 15-17 May 2002 and a two-day workshop held in Buchs, Switzerland, 19-20 September 2005 (specifically on connection areas). Several descriptions in this report refer to the work undertaken in preparation for, or during, these two workshops. However, the workshops alone were not sufficient to complete the biodiversity vision, and many other activities were carried out besides those events.

In Table 2 is the timeline of the biodiversity vision process for the Alps.

Table 2. Timeline of the biodiversity vision process for the Alps (including the identification of priority conservation areas and connection areas).

2001	
March-April 2001	Contacted future partners
April 2001	Developed concept for the biodiversity vision process
June-July 2001	Partners accepted to collaborate
19-20 June 2001	Orientation meeting with the Conservation Science Programme of WWF-US (Holly Strand); assessed data already collected during the Reconnaissance Phase; prepared a "to do" list for the vision workshop to be held in May 2002
June 2001	Mandate issued to GIS expert
July 2001	Started data collection/contacts with data holders (continued until final version of maps in March 2003)
September 2001	Meeting with partners to finalize logistics and contents of biodiversity workshop; identified three different potential locations and dates for the workshop (final date and location to be set after consultation with key experts); produced draft concept for workshop
October 2001	Fixed location and date of biodiversity vision workshop (Gap, F, 15-17 May 2002)
16 November 2001	Methodology meeting with partners (Milan); adapted standard methodology to Alpine situation
November 2001	Finalized concept and draft methodology to propose to experts; drafted workshop programme
December 2001	Contacted key experts and asked for their availability
2002	
January 2002	Sent out first invitations (invitations continued until April 2002)
January 2002	Published first announcement of workshop
January 2002	Started consulting experts to assemble list of focal species and habitats
March 2002	Sent out draft methodology and launched group work
15-17 May 2002	Held biodiversity vision workshop (Gap); first draft of taxon maps; their overlay; preliminary corridors; priority actions
May 2002	Prepared list and assessment of gaps left from the workshop
May-September 2002	Filled in data gaps left in Gap
June 2002	Sent first update letter to participants and non participants; layout of next steps

September 2002	Prepared second draft of taxon maps and overlay
26 September 2002	Held workshop in Alpbach, AT; peer-review of second draft of maps
October 2002	Prepared third draft of maps and overlay
2003	
March 2003	Consolidated all data collected to fill in the gaps still remaining in the third draft of the maps
March 2003	Prepared fourth draft of maps and overlay; conducted a sensitivity analysis
25 March 2003	Meeting with a group of landscape ecologists to identify the approximate boundaries of priority areas (Zürich)
March 2003	Issued contract for biological analysis of CPAs (biological description, threats, opportunities)
April 2003	Sent second update letter or email
May 2003	Completed representation analyses (according to biogeographic subregions and natural potential vegetation)
June 2003	Produced final version of maps
July 2003	The four partners WWF, CIPRA, ISCAR and ALPARC decided to establish a *Consortium* to continue working on the biodiversity vision and its implementation
December 2003	Issued contract for a socio-economic analysis of CPAs
2004	
January 2004	Published *The Alps: a unique natural heritage* (sponsored by the German and Italian governments), a reader-friendly recount of the work and the results on priority areas
February 2004	Launched and distributed *The Alps: a unique natural heritage*; sent third update via the accompanying letter and invitation to express interest in participating in the next steps of the biodiversity vision
February 2004	Issued mandate to ALPARC by the Permanent Committee of the Alpine Convention to undertake a pilot project on the identification of corridors among protected areas
March 2004	Expressions of interest for the next steps of the biodiversity vision started to arrive
March 2004	Audit of WWF European Alpine Programme started, towards improving the biodiversity vision
16 June 2004	Held meeting of WWF European Alpine Programme and BirdLife Italy to discuss concept for the identification of connection areas in the Alps (Milan)
13-15 May 2004	Participated in the international conference *Biodiversity in the Alps*, organized by LBV/Germany; presented the methodology and results of the Consortium (Bad Hindelang, Germany)
30 July 2004	Held meeting with Permanent Secretariat of the Alpine Convention and WWF (Innsbruck); presented the priority areas and discussed the need to harmonize ALPARC's approach to corridors and WWF's approach to connection areas in the Alps
August 2004	Biological and socio-economic analyses of CPAs completed
22-25 September 2004	Alpine Week, Kranjska Gora (SL); presented biodiversity vision, priority conservation areas and the need to complete the identification of connection areas
29 September- 2 October 2004	Participated in the *2nd Young Scientist Conference on Interdisciplinary Mountain Research*; presented the methodology and results of the Consortium (Trafoi, Stelvio National Park, Italy)
November 2004	Presented biodiversity vision to the 28th meeting of the Permanent Committee of the Alpine Convention (by CIPRA International, official observer)
November 2004	Final draft of Audit Report ready; several recommendations on how to improve the biodiversity vision process made
22 November 2004	Held meeting of WWF European Alpine Programme, BirdLife Italy and Alterra Institute to refine concept for connection areas (Milan)
16 December 2004	Held Consortium meeting (Chambery); advanced the discussion on how to harmonize the ALPARC and the WWF/Consortium approach to corridors
December 2004	Alterra Institute made a proposal for technical support to the WWF European Alpine Programme for the identification of connection areas in the Alps
December 2004	Published results of the ALPARC pilot project on corridors among protected areas (*Transboundary ecological network*, Alpine signals 3)

2005	
March 2005	Draft concept ready for the harmonization of ALPARC and WWF approaches to corridors/connection areas
1 April 2005	Held meeting of the Consortium and the Permanent Secretariat of the Alpine Convention (Innsbruck); decided to consider ALPARC and WWF approaches to corridors as two phases of the same project; set a date for the workshop on connection areas (19-20 September 2005)
April 2005	Final concept ready for the harmonization of ALPARC and WWF approaches to corridors
July 2005	Final version of the Terms of Reference for expert input agreed upon by the four partners (WWF, CIPRA, ISCAR, ALPARC); first experts consultation on connection areas began
5 September 2005	Held meeting with Alterra Institute to plan the Buchs workshop (Utrecht, NL)
19-20 September 2005	Buchs (CH) workshop to identify connection areas
October 2005	First draft of Buchs workshop report ready
7-8 November 2005	Held Berchtesgaden (D) meeting organized by ALPARC on the ecological network among protected areas; discussion of the methodology and the preliminary results for connection areas in the Alps
November 2005	Map of protected areas most important for biodiversity and connectivity produced by ALPARC
2006	
February 2006	Consortium decision to complete the preliminary map of connection areas by WWF alone, and to start a new, common, medium-term project to discuss the methodological issues of ecological networks in the Alps
February 2006	Final version of *Summary of preliminary results on connection areas* ready
February 2006	Started second experts consultation to peer-review and integrate the preliminary connection areas (led by WWF)
March 2006	Completed second expert consultation on connection areas
March 2006	Final draft of *Technical report on preliminary results on connection areas* ready; peer-review started
13 April 2006	Final version of technical report on connection areas ready; distribution started
September 2006	Final version of *Technical report on the full biodiversity vision* ready; distribution started

The table shows that preparation for the biodiversity vision workshop started about one year before the workshop took place (orientation meeting in June 2001, Gap workshop in May 2002). It is also evident that it took about two years from the beginning of data collection to produce the final version of the map of priority areas (data collection started in July 2001, the final map of priority areas was ready in June 2003, about one year after the biodiversity vision workshop in Gap), and even more time to produce the map of connection areas (map of connection areas was ready in March 2006). In the first case progress was delayed by the lack of certain data (e.g., the Important Bird Areas for some Alpine countries) and the absence of some key experts from the workshop. In the second case delay was due to the need for careful discussion of the conceptual terms of macro-corridors and harmonization of the initiative with those already existing. The absence of key experts from the workshop also hampered progress.

The process started with the identification of partners. CIPRA International, ISCAR and ALPARC were identified as the best possible partners because of their pan-Alpine vision, knowledge of the Alps, experience, long history (CIPRA International was founded in 1952), link to the Alpine Convention and potential interest in WWF's proposal of a biodiversity vision for the Alps. Furthermore, they have a very good reputation among the Alpine community and have added credibility to WWF's proposal. There were also benefits for them:

- about 15% of Alpine territory is under protected areas, but nobody had ever produced a map of all areas worth protecting in the Alps for their biodiversity value (providing a context to protected areas and their role in biodiversity conservation)

- there are very few experts with good knowledge of the entire Alpine range: it was very interesting for the other experts to be part of an effort at larger scale

- no organization alone can achieve the long-term conservation of the Alps; there is a much greater chance of success if various organizations combine their efforts.

As soon as the three organizations agreed to enter a partnership for the development of a biodiversity vision for the Alps, all decisions were jointly made and the logos of the four partners were represented equally on all material produced.

Following this initial phase, an internal orientation meeting was organized with staff from the Conservation Science Programme of WWF US (facilitated by Holly Strand), in June 2001. Participants were those involved in the organization of the biodiversity vision workshop (from WWF, given that they were appointed to lead the process). During the orientation meeting, the template methodology for arriving at a biodiversity vision was reviewed as well as the Alpine data already collected, and a work plan for how to proceed was developed. Immediately afterwards the identified GIS expert (Christoph Plutzar) received a mandate to begin collection of new data. In Annex 7 the Terms of Reference for the GIS expert.

The date of the first workshop was set so to allow enough preparation time. The town of Gap in the French Alps was chosen as the location for several reasons: it is in the ecoregion and in a spectacular spot, it was the Alpine Town of that year and it combined its hospitality with that of its Conservatoire Botanique National Alpin, which hosted the workshop itself. Furthermore, the town of Gap made a financial contribution and obtained the "blessing" of the International Year of the Mountains (2002).

Five institutions provided technical support during the entire process:

1. WWF US with both the Conservation Science Programme (Holly Strand, John Morrison) and the Ecoregional Conservation Strategies Unit (Doreen Robinson, Sheila O'Connor), which accompanied the Alpine process using experience gained in several other ecoregions;
2. the Conservatoire Botanique National Alpin of Gap, France (Jean-Pierre Dalmas), which offered its GIS lab and assisted in all technical matters during the workshop in Gap in 2002 (see Fig. 5);
3. the Department of Conservation Biology, Vegetation Ecology and Landscape Ecology of the University of Vienna, Austria (Georg Grabherr, Christoph Plutzar), which supported the initiative with data collection, analysis and GIS work, especially during the first part of the process (priority areas);
4. the Vienna Institute for Nature Conservation & Analyses GmbH (VINCA), based in Vienna, Austria (Christoph Plutzar), which provided all GIS services during the second part of the process (connection areas);

5. the Alterra Institute, based in Wageningen, The Netherlands (Irene Bouwma, Evelien Steingrover, Theo van der Sluis), which provided scientific and technical guidance during the second part of the process (connection areas).

Fig. 5. Conservatoire Botanique National Alpin, Gap, France. This was the location of the workshop.

The objective of the Gap workshop was to identify the most important areas and macro-corridors for the biodiversity of the Alps and the urgent actions needed for the coevolution of nature and human activities in this region (the macro-corridors were then re-identified at a subsequent workshop a few years later). Two main phases were then planned: the definition of the areas important for the biodiversity of the Alps, and the preliminary identification of activities required for their conservation (see Annex 8 for a description of the workshop).

Invitations for the workshop were sent out to both experts and observers (Annex 9a and Annex 9b). A registration form was also included (Annex 10), to aid in the formation of working groups which would be complete both from a geographic and a thematic point of view.

Information about the workshop was circulated widely (e.g. on internet sites and the bulletins of all partners) and some requests for participation were received from experts who had not yet been identified. If these people met the criteria for participation described above, they were also invited.

Because of the far-ranging consequences of developing a common biodiversity vision for the Alps and of the likely policy implications, not only scientific experts were needed, but also observers. Observers were requested to contribute to the process and mainly work on policy and implementation issues.

Given the scale of map work (1:500,000, a rough scale indeed without either the chance or the need – in this phase – to focus on anything local), the most important requirement for experts was that they have a good general knowledge of the entire Alps or at least a large portion of them. Specific areas of expertise requested were mainly: vegetation/flora, mammals, birds, reptiles/amphibians, fish and threats to biodiversity (including agriculture, both a threat and an opportunity). The intention was to create thematic groups of experts as complete as possible: i.e., that the experts of each thematic group, together, would possess a good knowledge of the entire Alps. Experts' task was to work on criteria and distribution data and to draw maps.

Facilitators had a crucial role in the workshop. In general facilitators for the biodiversity vision have to be familiar with the methodology and the overall process; they also have to be well respected by the scientific community and knowledgeable of the scientific community itself. A scientific background is an asset but not a requirement. For the Alps workshop, the first day was facilitated by Engelbert Ruoss, director of the UNESCO Biosphere Reserve Entlebuch (Switzerland) and member of ISCAR; the second day was facilitated by Thomas Scheurer, director of ISCAR and one of the experts who had contributed to adapting the template methodology to the Alpine situation. Both gentlemen are very familiar with the Alps and know the Alpine scientific community very well. To ensure continuity, Mr Ruoss also facilitated a second workshop that took place in September 2002 in Alpbach, Austria, within the Forum Alpinum. During that workshop the second draft of the map of priority areas was revised.

GIS work, over the entire five years of the process, was ensured by Christoph Plutzar. During the Gap workshop he was assisted by Holly Strand of WWF-US and by Thomas Kaissl of the University of Vienna; during the Buchs workshop he was assisted by Irene Bouwma of the Alterra Institute (NL).

PART II – PRIORITY CONSERVATION AREAS

3. Methodology for the identification of priority conservation areas in the Alps

3.1 Summary: brief description of the process

As already stated, the biodiversity workshop in Gap was one of the key events in the development of a biodiversity vision for the Alps. However, the process did not conclude at the end of the workshop but continued for about one more year (to fill in the gaps left at the workshop, to validate the results, to refine the maps). What follows is a brief description of the methodology used during the entire process.

The workshop (Fig. 6 through 11), the first public event to develop the biodiversity vision for the Alps, lasted three days and was organized with plenary sessions and working sessions in groups (see Annex 11 for the workshop programme). On the first day, after an introductory session, participants were divided into thematic groups, each for a different taxon or theme. Each group was provided with a base map of the Alps at a scale 1:500,000, several blank mylar sheets and a copy of the reference maps (forest cover, planned streets, etc. see 3.3 and Table 3). Their task was to identify the most important areas for that taxon or habitat type. Their results for the different taxa were digitized overnight, overlaid one on top of the other and presented to the experts the following morning for immediate validation. On the second day, the experts were divided into geographic groups, one for each subregion of the Alps (North West, South West, Central, North East and South East) and were asked to analyse and rank the areas which had been identified through the overlay of the taxon maps. Their results were, once again, digitized and presented to the plenary the following morning. On the last day, the experts were asked to identify the corridors among the priority areas and to identify preliminary long-term goals for the priority areas themselves. Interspersed throughout the three days was also an exercise to develop a vision statement for the Alps (see 3.13).

Fig. 6. The GIS expert Christoph Plutzar describing the reference maps available to the experts for the group work. Gap workshop, 15-17 May 2002.

Fig. 7. Group of experts working on the taxon maps. Gap workshop, 15-17 May 2002.

Fig. 8. Experts working on the taxon maps. Gap workshop, 15-17 May 2002.

Fig. 9. The GIS room for immediate digitizing of the work by the expert groups (use of the GIS room was granted by the Conservatoire Botanique National Alpin, Gap, France).

At the end of the Gap workshop most maps had been drafted and urgent actions identified. However, due to the absence of some experts and to the lack of time, some maps and the identification of some urgent actions were incomplete. Thus, the effort of the following months was devoted to filling in the data gaps. The experts present in Gap were contacted, as well as other experts who had not yet been involved. A first opportunity to revise draft results was given at the *ad hoc* workshop in Alpbach, AT, during the Forum Alpinum in September 2002. Other opportunities were given to smaller thematic groups. The work of refining the maps was coordinated both by external experts (e.g. Tom Wohlgemuth for the vegetation group), and by WWF staff (those who had facilitated the work of the thematic groups in Gap, namely: Christine Sourd and Frank Mörschel for mammals, Doris Calegari and Holger Spiegel for birds; Frank Mörschel for reptiles and amphibians; and Hermann Sonntag for invertebrates and freshwater).

Fig. 10. The collection of maps drawn during the Gap workshop.

Fig. 11. Maps drawn during the Gap workshop.

During the Gap workshop all decisions made were recorded on specific datasheets (see 3.7 and 3.10). Thus, for each polygon drawn on a map, there existed a corresponding datasheet describing why that polygon was considered important by that group of experts. There was an attempt to fill in similar datasheets for any integrations made to the first draft of the maps, but at times this was impossible. This means that for a limited number of polygons present on the taxon maps (the areas important for a specific taxon) there is now no corresponding datasheet. This is unfortunate, but irreversible. However, the detailed description of priority areas compiled by Kai Elmauer in 2004 partly overrides this lack of information.

Indeed, when the data gaps were finally filled in and the final maps produced, two consultants were contracted to describe the priority areas. Kai Elmauer undertook the analysis of biodiversity and of threats and opportunities for conservation (Annex 12), Dominik Siegrist and Priska Hänni-Mathis undertook a socio-political analysis.

3.2 Data collection, scope and scale issues, GIS issues

The Alps are one of the best-studied high mountain systems in the world. However, synoptic attempts at studies covering the entire Alps are very few (Bätzing's demographic and socio-economic studies; the habitat suitability assessments for the Alps by the Large Carnivore Initiative for Europe; CIPRA's Reports on the State of the Alps; the demographic analysis of the Alps by the System of Observation and Information of the Alps). Information and data are mainly available on a national or subnational basis (for example Swiss cantons, Italian regioni, Austrian Länder, French départements, etc.). To overcome this obstacle, in 2001 the WWF European Alpine Programme started to collect the relevant and available GIS data on biodiversity and socio-economic issues for the entire Alps, and tried to harmonize into pan-Alpine layers those that were only available at a national scale. Appropriate data had to fulfill the following requirements:

- the data set should include the whole Alpine region, defined as the area covered by the Alpine Convention
- the data set should be homogeneous
- the data set should be free of charge or available at low cost
- the data set should have a scale of at least 1:500,000.

Thus, only data available for the entire Alps were considered and transferred into a Geographic Information System (GIS) which was then used to formulate the biodiversity vision (for macro-corridors this is not always true as individual initiatives to identify corridors for subregions of the Alps were also taken into consideration). Table 3 gives an overview of the available data: namely, the reference layers described under 3.1).

A working scale of 1:500,000 was chosen, because it was possible to print the study area with a satisfying resolution on two A0 plots (a western part in "portrait" format and an eastern part in "landscape" format) and to prepare all the working maps and mylars for the workshop in Gap. Too many details would have disappeared using a smaller scale (e.g. the entire Alps on one A0 plot), while, had we chosen a larger (more detailed) scale, more plots would have been too bulky to work with[5].

The used projection was the same as Corine Land cover (2001)[6]: Lambert Equal Area Azimuthal with the parameters 9 and 48. All data sets with a different projection were adjusted to this projection.

3.3 Reference maps and data sources

At the workshop some maps were available to the experts as reference material. These maps were made available to all working groups in mylar form. Experts could use them while identifying the areas important for the various taxa and the major habitat types, and later when identifying the most urgent actions for each priority areas. Such maps had been prepared in the months preceding the workshop, and were also used after the workshop when experts were asked to fill in some of the gaps in the maps. These reference maps, available at the workshop as reference material and used throughout the process, were as listed in the table below (for images of the reference maps, see Annex 13).

[5] Maps are often known as **large scale or small scale**. A large scale map refers to one which shows greater detail because the representative fraction (i.e. 1/25,000) is a larger fraction than a small scale map which would have an RF of 1/250,000 to 1/7,500,000. Large scale maps will have a RF of 1:50,000 or greater (i.e. 1:10,000). Those between 1:50,000 to 1:250,000 are maps with an intermediate scale. Maps of the world which fit on two 8 1/2 by 11 inch pages are very small scale, about 1 to 100 million (from http://geography.about.com/cs/maps/a/mapscale.htm).

[6] The Corine projection has in the mean time changed due to the 15 new EU member states.

Table 3. Description of the reference maps used in the Gap workshop and of their sources. The figure number under each data set corresponds to the map in Annex 13.

Data set	Sources	Description
Base map (Figure 1)	Corine, Pelcom, European Topic Centre on Land Cover ETC/LC – EEA, Zukunft Biosphäre, Tele Atlas, Digital Chart of the World, Alpine Network of Protected Areas (ALPARC)	The base map was used as a background to allow a spatial orientation for the work with the mylars in Gap. It was created from different sources, showing the land cover classes, the 200m elevation isopleths, transport infrastructures (railways, motorways and major roads), political borders (countries and NUTS level 3 or 4), rivers, the borders of the Alpine Convention and the names of larger locations.
Bearded vulture (Figure 2)	International Bearded Vulture Monitoring Nationalpark Hohe Tauern / EGS Austria	Polygons with the core and the potential areas of bearded vulture distribution.
Brown bear (Figure 3)	IEA – Istituto Ecologia Applicata, Rome (I)	Environmental suitability surface with a spatial resolution of 250m and polygons showing the known extent of occurrence.
Built-up areas (Figure 4)	Slovenia: Corine Land cover Other: Tele Atlas	Urban areas derived from the Tele Atlas data set or Corine Land cover.
Butterflies (Figure 5)	P. Huemer / Ferdinandeum, Innsbruck (AT)	Point data of endemic or endangered butterfly species distribution.
Domestic breeds (Figure 6)	Università degli Studi di Torino Dipartimento di Scienze Zootecniche (I) – Riccardo Fortina Monitoring Institute for Rare Breeds and Seeds in Europe (CH) – Hans-Peter Grunenfelder Triglav National Park (SLO) – Marija Markes	Polygons showing areas with endangered domestic breeds. This map was produced combining the submissions of three experts on domestic breeds in the Alps (Mr. Hans-Peter Grunenfelder-CH, Mr. Riccardo Fortina-I and Ms Marija Markes-SLO). The idea was to identify the areas where important, typical Alpine domestic breeds are still present, and then to take these areas into consideration when identifying urgent actions for the conservation of the Alps.
Elevation (Figure 7)	Zukunft Biosphäre	Digital Elevation Model raster map with a spatial resolution of 200m. Additionally, a second map showing the 200m isopleths was created.

Forest (Figure 8)	Corine Land cover Pelcom European Topic Center on Land Cover ETC/LC – EEA	Forest areas of the base map.
Golden eagle potential habitat (Figure 9)	Zukunft Biosphäre	Raster map with spatial resolution of 250m showing a potential habitat surface for the golden eagle.
Golden eagle population density (Figure 10)	Zukunft Biosphäre	Raster map with spatial resolution of 250m with a surface showing a population density model for the golden eagle.
Hunting activity in the southern (Italian) Alps (Figure 11)	Istituto Nazionale per la Fauna Selvatica (National Wildlife Institute) Unione Nazionale Cacciatori Zona Alpi (National Union of Alpine Hunters) WWF Italy (data 2000)	Map showing the hunters' density at regional level
Important Bird Areas (IBAs) (Figure 12)	AT: Birdlife Austria[7] D: Birdlife Germany (NABU)[8] I: Birdlife Italy (LIPU) FL: Birdlife Liechtenstein SLO: Birdlife Slovenia (DOPPS) CH: Centre Suisse de cartographie de la faune F : Muséum National d'Histoire Naturelle, Paris. Thanks also to the support and coordination of BirdLife International.	Polygons of the important bird areas. IBAs are key sites for conservation – small enough to be conserved in their entirety and often already part of a protected area network. They do one (or more) of three things: - Hold significant numbers of one or more globally-threatened species. - Are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species. - Have exceptionally large numbers of migratory or congregatory species. (www.birdlife.net) All IBA boundaries became fully available in mid-2003. Before that date, when digital boundaries of IBAs were not fully available, IBAs were represented on maps as dots (see for example Austria) or not represented at all (see for example France).
Inland water (Figure 13)	Corine Land cover, Digital Chart of the World	Map showing lakes and rivers.

7 Available after Gap.
8 Including SPAs (Special Protection Areas).

Land cover (Figure 14)	Liechtenstein: Pelcom Switzerland: Switzerland land cover reclassified to Corine level 2, European Topic Center on Land Cover ETC/LC – EEA Other: Corine Land cover	The land cover data set was assembled from different sources. Because of the different classifications of the input data, it was necessary to build a coarser, consistent legend. The result was a raster map with a spatial resolution of 250m showing eight classes: - Urban, industrial, mining, transport - Agriculture - Forest - Natural grassland, moors & heathland, shrubs - Bare rocks, glaciers, perpetual snow - Inland wetlands - Coastal wetlands - Inland waters.
Lynx (Figure 15)	IEA – Istituto Ecologia Applicata, Rome (I)	Environmental suitability surface with a spatial resolution of 250m and polygons showing the known extent of occurrence.
Major forest types of the southern Alps (Figure 16)	WWF Mediterranean Programme, Rome (I)	Polygons with the major forest types of the southern Alps.
Night luminosity (Figure 17)	US Air Force Defense Meteorological Satellite Programme (DMSP) Operational Linescan System (OLS) US National Oceanic and Atmosheric Administration's National Geophysical Data Center	Raster map with a spatial resolution of 750m showing the night-time visible lights. The lights are a direct indicator for human activity; dark regions show areas with low anthropogenic pressure.
Planned streets (Figure 18)	WWF	Map showing inner Alpine, transalpine and Italian "legge obiettivo" street projects.
Population density (Figure 19)	Tele Atlas	Inhabitants/km² on NUTS 5 level.
Protected areas (Figure 20)	The Alpine Network of Protected Areas (version: 2002)	Polygons showing nationals parks, regional nature parks, reservation areas and other areas under special protection.
Ramsar sites (Figure 21)	UNEP – WCMC for the version available in 2002. www.ramsar.org for the new version used in 2006 for the gap analysis	Polygons showing Ramsar sites. The Ramsar convention is a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Remote areas (Figure 22)	Department of Conservation Biology, Vegetation and Landscape Ecology, University of Vienna (AT)	Model surface showing remoteness from infrastructure and built-up areas. Remote areas are non-fragmented areas with no direct human interference. This map was produced by Thomas Kaissl as part of his master thesis at the University of Vienna. This map is an indirect indication of where ecological and evolutionary processes still take place undisturbed in the Alps (lack of human interference means the opportunity for nature to take its course undisturbed).
Skiing areas (Figure 23)	ADAC Skiing Guide	Point data set of skiing areas in the Alps digitized by WWF showing a weighed combination amount of guest beds, lift capacity and length of ski runs.
Transport (Figure 24)	Slovenia: Digital Chart of the World Rest: Tele Atlas	Map showing motorways, major roads, minor roads and railways.
Urbanization centres (Figure 25)	M. Perlik / University of Bern (CH)	Polygons showing cities and urbanization centres. The map distinguishes between urbanization zones with a centre in the Alpine region and centres outside.
Vegetation belts (Figure 26)	By P. Ozenda and A.M. Tonnel of the Laboratoire Botanique of the University of Grenoble, 1984 (photo-enlarged to 1:500,000 from the original 1:2,250,000)	It shows the distribution of the vegetation types by elevation belts. - *Piedmont*: mesomediterranean, plain oak forests, pannonic, submontane oak-beech forests. - *Collinean belt*: western type (*Quercus pubescens*), eastern type (*Ostrya carpinifolia*), medioeuropean type (acidophilous oak forests), suprannonic type. - *Mountain belt*: outer beech forests, inner fir and spruce forests, inner pine forests. - *Subalpine belt*: outer type, inner type (cembro pine and larch). - *Alpine and nival belts*: on calcareous rocks, on siliceour rocks, glaciers).
Wolf (Figure 27)	IEA – Istituto Ecologia Applicata, Rome (I)	Environmental suitability surface with a spatial resolution of 250m and polygons showing the known extent of occurrence.

At the end of the workshop a survey on the usefulness of these reference maps was conducted among the experts present. The six maps which resulted most useful to the experts were the base map, the forest cover map, the protected areas map, the river/water map, the population density and the IBAs. The complete results of the survey can be found in Annex 14.

3.4 Methodology and rationale

The ecoregion conservation approach recommends that a series of steps are taken to develop a biodiversity vision. This template methodology was reviewed by representatives of ISCAR (i.e. the scientific community of the Alps) and of WWF and adapted to the specific features of the Alps.

Special attention was paid to the role of the cultural landscape in the Alps, namely the landscape arising several thousand years ago from the manipulation of the land by humans and maintained through traditional "soft" land uses such as extensive agriculture and grazing of local domestic breeds (see also 3.13, *Additional information collected*). About 25% of the community diversity of the Alps depends on this landscape (Grabherr, 2000), and some related species and habitat types are considered so important at a European level that they are protected by EU legislation (see for example the Birds and the Habitat Directives and the objectives of the Natura 2000 Network). In the Alps, unlike other ecoregions where the biodiversity to be protected is that predating human intervention, it was decided to value such cultural landscapes and to consider them among the typical natural habitats of the Alps deserving protection (when hosting biodiversity). As well as contributing to conserving a distinct portion of biodiversity, this approach also helped to demonstrate to mountain communities that the biodiversity vision was not intended to work against them.

As for invasive species, it was originally decided that preventing or eradicating them would be the fifth pillar of biodiversity conservation (see 1.4). However, it soon became obvious that this principle was superfluous as it is already "nested" under the first three pillars. Despite its removal from the principles, the caution towards alien species in the Alps remains a concern.

The considerations made above were incorporated in a short document briefly outlining the methodology proposed for developing the biodiversity vision for the Alps (Annex 15). Before the first workshop (the one that took place in Gap) this draft methodology was distributed to the experts that would participate. The document was both an explanation of the activities the experts would undertake during the workshop, and a list of tasks the experts were asked to perform *in preparation for* the workshop. It was presented as a proposed methodology; however, no suggestions for modifications were ever received.

The standard methodology includes several steps. For the Alps they were simplified to eight steps:

1) Delineate the ecoregion and identify the biogeographic subregions
2) Identify focal species for different taxa, key habitats as well as ecological processes that support Alpine biodiversity
3) Select taxon priority areas for each taxon
4) Select candidate priority areas for biodiversity as a whole based on taxon priority areas and priority areas for ecological processes
5) Evaluate habitat representation of candidate priority areas
6) Rank priority areas for biodiversity conservation
7) Identify important corridors among priority areas
8) Conduct a gap analysis for protected areas or other sites considered important.

These steps will be described in the following sections.

3.5 Step 1: Delineate the ecoregion and identify the biogeographic subregions of the Alps

As already explained, it was agreed that the boundaries of the Alps ecoregion would reflect the area of application of the Alpine Convention. By doing so, the initiative for the biodiversity vision of the Alps would benefit from the studies already produced under the Alpine Convention. Furthermore, there would be a policy instrument to be referred to in implementing the vision. The digital boundary of the Alpine Convention was received from the Network of Alpine Protected Areas and modified to address some minor inaccuracies.

As for biogeographic subregions, they help to ensure representation of habitats and species within priority areas (Goal 1 and 2 of biodiversity conservation, see 1.4), given that species composition of similar habitats in different subregions will vary. Various subregion classifications were available for the Alps in 2002 (see Annex 16), such as:

- Jean-Paul Theurillat (University of Geneva, CH) divided the Alps into a hierarchical system of 2, 3, 6, 8, 12, and 22 biogeographic divisions.

- Udo Bohn et al. (Bundesamt für Naturschutz, Germany) identified subdivisions of the Alps based on potential natural vegetation. (This classification is not strictly and formally biogeographic. However, as potential natural vegetation is determined by biogeographic factors such as climate, substratum and soil, it can be an indirect measure for biogeographic subregions.)

- Paul Ozenda (Laboratoire d'Ecologie Alpine, Université Joseph Fourier, Grenoble, 1988) divided the Alps into the *fringe Alps* (with seven biogeographic subdivisions) and the *inner Alps* (with two biogeographic subdivisions).

The systems are equally valid; it was decided to use the systems by Theurillat and Bohn because their data sets were readily available in digital GIS format, while Ozenda's was not. The representation analysis according to these two systems is described under 3.9.

3.6 Step 2: Identify focal species for different taxa, key habitats and ecological processes that support the Alps biodiversity

Note: all scientific names of species refer to the period 2002-2003, when the focal species were identified and the maps produced. Since then, some species have been renamed; where possible, this is acknowledged in the text.

The Alps are characterized by a specific set of species, communities, habitats and processes which should be preserved or restored as an important part of the biodiversity of the ecoregion and to maintain its ecological integrity. Ideally, a conservation strategy takes all species, communities, habitats and ecological processes into account in fulfilling the goals of biodiversity conservation. However, due to limited resources and data, only a small set of species and key habitats can be considered. These are called *focal* species or habitats and they are representative of the region they belong to (Miller et al. 1998). A *focal species* is a species which meets several of the following requirements/criteria and therefore makes it a good model for conservation of whole species assemblages (and of their habitat) (Miller et al. 1998):

Habitat criteria
1. Dependence on large areas to maintain viable populations / wide-ranging;
2. Area sensitive / specialized habitat requirements
3. Dependence on rare, widely dispersed habitat

Life history criteria
4. Limited dispersal ability
5. Seasonal/daily population concentration
6. Large body or largest member of feeding guild
7. Reproductive specialization / low reproductivity or fecundity
8. Specialized dietary requirements
9. Climatic sensitive

Other criteria
10. No invasive species
11. Major life history traits and distribution data should be known about the species (e.g. area requirements)

By conserving these species a whole array of other species, communities or habitat types will be conserved. Guidelines were provided to the experts for the selection of focal or priority species (see Annex 17).

Only focal taxa or habitats were considered for which data were available for the entire Alps region, at the same scale and in a consistent format. In other words, it was of the utmost importance to think at the scale of the entire Alps, and the chosen level of detail (minimum common denominator) had to allow comparison within the Alpine range. For this reason, scientific categories were simplified to adopt less detailed definitions (e.g. "forested areas" rather than different types of forests).

The main taxa or habitat types which were selected as focal are (see Table 4 under 3.7 for a full list and more details):

- Flora
- Mammals
- Birds
- Amphibians and Reptiles
- Invertebrates (Insects)
- Freshwater habitat.

Within these taxa or habitat types a further selection was made for focal species of subsets of habitat types, as follows.

Flora

This theme started as "vegetation" and was then renamed "flora", as the corresponding map is based on the distribution of vascular plant species (lichen and moss species were not addressed). The term *flora* is also consistent with the other taxon groups used for the identification of priority areas.

Mammals

Three subsets of mammal species were selected: large carnivores, large herbivores and medium/small mammals, each with the following focal species (or families), as decided by the experts of each group according to how representative they were of the Alps:

- For large carnivores: bear (*Ursus arctos*), lynx (*Lynx lynx*) and wolf (*Canis lupus*)
- For large herbivores: chamois (*Rupicapra rupicapra*), ibex (*Capra ibex*) and red deer (*Cervus elaphus*)
- For medium and small mammals: otter (*Lutra lutra*), *Eptesicus nilssoni*, *Rhinolophidae*, *Microtus bavaricus*, *Apodemus alpicola*.

The experts produced maps for each of these three subsets of mammals, which were consolidated into only one map for all mammals (see 3.7 and Fig. 13) in order not to overestimate the weight of this taxon compared to others.

Birds

It was decided to base the bird layer on the IBAs, the Important Bird Areas identified by BirdLife International and its partners throughout the world. IBAs are the most important areas for birds according to a set of internationally-agreed criteria and therefore represent a very advanced global vision for birds. In fact, rather than trying to start anew and identify focal bird species and then their priority areas, it seemed much more effective and strategic to embrace the results of the work already undertaken by BirdLife which is widely recognized in Europe and worldwide (in Europe IBAs are the basis for the identification of sites according to the Birds Directive). The collaboration of BirdLife International and of the national organizations of the Alpine countries affiliated to it (e.g. DOPPS for Slovenia, LIPU for Italy, NABU for Germany, SVS for Switzerland) was therefore sought. They all responded offering support and the digital boundaries of the IBAs already identified in the Alps.

In addition to this valuable basis provided by IBAs, for Austria, Germany and Switzerland some bird species typical of the Alps were also selected by the group of bird experts as additional focal species. Such species may have not been considered during the identification of IBAs because they did not trigger IBA criteria, but still deserved to be taken into account for the Alps. An example was the need to identify areas in Germany for capercaillie. The full list of these species is:

- For the *Anatidae* family: Common Merganser (*Mergus merganser)*
- For the *Phasianidae* family: Rock Partridge (*Alectoris graeca saxatilis*)
- For the *Tetraonidae* family: Western Capercaillie (*Tetrao urogallus*)
- For the *Charadridae* familiy: Eurasian Dotterel (*Charadrius morinellus*, now called *Eudromias morinellus*)
- For the *Scolopacidae* family: Common Sandpiper (*Actitis hypoleucos*)
- For the *Upupidae* family: Eurasian Hoopoe (*Upupa epops*)
- For the *Picidae* family: White-backed Woodpecker (*Dendrocopos leucotos*), Grey-faced Woodpecker (*Picus canus*) and Three-toed Woodpecker (*Picoides tridactylus alpinus*)
- For the *Turdidae* family: Bluethroat (*Luscinia s. svecica*), Blue Rock Thrush (*Monticola solitarius*) and Rufous-tailed Rock-Thrush (*Monticala saxatilis*)

- For the *Fringillidae* family: Citril Finch (*Serinus citrinella*).

The IBAs and the areas important for the other focal bird species were mapped onto two different layers, but then merged into one overall bird layer (see 3.7 and Fig. 14).

Amphibians and Reptiles

Five focal species were identified for amphibians.

- For the *Salamandridae* family: Alpine Salamander (*Salamandra atra aurorae*), *Salamandra atra ssp*. (not yet described in 2002, but now known as *Salamandra atra pasubiensis*), Lanza's Salamander (*Salamandra lanzai*) and Alpine Newt (*Triturus alpestris*, neotenic or paedomorphic)
- For the *Plethodontidae* family: Strinati's Cave Salamander (*Speleomantes strinatii*).

Three focal species were identified for reptiles.

- For the *Lacertidae* family: Horvath's Rock Lizard (*Lacerta horvathi,* now called *Iberolacerta horvathi*) and Viviparous Lizard (*Zootoca vivipara carniolica*)
- For the *Viperidae* family: Orsini's Viper (*Vipera ursinii*).

Invertebrates - Insects

Originally, two working groups on invertebrates had been planned, one on terrestrial species and one on aquatic ones. However, without sufficient data and too few experts, aquatic invertebrates could not be taken into separate consideration (aquatic invertebrates are included in the freshwater habitat theme). For terrestrial invertebrates, only butterflies and beetles – the only groups of species for which data were available at the same scale for the entire Alpine range – could be considered. Thus the invertebrates layer now only covers "insects" and includes the following orders:

- butterflies *(Lepidoptera)*
- beetles *(Coleoptera)*.

Beetles and butterflies were mapped onto two different layers, but then merged into one overall insect layer (see 3.7 and Fig. 16).

Freshwater habitat

Originally, a working group on fish and one on aquatic invertebrates had been planned. However, given that it was difficult to find experts and data for these two themes covering the entire Alps, it was decided to merge them into one theme called "freshwater habitat". The presence of fish or aquatic invertebrates species, as known by the freshwater experts, was an indirect factor in the identification of the freshwater habitats (see criteria under 3.7 and in Table 4).

Ecological processes

Ecological processes[9] include water cycle, migrations, natural discharge river flow, climate change, etc. As ecological processes are usually inadequately defined and their distribution not mapped, they could only be considered indirectly (see 3.8). Important freshwater habitat, for example, partly incorporates intact flood regimes; migration routes of mammals and birds have been considered when including vertical gradients within the boundaries of the priority areas, and an analysis of remote areas in the Alps (Kaissl 2002, see Fig. 22 in Annex 13) indicates areas with intact geological processes.

3.7 Step 3: Select taxon priority areas for each taxon

For each taxon and key habitat, the most important areas in the Alps were selected. It should be highlighted that the areas were identified as "most important" only if they really had an importance at a pan-Alpine level and all members of the taxon group agreed. This worked as a "filter" and prevented areas of local or regional importance from being mapped, which would have altered the results and defeated the purpose of the exercise.

Specific criteria were listed for this purpose by the international groups of experts gathered for the three-day workshop in Gap (see Table 4). On the first day experts were divided into working groups according to taxa and habitat types and they used these criteria to identify the areas in the Alps which are most important for the respective taxa/key habitat types. They considered the area requirements of relevant species (the areas should be large enough to ensure the long-term viability of the species' (meta-)populations). As already described, within the taxon groups of mammals, birds and insects, sub-taxon maps were defined and later merged into only one map for each taxon.

The areas important for the taxa or habitat types were hand-drawn on mylar sheets which had previously been overlaid onto a base map[10] of the entire Alpine range (scale 1:500,000), and then digitized into a Geographic Information System (GIS). The digital maps were thus presented to the same experts and validated on the spot, allowing immediate correction of potential mistakes.

A datasheet was filled out for each taxon area or habitat area identified (i.e., for each polygon drawn on the map), which provided information about the area itself (see Annex 18 for an example of a blank datasheet which had to be completed).

Missing information for certain species, habitat and/or countries was incorporated during an extensive review process after the workshop.

Following are descriptions of the criteria used for the identification of the areas most important for each taxon or habitat type (flora, mammals, birds, amphibians and reptiles, insects and freshwater habitat).

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[9] Examples of ecological processes are: important migration routes of birds, mammals, etc. (including seasonal movements of animals), geological processes (avalanches, mud and rock slides), flood regimes, naturally-occurring fire regime, etc.

[10] The base map shows land cover (eight classes – from Corine), boundaries (Alpine Convention, Nations, NUTS levels 3 and 4 – from Tele Atlas), transport systems (railroads, motorways, major roads – from Tele Atlas) and rivers (from the Digital Chart of the World).

Flora

The map of areas important for flora in the Alps is shown in Fig. 12. A transcription of the datasheets filled in for flora is found in Annex 19.

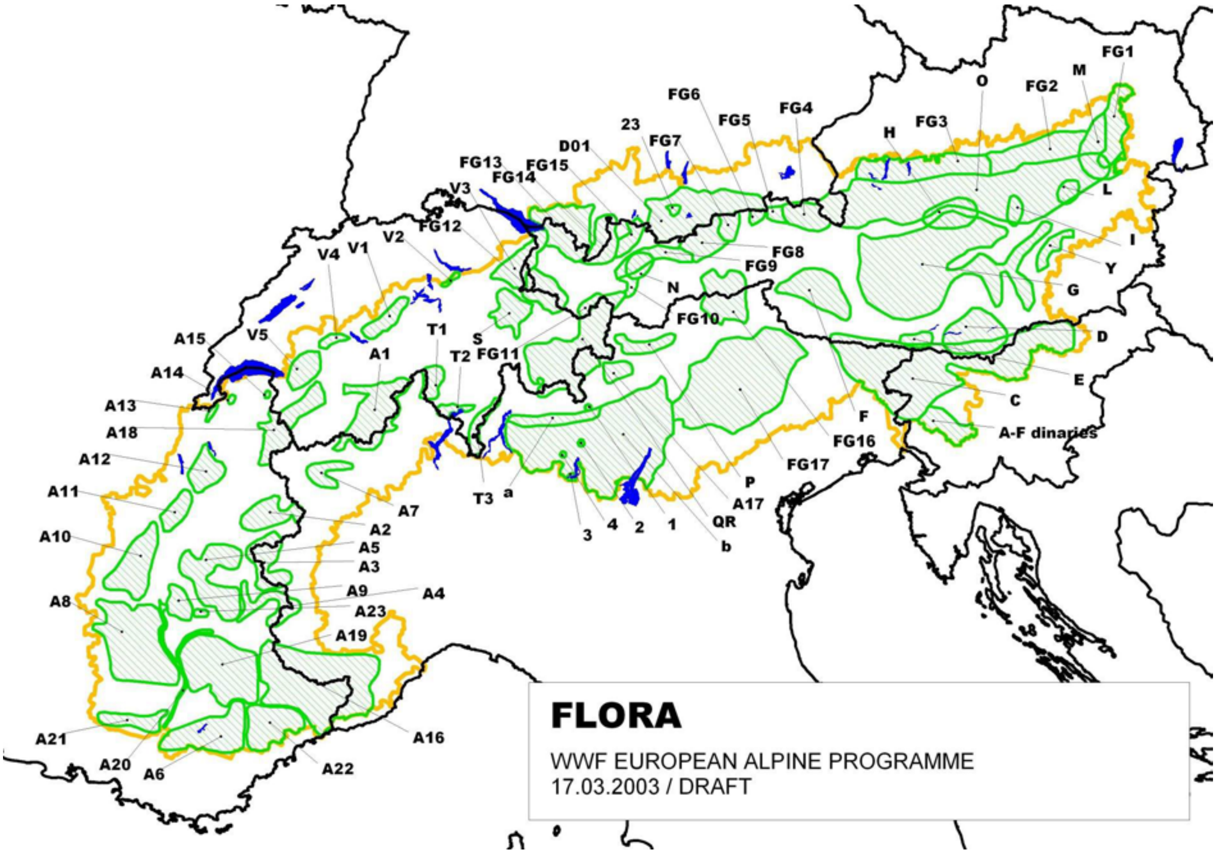


Fig. 12. Areas important for flora in the Alps.

This map started as “vegetation” and ended by being called “flora”. The criteria used to identify areas important for flora in the Alps are (among these criteria there are some which still reflect the original focus on vegetation):

- Richness of endemic species
- Large forest blocks
- Distinct dry areas
- Alpine rare species
- Areas with particular ecological phenomena important for flora (i.e., glacier forelands, peatbogs).

Although the flora map was constructed according to slightly different criteria for the western and the eastern Alps, the results are reasonable and reflect the actual status of flora and vegetation in the Alps. For example, that the area in Switzerland roughly corresponding to the Gotthard is not considered important for flora at a pan-Alpine scale is plausible given that this is a transition area between the eastern and western Alps and a rain barrier. Relict flora species are still found in the western Alps, where priority areas for flora have been identified in smaller polygons, while larger forest blocks are still found in the eastern Alps, where priority areas for flora/vegetation have been identified in larger polygons (Wohlgemuth, personal communication).

Mammals

The consolidated map of areas important for mammals in the Alps is found in Fig. 13. The individual maps of areas important for the three mammal sub-taxa (large carnivores, large herbivores, medium/small mammals) are found in Annex 20. A transcription of the datasheets of the three sub-taxa is found in Annex 21a, Annex 21b and Annex 21c.

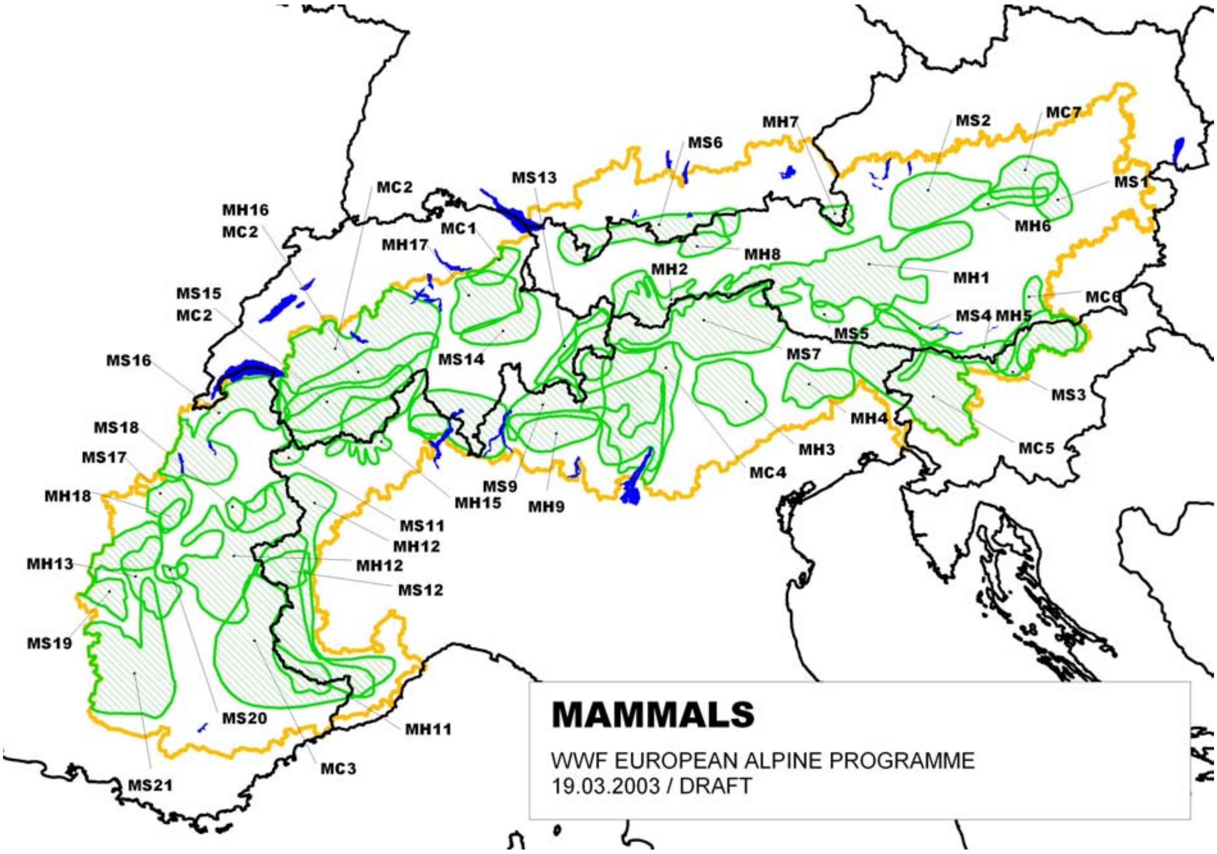


Fig. 13. Areas important for mammals in the Alps (consolidated map).

The experts worked in three sub-groups (large carnivores, large herbivores and medium/small mammals). The three layers thus created were merged into one. Each sub-group developed different criteria for the different sub-taxa, as they deemed appropriate.

For large carnivores, areas were selected as important if they were areas where the species currently reproduced, or could naturally reproduce within the next 10 years, or where the individual countries were planning to reintroduce them.

For large herbivores, areas were selected as important if they held all three focal species, if they had optimal or core habitat for some of the species, if they were important for habitat protection and restoration (e.g. areas overgrazed by red deer) and if they were areas for endemism (see area for *Rupicapra r. cartusiana*).

For medium and small mammals, areas were selected as important if the focal species were currently found there.

<u>Birds</u>

The consolidated map of areas important for birds in the Alps is shown in Fig. 14. The individual maps of the IBAs and of the areas important for selected species of focal birds are found in Annex 22. A transcription of the datasheets filled in for these latter areas is found in Annex 23. No datasheet was filled in for the IBAs.

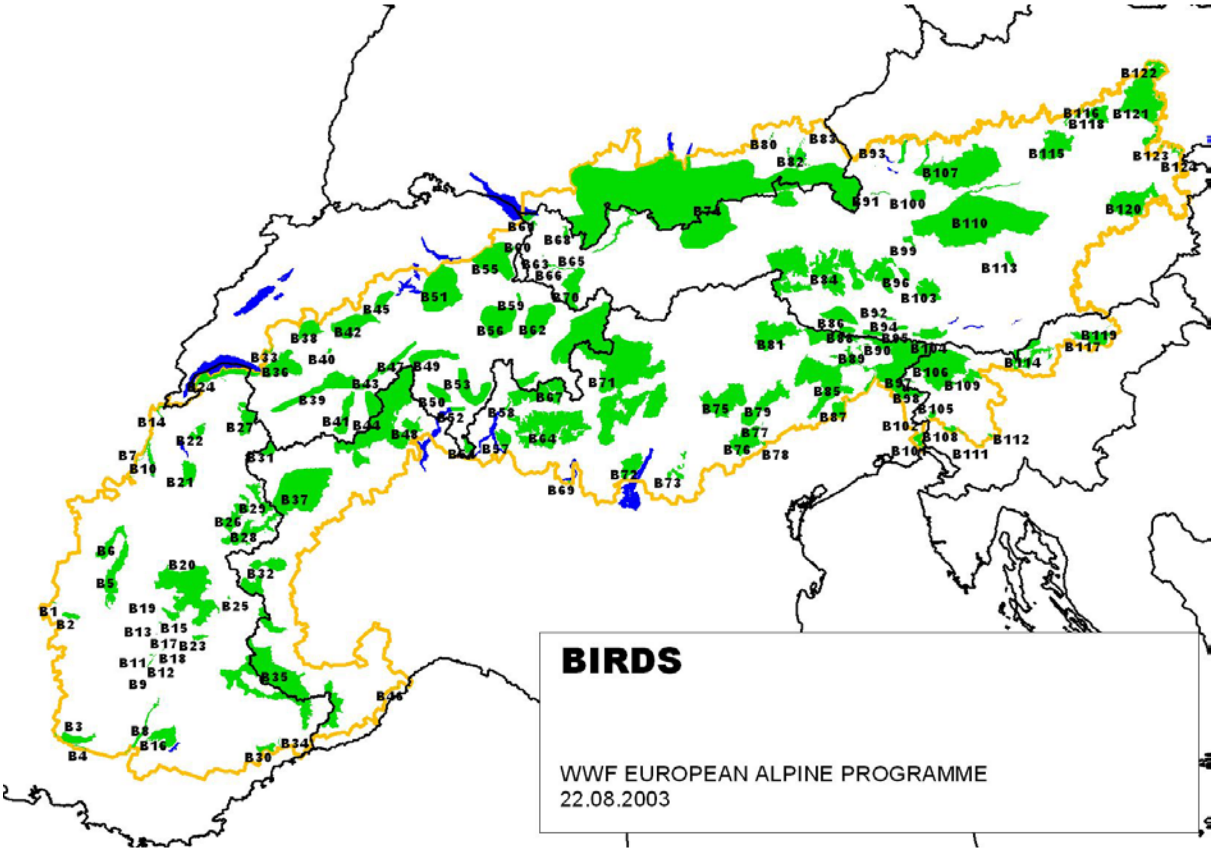


Fig. 14. Areas important for birds in the Alps (consolidated map).

IBAs were identified according to three main criteria (see www.birdlife.org):

- They hold significant numbers of one or more globally-threatened species
- They are one of a set of sites that together hold a suite of restricted-range species or biome-restricted species
- They have exceptionally large numbers of migratory or congregatory species.

In addition, as already explained under 3.6, BirdLife representatives and other bird experts of the Alps identified the aspects of birds biodiversity not already covered by the IBAs programme and proposed integrations for some countries of the Alps. Thus, for the selected number of bird species already listed under 3.6, important areas in the Alps were also added to the layer of IBAs. This, however, was not done for all Alpine countries but only for Austria, Germany and Switzerland.

Amphibians and Reptiles

The map of areas important for amphibians and reptiles is found in Fig. 15. A transcription of the datasheets filled in for these areas is found in Annex 24.

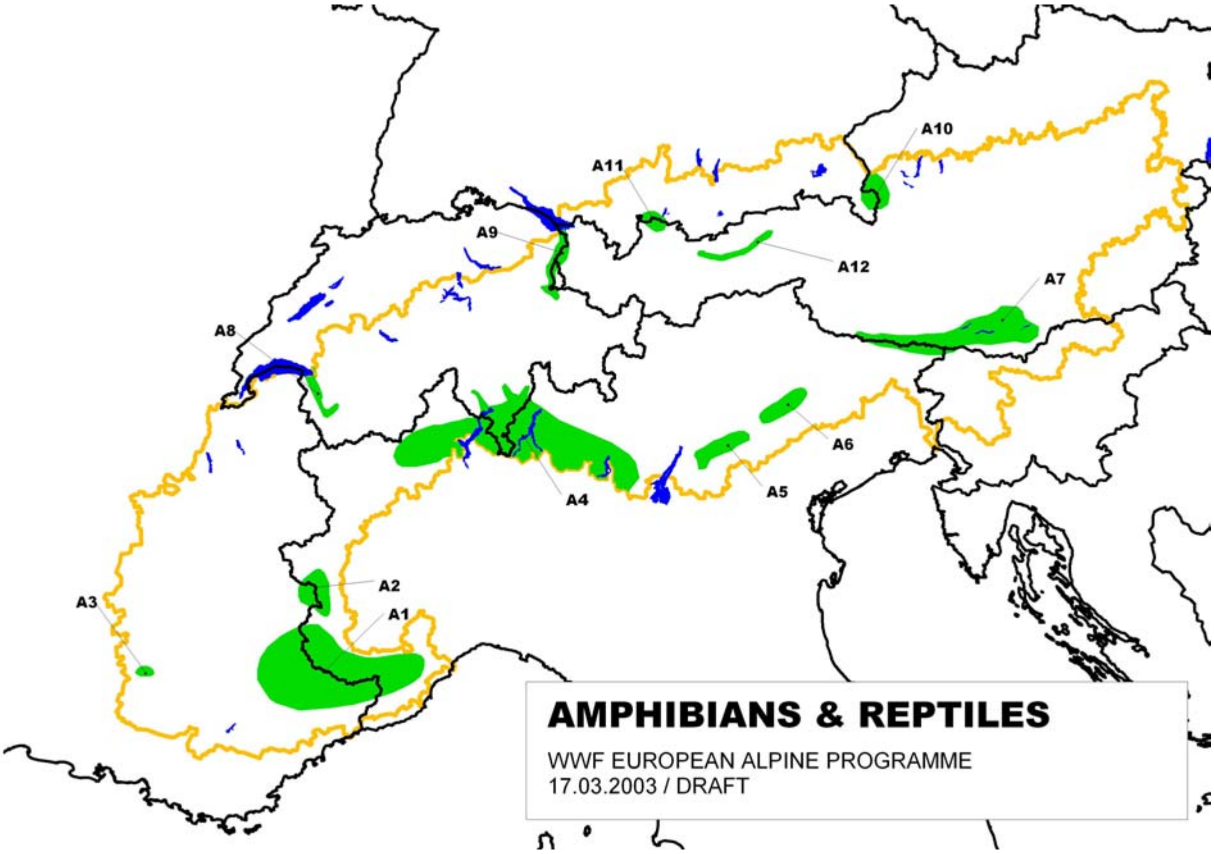


Fig. 15. Areas important for amphibians and reptiles in the Alps.

Areas of the Alps were identified as important for amphibians and reptiles if they host the focal species (including endemic and IUCN Red List species), if they host species richness (more than one species in the same place), and if they host ecological and evolutionary phenomena.

Invertebrates - Insects

The consolidated map of areas important for insects is found in Fig. 16. The individual maps for biodiversity centres and endemic centres for the two sub-taxa (beetles and butterflies) are found in Annex 25. A transcription of the datasheets filled in for the two sub-taxa is found in Annex 26a and Annex 26b.

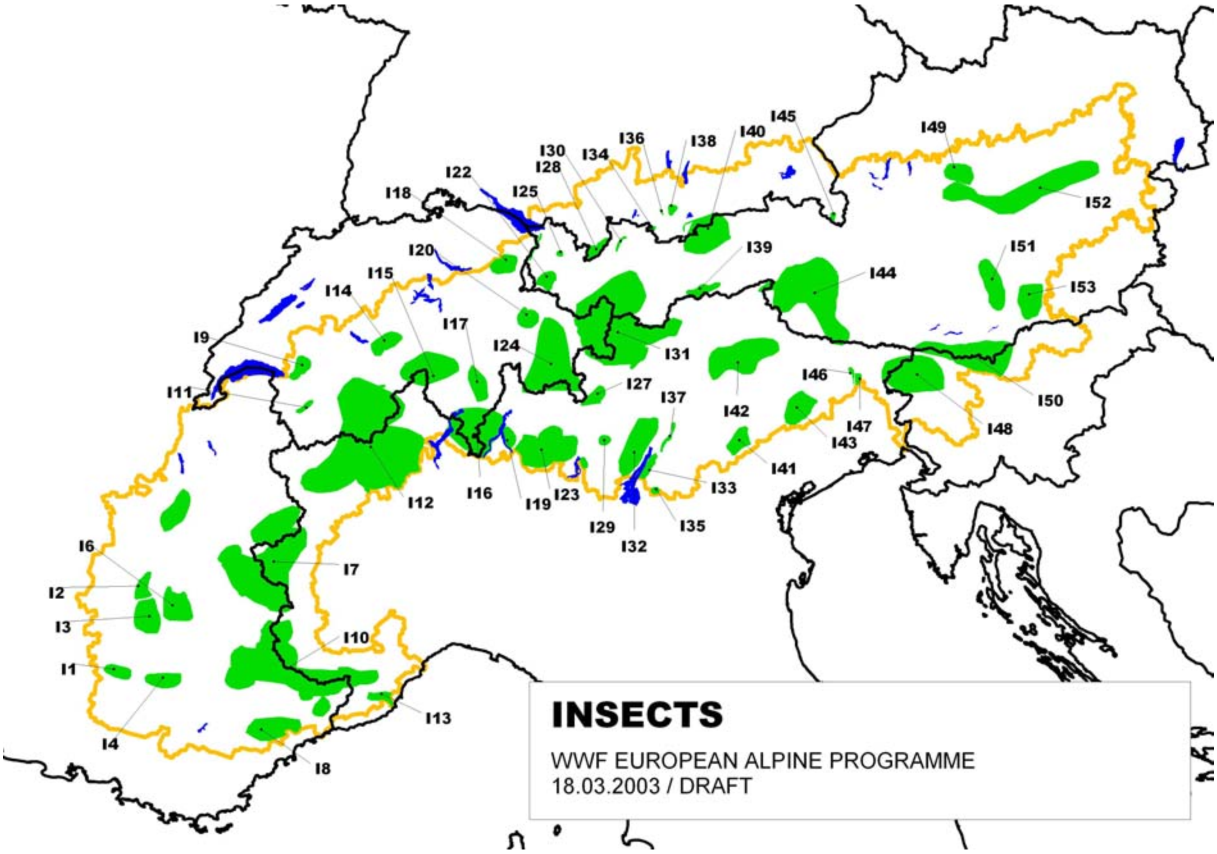


Fig. 16. Areas important for insects in the Alps (consolidated map).

Areas of the Alps were selected as important for insects if they represented endemic centres for butterflies and beetles (i.e., centres of endemisms), or biodiversity centres for butterflies (i.e., areas with several species).

Freshwater habitat

The map of areas important for freshwater habitat is found in Fig. 17. A transcription of the datasheets filled in for these areas is found in Annex 27.

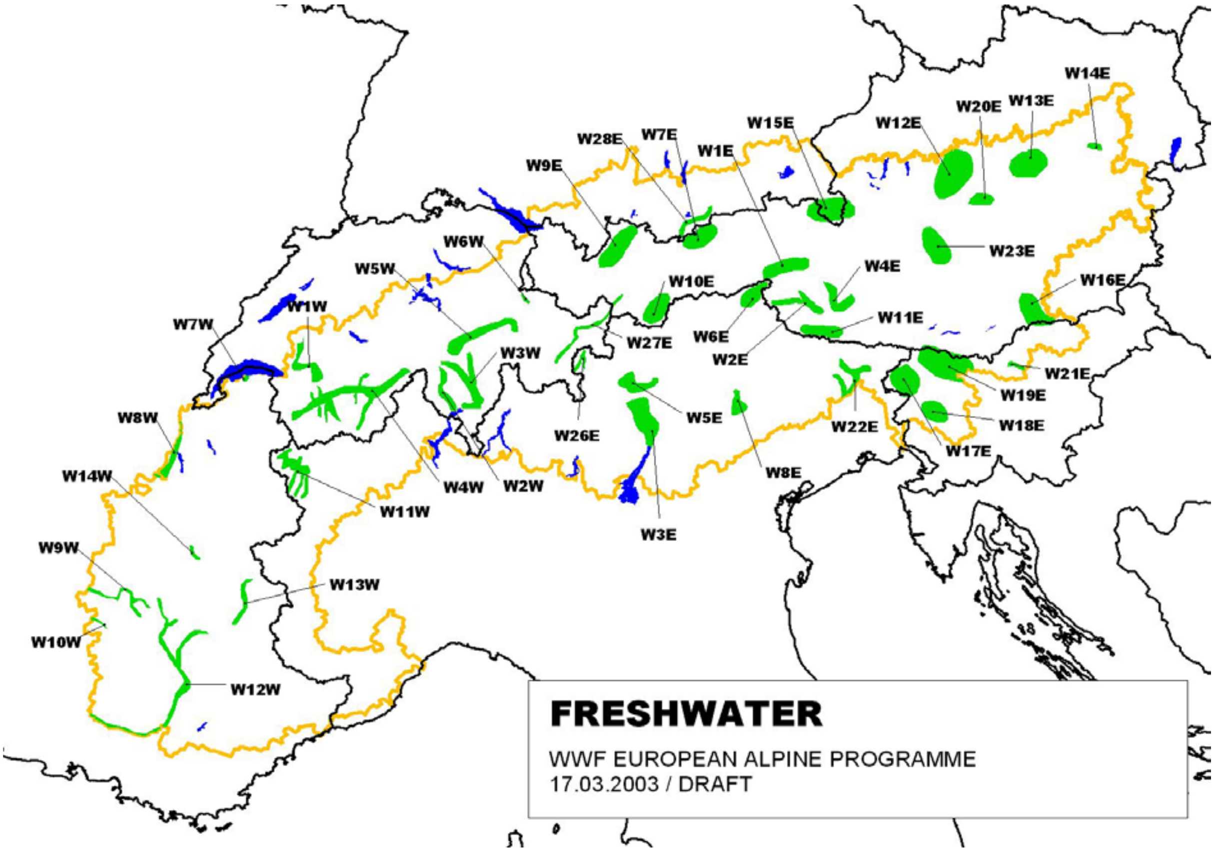


Fig. 17. Areas important for freshwater habitat in the Alps.

Areas of the Alps were selected as important for freshwater habitat if they represented remaining, intact rivers with a relatively natural floodplain, or if they were natural or semi-natural lower river stretches in valley bottoms (as opposed to upper stretches in the high mountains). The presence of certain invertebrate or fish species was an indirect indicator for intact rivers and floodplains and for natural or semi-natural river stretches.

Table 4: Summary of the criteria and the focal species used to identify priority areas for taxa and habitat types in the Alps.

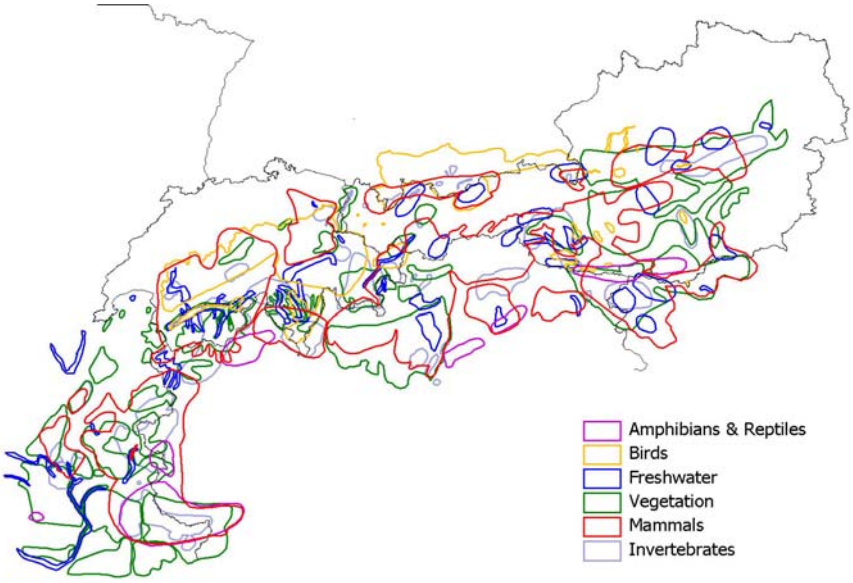
Taxon / key habitat	**Focal species**	**Criteria**	**Remarks**
Flora		1. Endemic species richness 2. Large forest blocks 3. Distinct dry areas 4. Alpine rare species 5. Particular ecological phenomena (i.e., glacier forelands, peatbogs)	
Mammals			
Large carnivores	• Bear (*Ursus arctos*) • Wolf (*Canis lupus*) • Lynx (*Lynx lynx*).	1. Areas where focal species currently reproduce 2. Areas where focal species can naturally reproduce within the next 10 years 3. Areas where individual countries want to reintroduce focal species within the next 10 years.	
Large herbivores	• Chamois (*Rupicapra rupicapra*) • Ibex (*Capra ibex*) • Red deer (*Cervus elaphus*).	1. (Focal) Species richness 2. Areas with optimal or core habitat for focal species (may need restoration first) 3. Areas important for habitat protection and restoration in relation to focal species 4. Area of endemism (see *Rupicapra r. cartusiana*).	
Medium/small mammals	• Otter (*Lutra lutra*): localized distribution, good habitat indicator, umbrella species • *Eptesicus nilssoni*: only bat typical for the Alps • *Rhinolophidae* (the whole family): localized distribution (in valleys up to 1000m), good habitat indicator, important for conservation • *Microtus bavaricus*: endemic • *Apodemus alpicola*: endemic	1. Known current distribution of focal species	
Birds			
IBAs		Important Bird Areas (IBAs)	

Focal bird species for the Alps which did not trigger IBA criteria	• *Mergus merganser* • *Alectoris graeca saxatilis* • *Tetrao urogallus* • *Charadrius morinellus* (now called *Eudromias morinellus*) • *Actitis hypoleucos* • *Upupa epops* • *Dendrocopos leucotos* • *Picus canus* • *Picoides tridactylus alpinus* • *Luscinia s. svecica* • *Monticola solitarius* • *Monticola saxatilis* • *Serinus citrinella*	Additional areas of high biodiversity value for focal species	For Italy, France, Liechtenstein and Slovenia, only IBA sites were used
<u>Amphibians and Reptiles</u>	• *Salamandra atra aurorae* • *Salamandra atra ssp*. (not yet described in 2002 but now known as *Salamandra atra pasubiensis*) • *Salamandra lanzai* • *Triturus alpestris* (neotenic or paedomorphic) • *Speleomantes strinatii* • *Lacerta horvathi (*now known as *Iberolacerta horvathi*) • *Zootoca vivipara carniolica* • *Vipera ursinii*	1. Areas with endemic species 2. Areas with species listed in the IUCN Red List 3. Areas with ecological and evolutionary phenomena 4. Areas with focal species 5. Areas with species richness	
<u>Insects</u>			
	• Butterflies *(Lepidoptera)* • Beetles *(Coleoptera)*	Endemic centres for butterflies and beetles	
		Biodiversity centres for butterflies and other species (this layer may be regionally inconsistent)	Butterflies are among the best known invertebrate groups, the overview about endemic species in the Alps is quite good and the difference in the data quality in the different regions is small.
<u>Freshwater habitat</u>		1. Remaining, intact rivers with floodplains 2. Lower stretches in river valleys (as opposed to stretches upstream in the high mountains or in river canyons), when in natural or semi-natural status (even if after restoration).	

3.8 Step 4: Select candidate priority areas for biodiversity as a whole based on taxon priority areas and priority areas for ecological processes

All the maps of most important areas for taxa and habitat types were then overlaid using GIS techniques. From the overlay, the areas most important for biodiversity as a whole can be identified (i.e., the areas within and around the maximum overlap of areas most important for taxa and habitat types).

This was done for the first time during the Gap workshop (Fig. 18) and preliminary priority conservation areas were identified (Fig. 19).



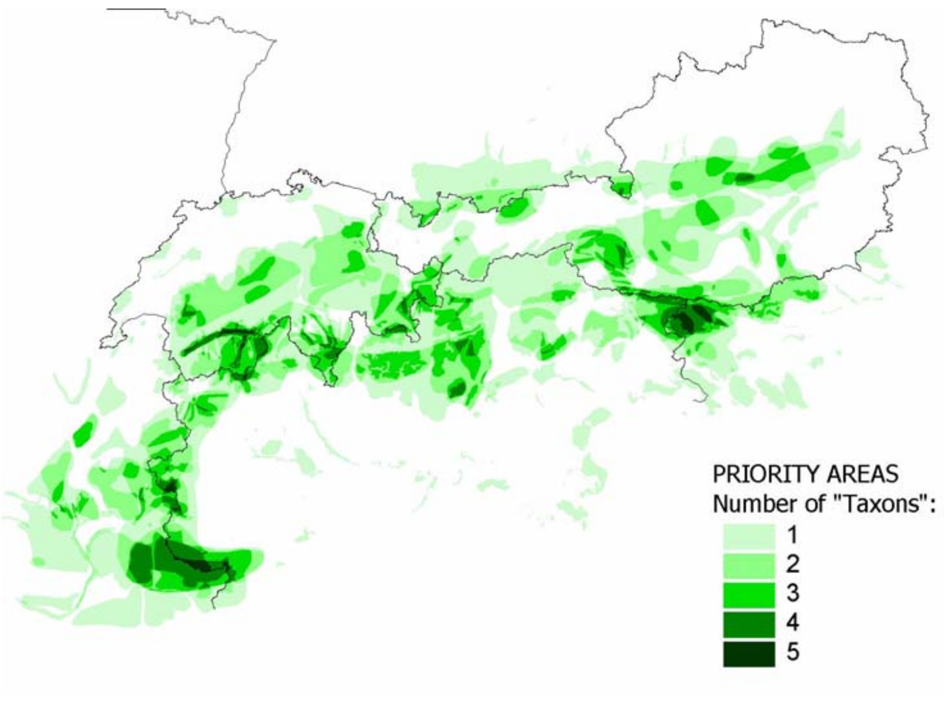


Fig. 18. Overlay of the preliminary areas important for the different taxa and habitat types. The map on top shows the boundaries of the polygons (the so called *spaghetti map*); the map on the bottom shows solid polygons (the darker the colour, the more taxon layers overlap (from 1 to 5 layers, as indicated in the legend). Both maps are from the Gap workshop in 2002.

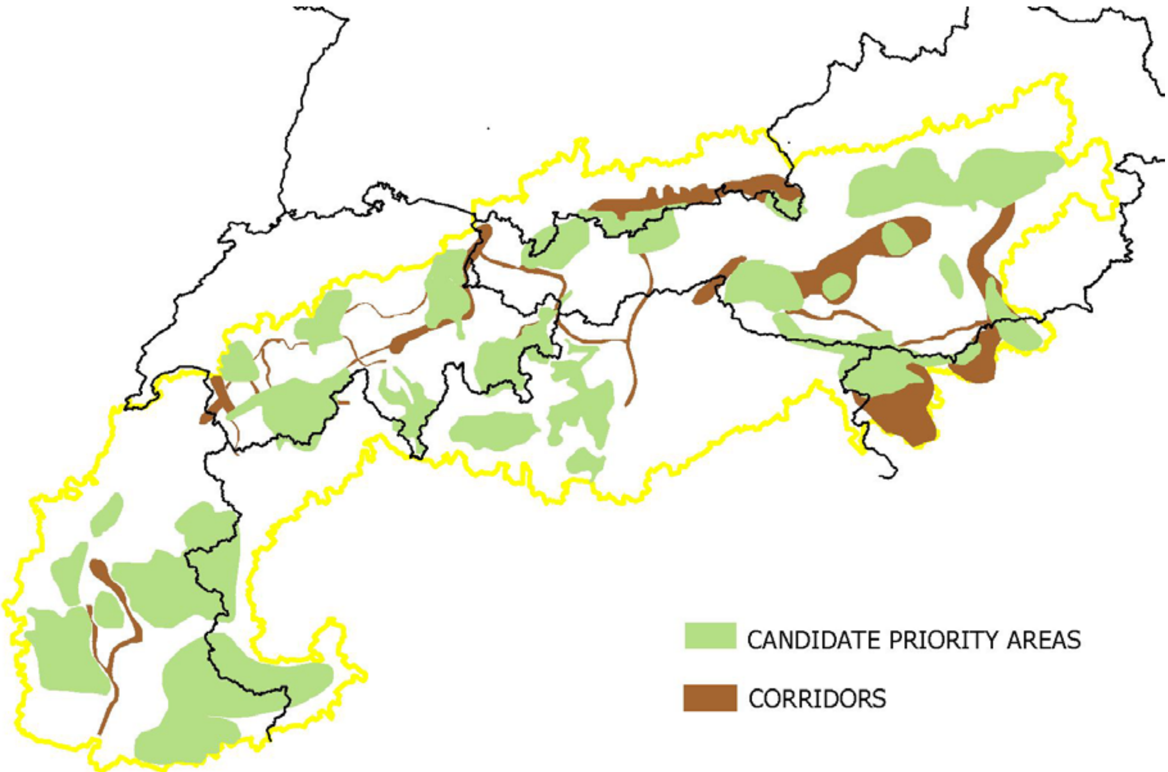


Fig. 19. Preliminary priority conservation areas identified in Gap in 2002. Only polygons in light green should be considered (brown polygons are preliminary corridors, which will be addressed in Step 7 under 3.11).

However, given that data gaps still existed in the database and that the experts groups were not complete, those results could not be considered final. A second overlay of taxon and habitat maps was undertaken when all the data gaps were filled in, about one year later (Fig. 20). At this point, new priority conservation areas were also identified (Fig. 21).

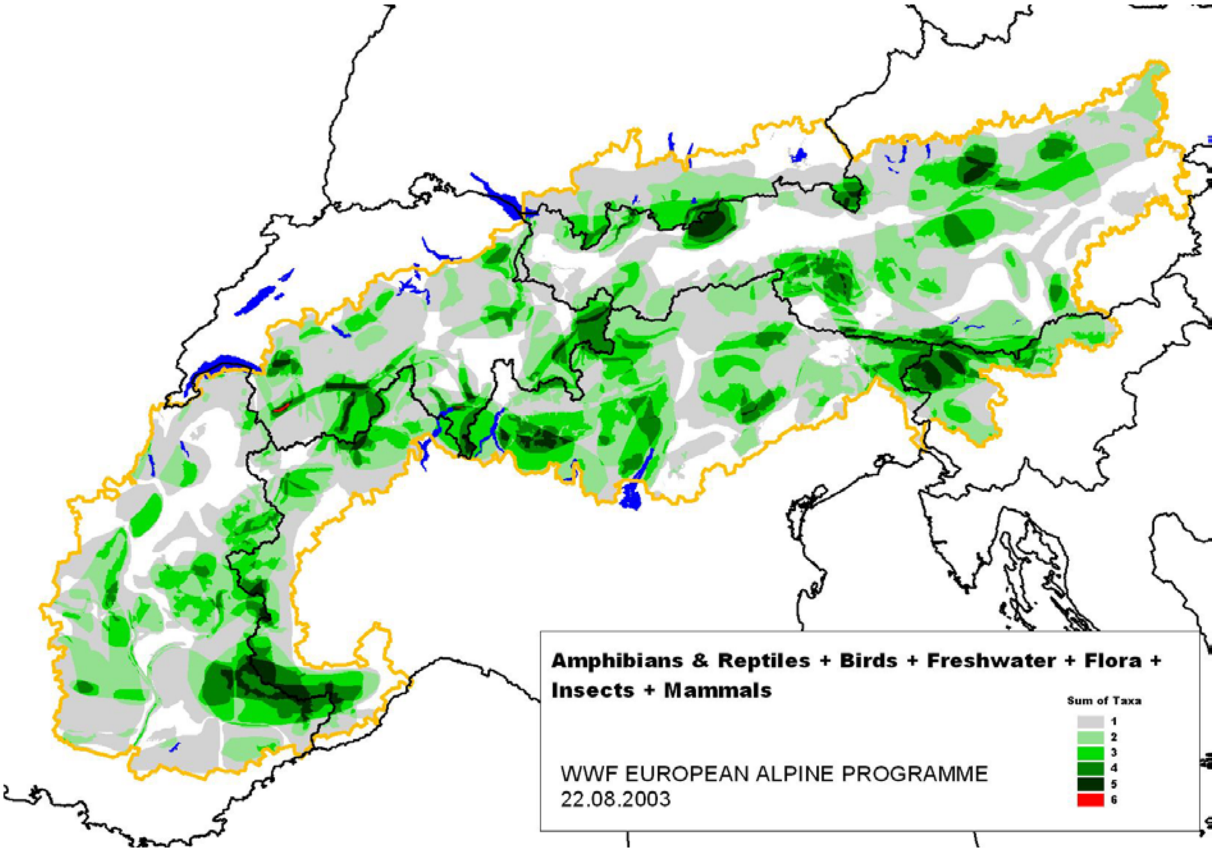
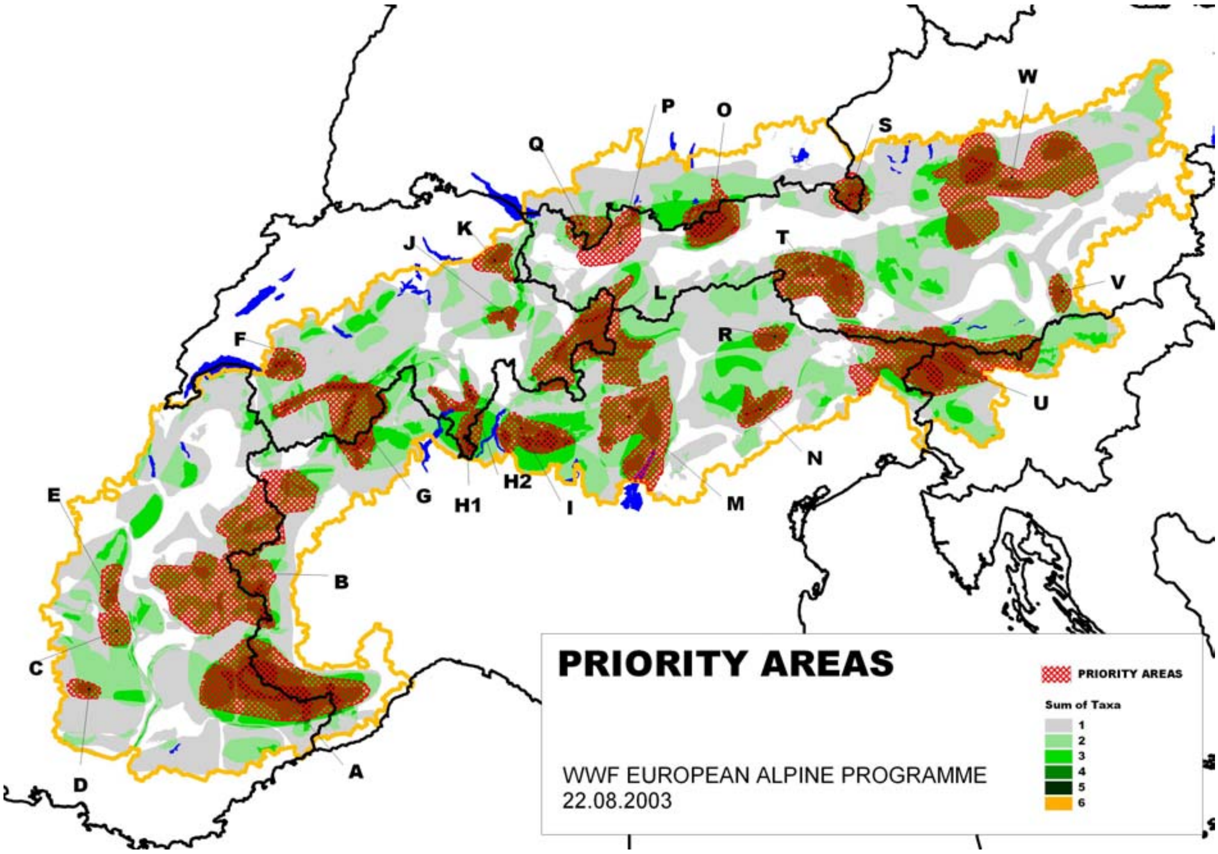


Fig. 20. Final overlay of the areas important for the different taxa and habitat types (2003).



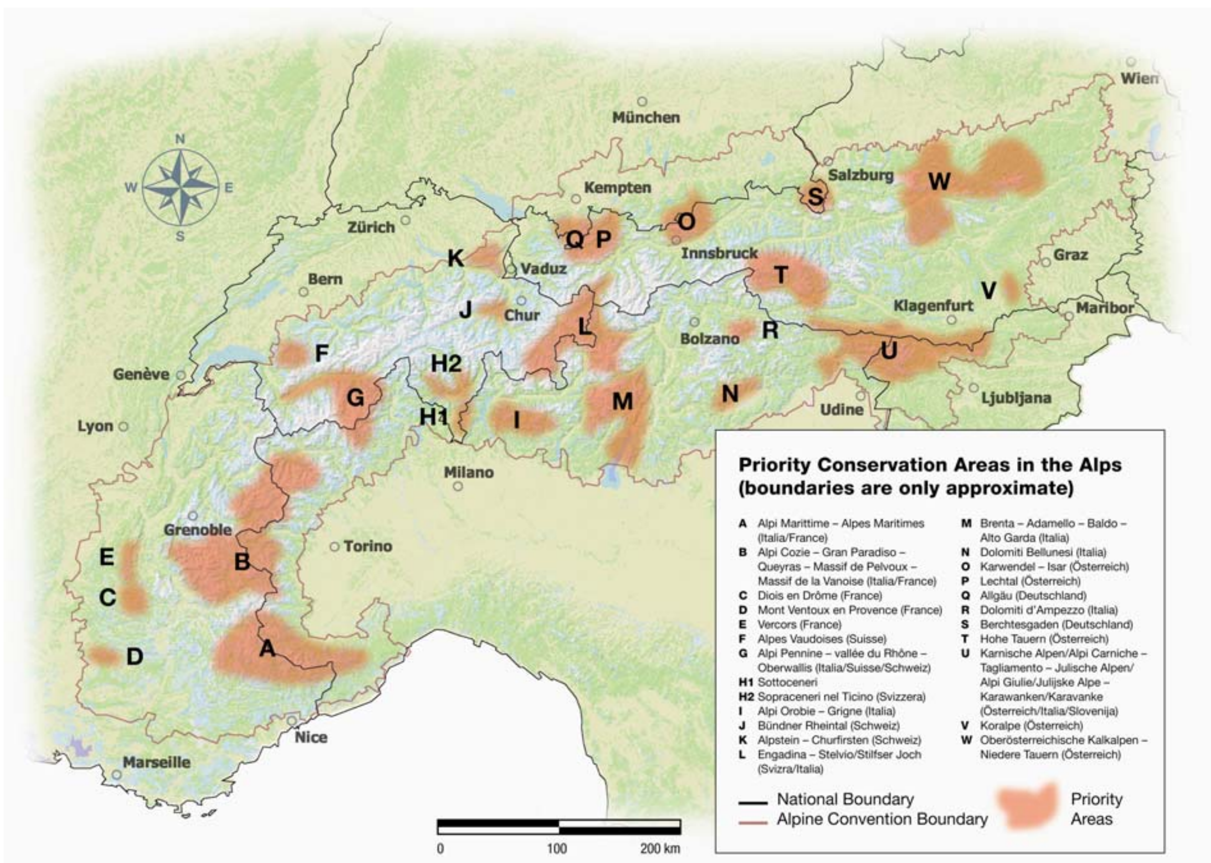


Fig. 21. Final priority conservation areas (2003). The map on top shows the boundaries of the priority areas over the taxon overlay; the map on the bottom shows only the priority areas on a base map of the Alps (in the mean time, names and countries of the priority areas in the box have changed: the correct ones are listed in Table 5).

Before agreeing on this new, final overlay, a discussion was held on the intrinsic value assigned to each layer. In particular, it was pointed out that simply overlaying the different layers without assigning different weights implied giving each layer the same value, even though some may represent taxa much richer or numerous in species than others. This may have seemed an unorthodox approach, considering that there existed three layers for vertebrates (mammals, birds, reptiles and amphibians), only one each for invertebrates (by far the largest majority of animal species) and flora/vegetation, and only one for everything to do with aquatic species or habitat types (freshwater habitat).

Thus, a sensitivity analysis was conducted, assigning different weights to different layers and counting the existing sub-taxon maps (for mammals and insects) as separate layers. The resulting overlay did not change significantly, therefore it was decided to consider one layer for each taxon and to assign the same value to each one of them.

Also, the same value was assigned to the remote area layer (Fig. 22 in Annex 13) as the taxon layers and a new overlay was produced including it. In this case, again, the results did not change significantly. It was decided, however, not to consider remote areas as important to biodiversity, given that they are often mountain peaks covered in ice and rocks, thus not really relevant for biodiversity. However, the remote area layer was used as a reference map during the delineation of the priority area boundaries (see criteria below) and as a proxy for ecological processes (see end of the current 3.8 section).

Having agreed on assigning the same weight to each layer, the boundaries of the priority conservation areas were identified according to these criteria:

1. Include within the boundaries of a priority area all areas where a minimum of 4 taxon/habitat priority area layers overlap (areas of maximum overlap of 4 or 5 layers represent the *core* of priority areas)
2. Include within the boundaries of a priority area also areas with an overlap of 3 or 2 layers, when these are adjacent to areas with an overlap of 4 or 5 layers
3. Include within the boundaries of a priority area also intact floodplain regions should there be a river nearby (whether or not the river is part of the freshwater priority area layer), and intact river corridors (even without floodplain)
4. Include within the boundaries of a priority area as many remote areas as possible, when they are adjacent to areas of great taxon overlay
5. Include within the boundaries of a priority area as much vertical gradient as possible
6. Consider the area requirements of the focal species present for the size of the priority area
7. Consider the potential of an area, not only the current state (addressing restoration as well as conservation)
8. Draw rough boundaries at a scale of 1:500,000, which will have to be verified at a more detailed scale during a landscape level analysis.

The boundaries of the priority areas were drawn by a small, international group of landscape ecologists directly onto a base map of the Alps also showing the overlay (scale 1:500,000), and then digitized. It should therefore be underlined that such boundaries are an approximation and are meaningful only at the scale at which they were identified (ecoregional scale). Furthermore, it should be remembered that the overlay comes from other "source" maps (the taxon maps) which were drawn at a very rough scale: the caution about the approximation of the boundaries of the priority areas could therefore not be more appropriate.

Thus the rough boundaries of the priority areas draw attention to specific areas of the Alps where it will be worthwhile to conduct a more detailed (landscape) analysis on a regional or local scale. This subsequent phase – which is not part of the current process – will have to take place later on and will have to include the involvement of local interested parties (authorities, experts and communities).

To reflect the approximation of the boundaries, experiments with different graphics were conducted, in an attempt to draw attention to the general location of the priority areas and not to the specific boundaries. Annex 28 shows examples of different graphics. The one preferred to date is Map A. Maps B and C show very well that some boundaries are ill-set and should definitely be revised.

A revision of the boundaries is also being partially undertaken through the identification of the connection areas of the Alps (see Chapter 5): some local experts gave indications on which areas should be enlarged and why, and which should be connected to others.

Twenty-four priority areas for the conservation of biodiversity in the Alps were finally identified. The final list is found in Table 5.

Table 5. Final list of the priority conservation areas of the Alps. Names of priority areas are expressed in the languages of the countries in which they are located. Country names are also expressed in the local language. This list could be revised in future years.

Name of priority area	Location	Notes
A. Alpi Marittime – Alpes Maritimes	Italia/France	Includes Alpi Marittime and Mercantour parks.
B. Alpi Cozie – Gran Paradiso – Queyras – Massif de Pelvoux – Massif de la Vanoise	Italia/France	In the Cotian Alps area, great example of larch forest is also included. Note that Orsiera Regional Park is very near this priority area and is a good area for black grouse. It includes river corridors SW of Aosta (migratory pathways) and elevation gradients.
C. Diois en Drôme	France	
D. Mont Ventoux en Provence	France	
E. Vercors	France	
F. Alpes Vaudoises	Suisse	

G. Alpi Pennine – Vallée du Rhône – Oberwallis	Italia/Suisse/Schweiz	Catchment area. It includes Rhône, Zermatt, Mt Rosa, Val Sesia, Val d'Ossola. Alpine endemisms and valley. Old Alpine traditions. Large townships. Large ski resorts (Zermatt, etc.) but they do not allow cars. Upper Rhône also includes Mediterranean species. Note that the Aletsch region was not included even though it is relatively important. It does not show up in the taxon layers, only in the remote area layer.
H1. Sottoceneri – Colline Comasche – Alto Lario	Svizzera/Italia	It includes Val Maggia. Island of calcareous among gneiss. Several small townships.
H2. Sopraceneri nel Ticino	Svizzera	Floodplain of granitic, crystalline catchment. H1 and H2 were purposely kept separate but under the same common "name" because they are different enough biogeographically, and yet both part of the same Ceneri complex.
I. Alpi Orobie – Grigne	Italia	
J. Bündner Rheintal	Schweiz	
K. Alpstein – Churfirsten	Schweiz	The western portion includes bogs.
L. Engadina – Stelvio/Stilfser Joch	Svizra/Italia/Österreich	"Svizra" is in Romansch. It includes Upper Engadin (Oberengadine), Lower Engadin, Val Venosta, Stelvio/Stilfser Joch (also important for bears).
M. Brenta – Adamello – Baldo – Alto Garda	Italia	Presence of bear.
N. Dolomiti Bellunesi	Italia	

O. Karwendel – Isar	Österreich/Deutschland	
P. Lechtal	Österreich	
Q. Allgäu	Deutschland/Österreich	
R. Dolomiti d'Ampezzo	Italia	
S. Berchtesgaden	Deutschland/Österreich	
T. Hohe Tauern	Österreich	
U. Karnische Alpen/Alpi Carniche – Tagliamento – Julische Alpen/Alpi Giulie/Julijske Alpe – Karawanken/Karavanke	Österreich/Italia/Slovenija	
V. Koralpe	Österreich	
W. Oberösterreichische Kalkalpen – Niedere Tauern	Österreich	It includes Niedere Tauern, Enns Valley, Kalkalpen.

Annex 29 shows enlarged maps of the individual priority areas. Once again, these enlargements serve the purpose of better locating these areas on the ground and are not for the precise definition of their boundaries.

A synthesis of the statistics of priority areas indicates that priority conservation areas cover slightly less than 24% of the Alps territory (about 44,450 km²). On average priority areas are 1,852 km², with a minimum surface of 226 km² (area J, Bündner Rheintal) and a maximum surface of 7,268 km² (area B, Alpi Cozie-Gran Paradiso-Queyras-Massif de Pelvoux-Massif de la Vanoise). These statistics should however be considered with caution given that they refer to boundaries which are approximate themselves. Full statistics for priority areas are found in Annex 30.

Annex 31 reconstructs which important taxon areas concurred in the identification of each priority area, showing the overlap of each important taxon area with priority areas.

Ecological and evolutionary processes deserve a side note. As already stated, they are difficult to identify and to map, and – in spite of several attempts and requests to experts – they were never formally and successfully tackled in the biodiversity vision for the Alps. Nevertheless, they are extremely significant for the ecological integrity of the Alps, and are an essential component of biodiversity conservation: a biodiversity vision which does not take ecological and evolutionary processes into consideration is a flawed and incomplete one. Thus, indirect ways to incorporate such processes into the identification of priority conservation areas had to be devised:

1. Remote areas are relatively non-fragmented and undisturbed. It can therefore safely be assumed that in these areas the typical ecological and evolutionary processes (whatever they are) can take place unimpaired. As a consequence, by including remote areas whenever possible within the boundaries of priority areas, the ecological and evolutionary processes present in the remote areas become incorporated into the priority areas.
2. Several processes occur along vertical gradients, for example: seasonal migrations of certain large herbivores or daily migrations of certain bird species, slope dynamics (avalanches, land slides), water regime (from glacier to stream) and adaptation to climate change. Thus, by including as much vertical gradient as possible within the boundaries of the priority areas the permanence of these processes is eased.
3. Several ecological processes are related to the hydrological cycle. By including floodplains and river corridors within the boundaries of the priority areas, such processes stand a higher chance of being conserved. Furthermore, some priority areas are identified thanks to the contribution of the freshwater layer, which maps the areas most important for intact rivers and floodplains.
4. Other processes like continental-scale migrations (e.g. birds), natural re-colonization of areas from which species had previously been eradicated (large carnivores) and species dispersal can be assured through the identification and subsequent conservation and restoration of main connection areas (see Chapter 5), or through the implementation of *ad hoc* land and resources management measures (see Chapter 8 *Outlook*).

3.9 Step 5: Evaluate habitat representation of candidate priority areas

The evaluation of habitat representation is important because it ensures that all the characteristic natural communities of the ecoregion are actually represented in the selected priority areas. Communities depend on habitat types; habitat types depend on biogeographic subregions, which in turn depend on substratum, elevation and climate conditions.

Of the available divisions of the Alps into subregions (see Step 1 under 3.5 and Annex 16), two were selected to check for representation of the priority areas: biogeographic divisions according to Jean-Paul Theurillat, University of Geneva and natural potential vegetation according to Udo Bohn et al., Bundesamt für Naturschutz. Within the Theurillat system, the division into eight subregions was used to test for representation. Within Bohn's system, natural potential vegetation is an interesting and significant indirect measure for biogeographic subregions, as vegetation (i.e., vegetation communities) is heavily influenced by climate, elevation and substratum, and in turn influences the natural animal communities.

When analyses of priority areas coverage versus the distribution of biogeographic subregions and potential natural vegetation were run, it became obvious that a particular subregion in the French Alps was underrepresented.

During the delineation of the boundaries of priority areas, the landscape ecologists proposed that if a subregion was not sufficiently represented by the priority areas already identified, one of two options should be considered:
1. enlarge an existing priority area to cover the underrepresented subregion (preferable option)
2. create a new priority area choosing an area with an overlap of at least three taxon layers.

Given that the underrepresented habitat discovered during the analyses was not adjacent to any existing priority area, a new priority area was created in the French Alps.

With this addition, all major habitat types according to both sets of subregions are adequately represented by the priority areas identified (Fig. 22 and Fig. 23 show the representation analyses respectively with biogeographic sub-divisions and with natural potential vegetation).

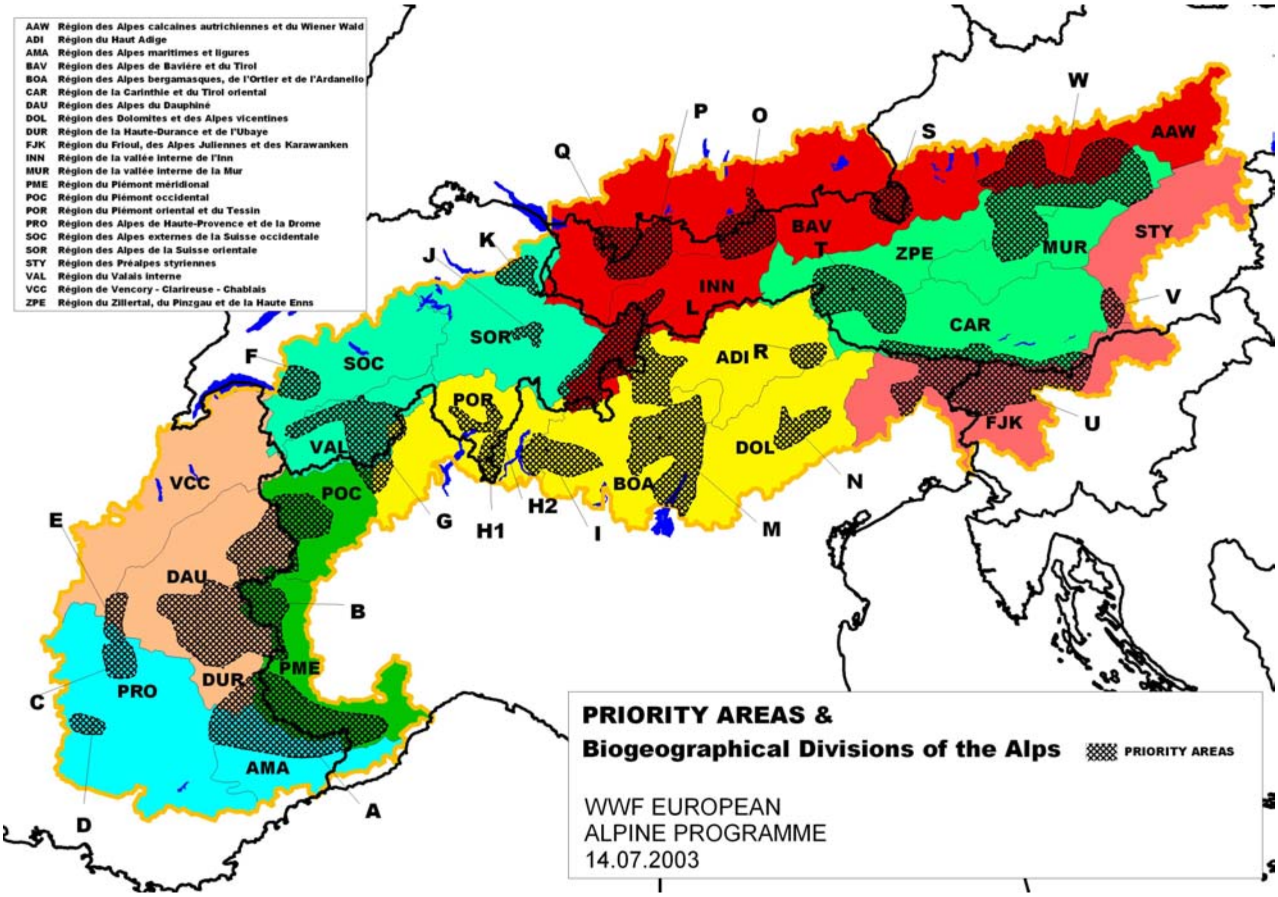


Fig. 22. Representation analysis of the priority conservation areas according to the biogeographic sub-divisions of the Alps.

For the biogeographic divisions of the Alps, an average of 24.6% of each sub-division is included in priority areas, with a minimum of 15.3% for Maritime Alps/Haute Provence (AMA/PRO) and a maximum of 42% for Piedmont (PME/POC).

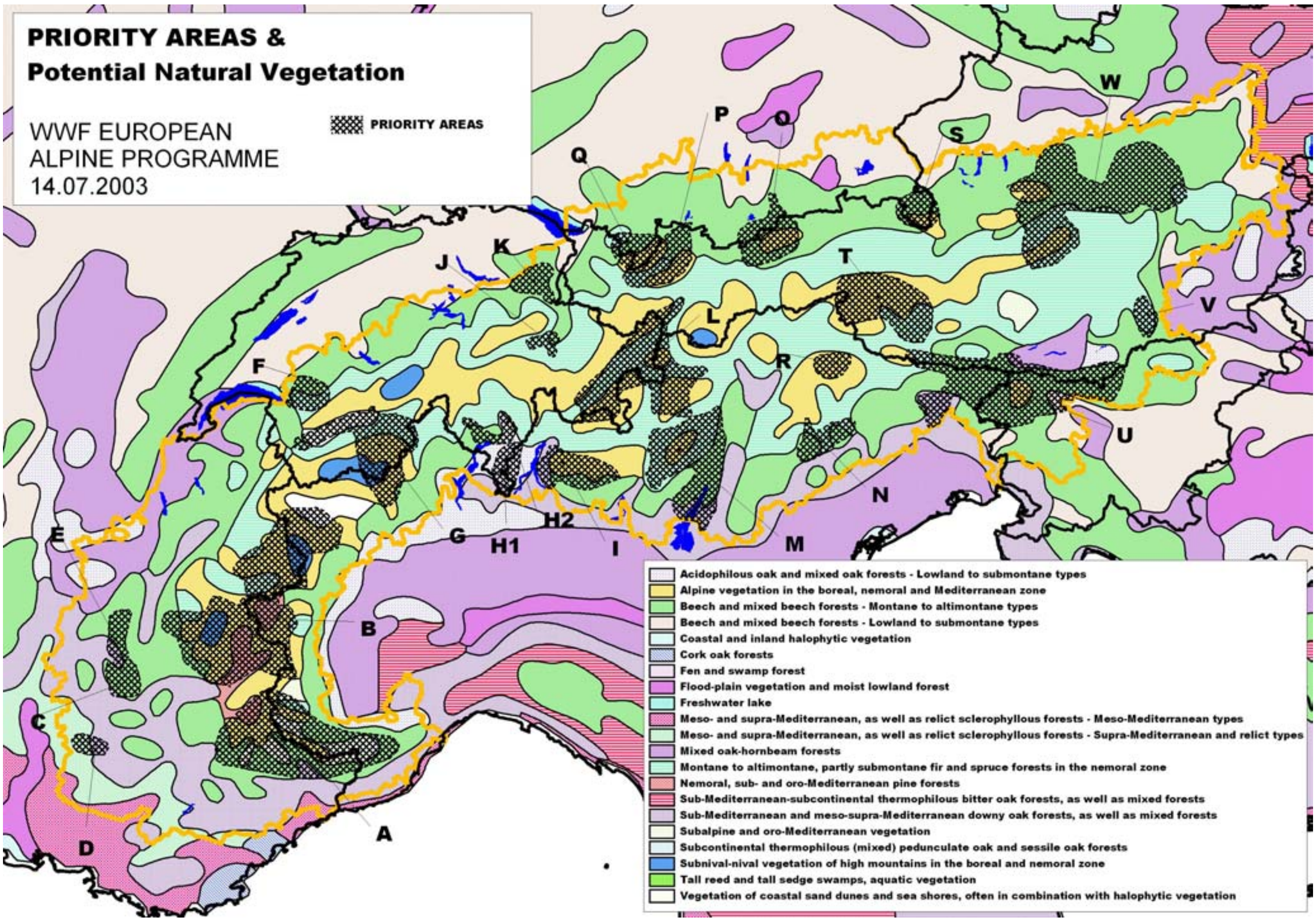


Fig. 23. Representation analysis of the priority conservation areas according to the natural potential vegetation of the Alps.

For the subregions based on the natural potential vegetation, an average of 32% of each natural potential vegetation type is included in priority areas, with a maximum of 63.7% for the “Subalpine and oro-Mediterranean vegetation (forests, scrub and dwarf shrub communities in combination with grasslands and tall-forb communities)” and a minimum of 5.5% for the “Meso- and supra-Mediterranean, as well as relict sclerophyllous forests Quercus ilex subsp. Rotundifolia-forests/Holm oak forests (Quercus ilex)”. For this analysis only the vegetation classes typical of the Alps (i.e., with their main distribution within the Alps) were considered, while the vegetation classes more diffused outside of the Alps were not included (a more detailed analysis can be found in the statistics).

3.10 Step 6: Rank priority areas for biodiversity conservation

Having selected priority areas for an ecoregion, these are likely to cover a significant amount of the ecoregion (about 24% of the Alps, see 3.8), probably too vast to start conservation action in all areas at once. Considering the reality of limited resources in the field of biodiversity conservation it is therefore appropriate to try to rank priority areas in terms of urgency or opportunity of conservation action.

The ranking of the priority areas of the Alps was undertaken in two different phases. The first phase took place in 2002 during the Gap workshop, and was based on only a preliminary identification of priority areas. It was carried out by the experts present at the workshop following a standard template taken from the ecoregion conservation methodology. The second phase took place in 2004 as part of the biodiversity assessment of the priority areas. It was based on the final delineation of priority areas and was carried out by the consultant Kai Elmauer according to a different set of criteria.

The standard ecoregion conservation methodology recommends the ranking of priority areas according to their biological importance (including landscape integrity as an indirect measure for biological importance), the level of threat imposed on them, or a combination of the two.

The first ranking of priority areas, undertaken in Gap, proved difficult because the criteria for it had not been discussed and assimilated in advance. In addition, as it was based on a *draft* map of priority areas (see Fig. 19) which still included some gaps, it could not be considered fully valid for the *final* priority areas (although some good overlap between preliminary and final priority areas exists).

From the point of view of methodology, however, it is still interesting to report on the procedure and the results of the first ranking. The experts present in Gap worked on the ranking in groups which were different from those of Steps 2 and 3: no longer according to taxa or habitat types, but according to geographic subregions. The Alps had been divided into five rudimentary and rather obvious subregions: South-West, North-West (also called Central-North), Central (also called Insubria), North-East and South-East, as shown in Annex 32. Thus, each group included experts on different themes with the necessary competence to carry out a non-detailed but complete (i.e. transdisciplinary) assessment. Experts were assigned to a group depending on their geographic knowledge of the Alps; each group assessed and ranked the priority areas included in that subregion. Three types of blank datasheets with a proposed work procedure were assigned to the different groups (see Annex 33a, Annex 33b and Annex 33c). The proposed ranking criteria were:

- Biological importance. Values 1 (low) to 4 (high) were to be assigned to five features: degree of naturalness, ecological phenomena and processes, habitat diversity (including cultural landscapes), endemics, and species diversity.
- Landscape integrity. This had to be assessed according to three levels: intact, altered/degraded, and heavily altered.
- Threats. Four levels of threat (severe, high, medium or low) for four different types of threats: conversion threats, degradation threats, exploitation threats to wildlife and vegetation, and overall future threat level.

The completed datasheets for the various priority areas are found in Annex 34a, Annex 34b, Annex 34c, Annex 34d and Annex 34e. The results of the first ranking exercise are shown in Annex 35 and should be considered *cum grano salis* because the map of priority areas had gaps and was not final, the criteria for ranking had been only briefly and not thoroughly discussed by the experts prior to the exercise, and no common interpretation existed of what the criteria meant.

The second ranking of priority areas was performed two years later on the final version of the priority areas, when all the information gaps left from the Gap workshop had been filled.

The ranking undertaken by Kai Elmauer was based on the results of his study *Analysis of priority conservation areas in the Alps: biodiversity, threats and opportunities for conservation* (August 2004, Annex 12 already described under 3.1). For each priority area, the types of existing threats which were described in his study were listed and counted, and the priority areas were ranked according to the overall number of threats to them (the higher the number of threats, the more urgent it is to act in the area). The threats considered were:

- depopulation
- urbanization
- holiday houses
- agricultural decline (pastures)
- agricultural intensification (mainly in valleys)
- climate change (erosion, water resources)
- recreation
- tourism (mainly winter tourism, ski areas)
- pollution (water, air)
- mining / gravel extraction from rivers
- damming / hydro power
- wind energy plants
- weak political backing (mainly for protected areas)
- conflicts between protected areas and local people
- poaching
- hunting
- berry and mushroom picking
- fires
- roads / traffic
- forestry
- military training
- invasive species.

Despite the heterogeneity of these threats and their different impacts, they were considered all at the same level without any attempt at prioritizing them or assessing their severity.

The analysis of threats was performed both on priority areas individually, and on combinations of them. For example, areas near each other and relatively homogeneous were combined in the same assessment, such as for instance:

- areas C (Diois en Drôme) + D (Mont Ventoux en Provence) + E (Vercors), or
- H1 (Sottoceneri-Colline Comasche-Alto Lario) + H2 (Sopraceneri) + I (Alpi Orobie-Grigne), or
- L (Engadina-Stilfser Joch) + M (Brenta-Adamello-Baldo-Alto Garda), or
- N (Dolomiti Bellunesi) + R (Dolomiti d'Ampezzo), or
- O (Karwendel-Isar) + P (Lechtal) + Q (Allgäu) + S (Berchtesgaden).

The rationale behind this combination of priority areas is that conservation strategies for various species need to be designed and implemented over large areas (for an in-depth discussion, see Chapter 4 *Results on priority conservation areas*).

Annex 36a shows the tables with the analysis of threats for each priority area or combination of them. Annex 36b shows the results in map form.

This methodology and the results are also interesting, as they show a different approach from that used at the Gap workshop. However, due to some doubts regarding the appropriateness of the threats selected by Elmauer and their impact, the results may not be fully reliable.

3.11 Step 7: Identify important corridors among priority areas

To meet some of the goals of biodiversity conservation (maintenance of viable populations of native species within their natural communities, maintenance of ecological and evolutionary processes, conservation of large blocks of natural habitat), connecting priority areas through corridors may become necessary. This is especially important for larger animal species capable of migration and which need corridors for dispersal and to maintain viable metapopulations. Corridors are also very critical for genetic exchange. In addition, large areas are needed to enable habitat and species assemblages to react to large scale disturbances and long-term variations such as climate change.

Thus, part of the Gap workshop was devoted to identifying corridors among protected areas. Both existing (functioning) and potential (no longer functioning but needed and possible to restore) were considered.

Criteria for the identification of corridors were developed by a group of experts on landscape ecology and corridors present at the Gap workshop. They were preceded by a definition:

> *Fragmentation is only the separation of habitat patches caused by human intervention. Therefore, high alpine habitat is not fragmented: those divisions of alpine habitat have always occurred.*

Specific elements for the identification of corridors were:

- intact rivers and floodplains
- natural, intact mountain passes
- known or "proven" corridors, including those with restoration potential
- areas with a degree of spatial heterogeneity, e.g. stepping stones for many species
- large, intact areas separated by a short distance.

[Incidentally, these criteria were integrated with three more after the Gap workshop (during the meeting held in Zürich on 25 March 2003 to finalize the boundaries on priority areas):

- rivers with a certain level of natural dynamics or natural discharge
- altered rivers with restoration potential
- wetlands and mountain passes used by migratory birds.]

Additional specific criteria were:

- determine critical maximum distance between intact habitat patches
- as focal species for defining critical distances use species that disperse poorly and are area-sensitive
- avoid placing corridors in areas divided by barriers such as highways, railroads, etc. unless possibility for bridging exists.

Fig. 24 presents the map of corridors identified during the Gap workshop.

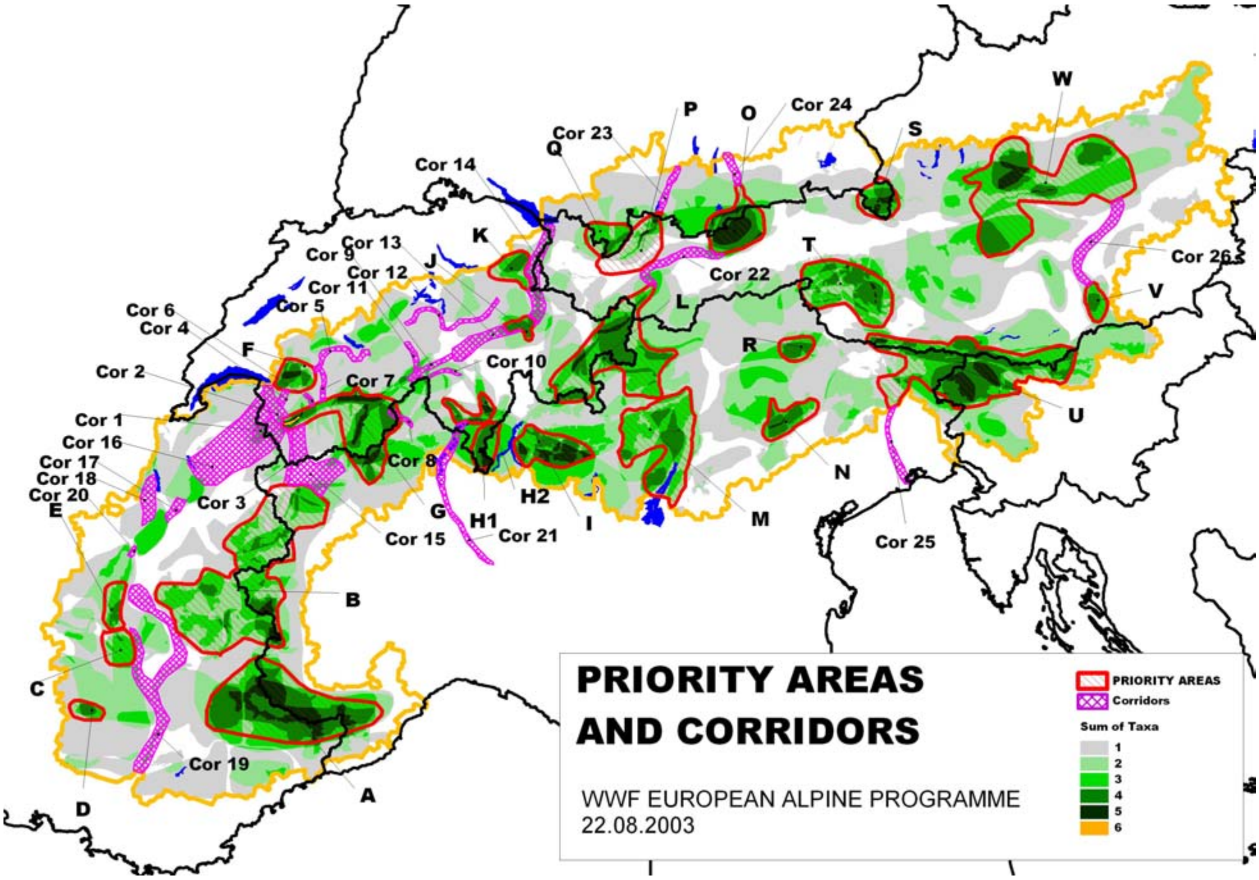


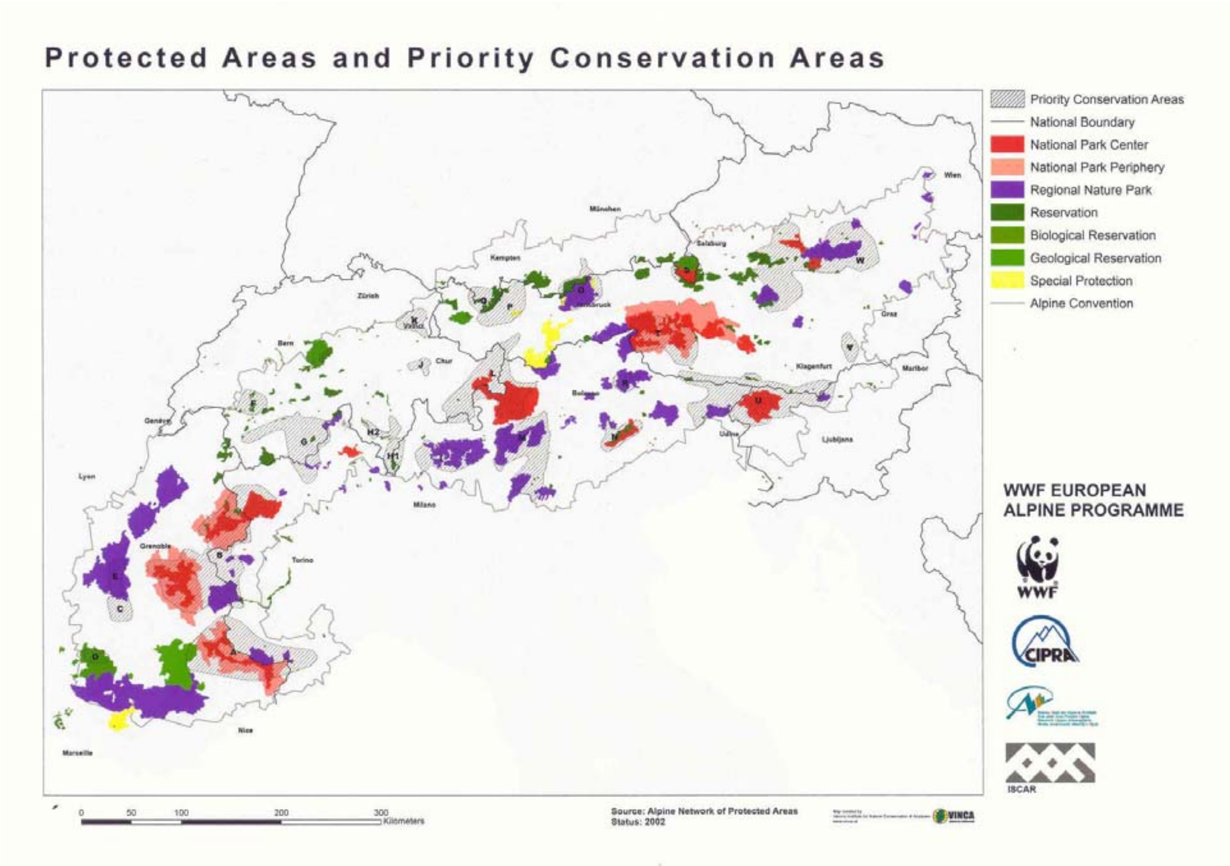
Fig. 24. Map of the preliminary corridors identified during the Gap workshop in 2002. They are preliminary and not final as time did not allow to complete the exercise and priority areas had not been identified in a final form.

The corridors identified during the Gap workshop have to be considered preliminary, given that time was not sufficient to complete the assessment and that the priority areas available on those dates were not final. The identification of corridors would be completed later on (2005-2006), when priority areas were finally identified and a methodology for the identification of corridors was refined (see Chapters 5 and 6). The identification of the main corridors of the Alps (later called *connection areas*) is thus another activity undertaken in two phases, like the representation analysis. During the second phase, the results of the first phase were taken into consideration.

3.12 Step 8: Conduct a gap analysis for protected areas or other sites considered important

Several gap analyses were conducted. Most of them were for areas considered important for biodiversity, but some were for other types of land tenure or infrastructures. They will be described one by one.

The gap analysis for protected areas is found in Fig. 25. According to the statistics (see Annex 30) about 59% of the area covered by priority areas is also covered by some form of protected areas (including IBAs).



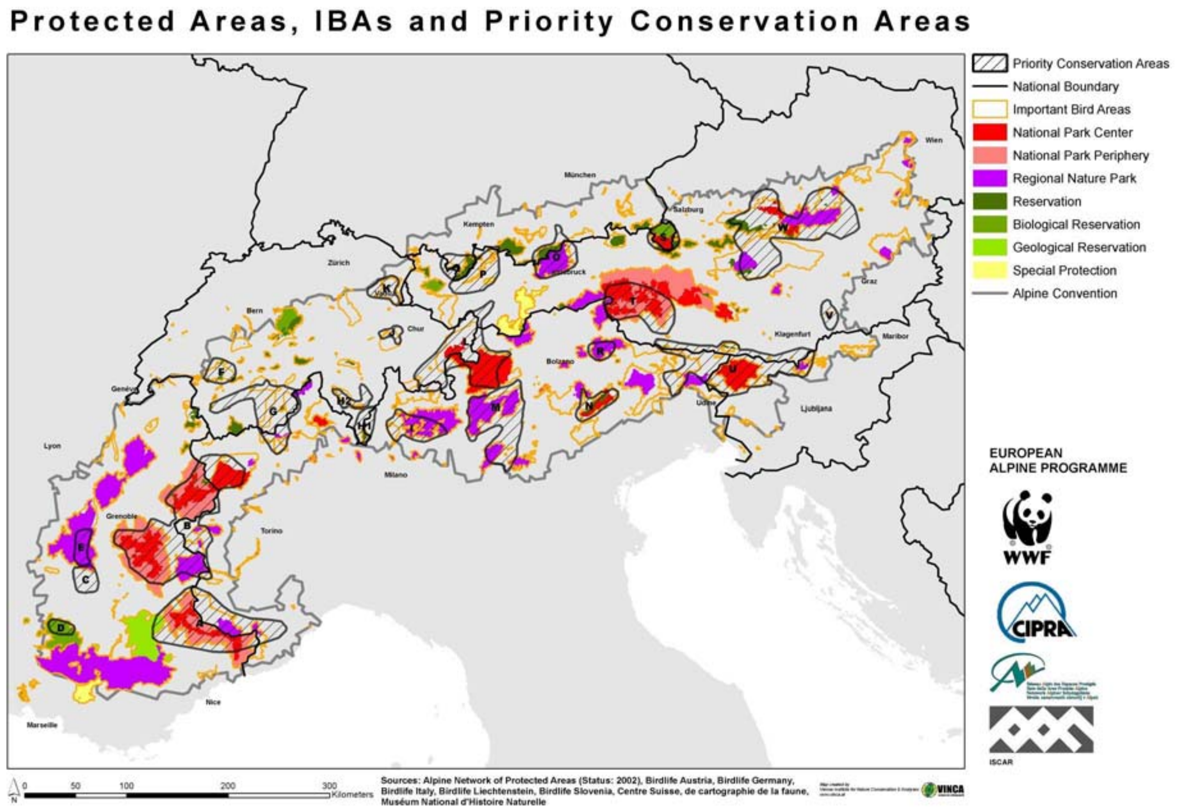


Fig. 25. Gap analysis for protected areas. The map at the top shows only priority areas and protected areas; the map at the bottom shows also Important Bird Areas. In both cases, the data set for protected areas, from ALPARC, dates back to 2002 and is not fully accurate (some boundaries are misplaced and some protected areas are not included). Statistics for this gap analysis are found in Annex 30.

The good overlap of priority areas and protected areas (see for example areas A, B, M, T) can be explained by two factors:

- the biodiversity included in protected areas is generally known better than the biodiversity found outside parks. This is because research and monitoring in parks are encouraged. The experts who contributed to the identification of important taxon areas obviously had access to this knowledge (or some of them were the producers of that knowledge themselves). As a consequence, the location of important taxon areas – and therefore of priority areas – may be biased in favour of protected areas;

- several protected areas are actually located where habitat is most pristine and biodiversity is at its highest density; additionally, the fact that in some parks human activities are regulated contributes to the maintenance of biodiversity.

On the other hand, the overlap of priority areas and protected areas is not complete, given that not all protected areas are located where biodiversity has its highest density: for example, some are located in areas important only for an individual taxon or few taxa (e.g, wetlands), others are located where the socio-economic conditions allowed for parks, with objectives other than biodiversity conservation. Thus there are areas considered very important for biodiversity (priority areas) which include no (or almost no) parks, such as priority areas C (Diois en Drôme), G (Alpi Pennine – Vallée du Rhône – Oberwallis), H1 and H2 (respectively Sopraceneri nel Ticino and Sottoceneri – Colline Comasche – Alto Lario), J (Bündner Rheintal), K (Alpstein – Churfirsten) and V (Koralpe).

An interesting analysis will be the gap analysis with only the protected areas *important for connectivity and biodiversity*. The selection of such protected areas was made by ALPARC in November 2005; it is shown in Fig. 43 and explained in Chapter 5. This overlay has not been possible so far because digital data for the protected areas was not available.

As will be discussed in more depth below (7.2), the intention of ecoregion conservation is not to protect all areas considered priority for biodiversity. The gap analysis with protected areas can provide useful information to public administrations and civil society regarding the significance of protected areas for biodiversity conservation.

The gap analysis for Important Bird Areas is shown in Fig. 26. The overlap of IBAs and priority areas is very good: 47.5% of the area covered by priority areas is also under IBA designation (full statistics are in Annex 30).

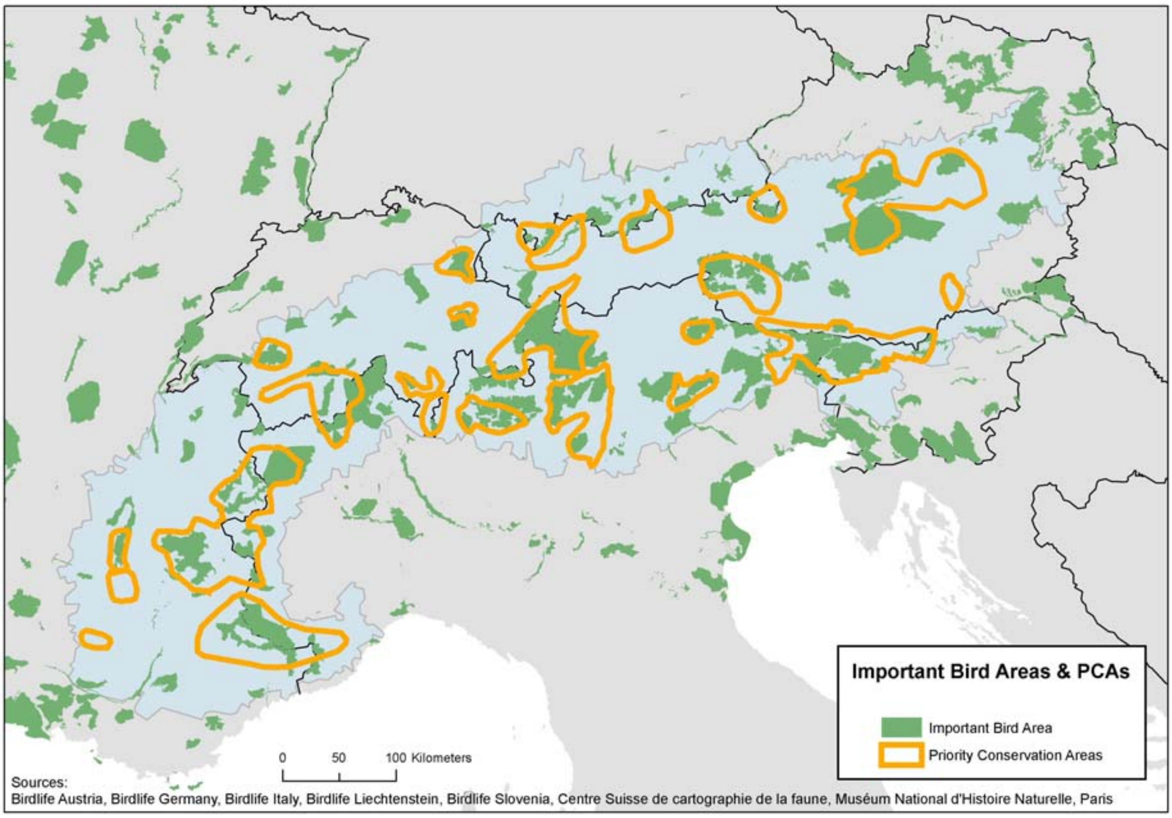


Fig. 26. Gap analysis for Important Bird Areas.

The overlap of IBAs and priority conservation areas is good but not complete: this is due to two factors:

- while both IBAs and priority areas can be considered the expression of a biodiversity vision, they are in fact based on two different criteria: importance for birds for the former, importance for the maximum number of taxa for the latter. The fact that IBAs represent areas important for one taxon only explains why – if they are not found in areas important also for other taxa – they have not been included in priority areas;

- partly as a result of the rough boundaries of the priority areas (see for example area I: Alpi Orobie-Grigne, whose boundary should in fact be extended to cover the entire area of some overlap of taxa and thus include the full IBA).

The location of IBAs near or between priority areas can however be one criterion to identify connection areas or to warrant the adjustment of priority area boundaries (see Chapters 5 and 6).

In a sense, this gap analysis could be misleading given that the IBAs were one of the layers used to identify the priority areas themselves. However, IBAs are a special category of protected areas and in any case they are a network of sites with acknowledged importance for at least one taxon: birds. They are now entrenched in the European Birds Directive and have therefore become very powerful tools for bird conservation. It thus seems appropriate to verify the location of IBAs with respect to priority areas, to know where the conservation of priority areas can benefit from the strength of European Directives.

The gap analysis for the Natura 2000 and the Emerald networks is shown in Fig. 27.

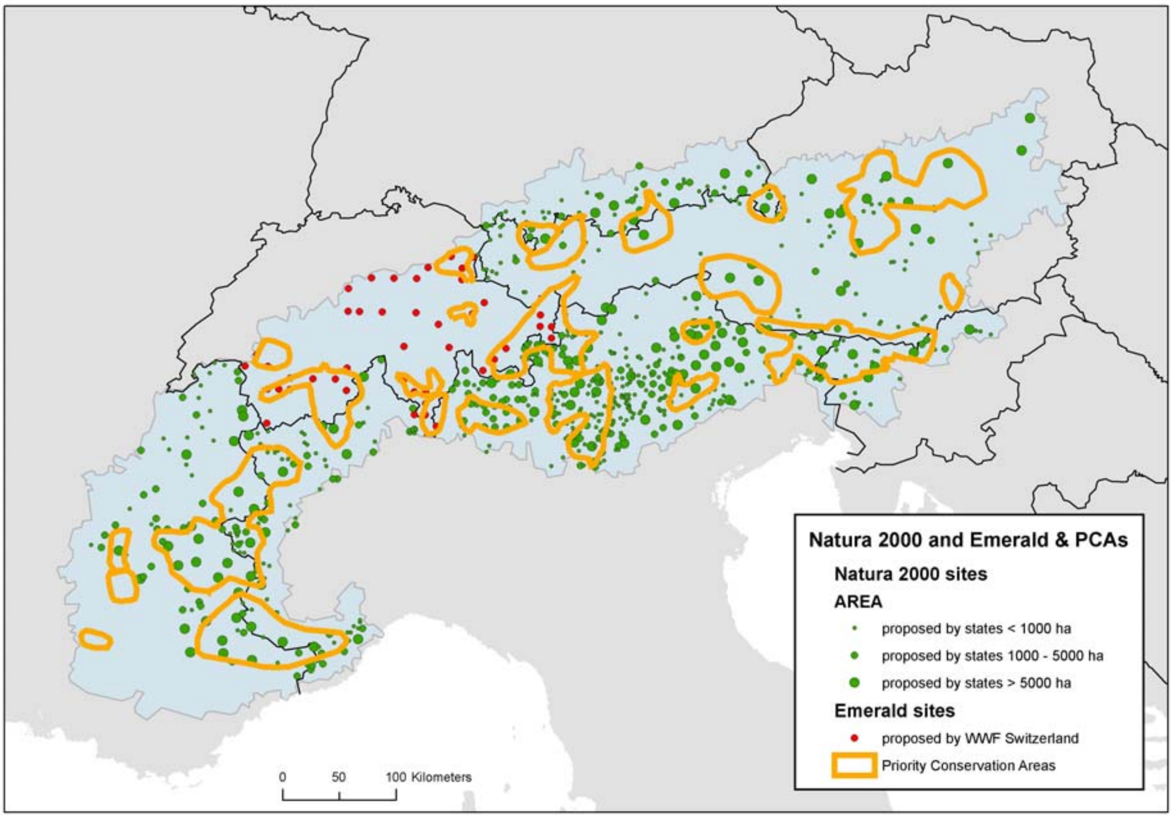


Fig. 27. Gap analysis for the Natura 2000 and the Emerald networks.

Natura 2000 and Emerald sites – also incorporated into European Directives, and thus benefitting from a very strong protection policy – are areas considered important for biodiversity. Natura 2000 and Emerald are the expression of yet another biodiversity vision: the protection of sites important for habitat and species threatened in Europe. This criterion is again different from that used for the identification of the priority areas (which are the areas important for the maximum number of taxa), therefore it should not be surprising if the overlap between the two is good but not complete.

The location of Natura 2000 and Emerald sites near or between priority areas can also be one criterion for the identification of connection areas or to warrant the adjustment of priority area boundaries (see Chapters 5 and 6).

The gap analysis for Ramsar sites is shown in Fig. 28.

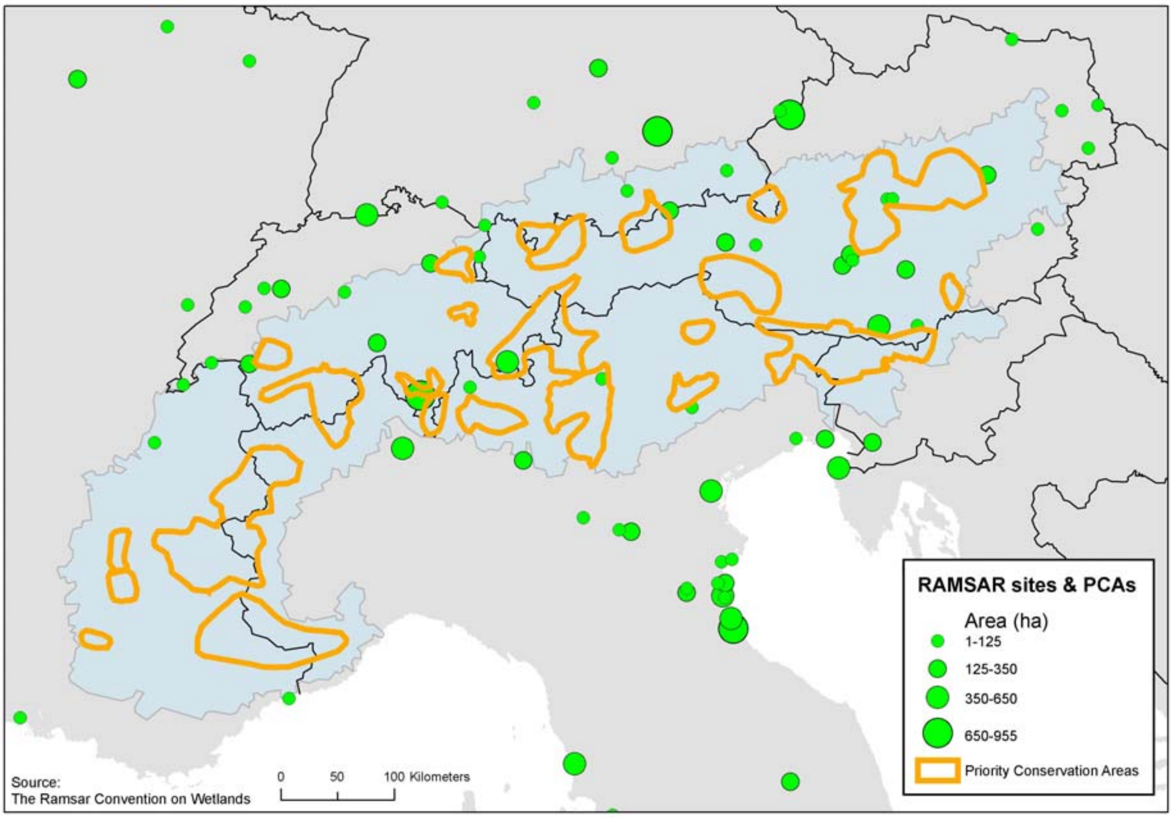


Fig. 28. Gap analysis for Ramsar sites (Wetlands of International Importance).

Ramsar sites are sites important for wetlands and are designated worldwide under the Ramsar Convention on Wetlands and placed on the Ramsar List of Wetlands of International Importance. Only twenty or so are found in the Alps. They thus represent areas acknowledged as important for a specific habitat type (wetlands). This habitat type in turn supports specific taxa (e.g. migratory birds, water birds).

Although the designation of a Ramsar site does not imply a protection as strict as that of a Natura 2000 site, the recognition of being a wetland of international importance carries some weight. This brings some benefits to the conservation of the priority areas which contain or are adjacent to Ramsar sites.

The location of Ramsar sites in the Alps near or between priority areas can also be one criterion for the identification of connection areas or to warrant the adjustment of the priority area boundaries (see Chapters 5 and 6).

The gap analysis for remote areas is shown in Fig. 29. The map of remote areas was created by Thomas Kaissl according to specific criteria (Kaissl 2002). Remote areas are, by definition, relatively non-fragmented and remote. (In the maps throughout this text and in the annexes, the terms “wilderness”, “remote” and “non-fragmented” are used interchangeably, referring to the same data set and areas.)

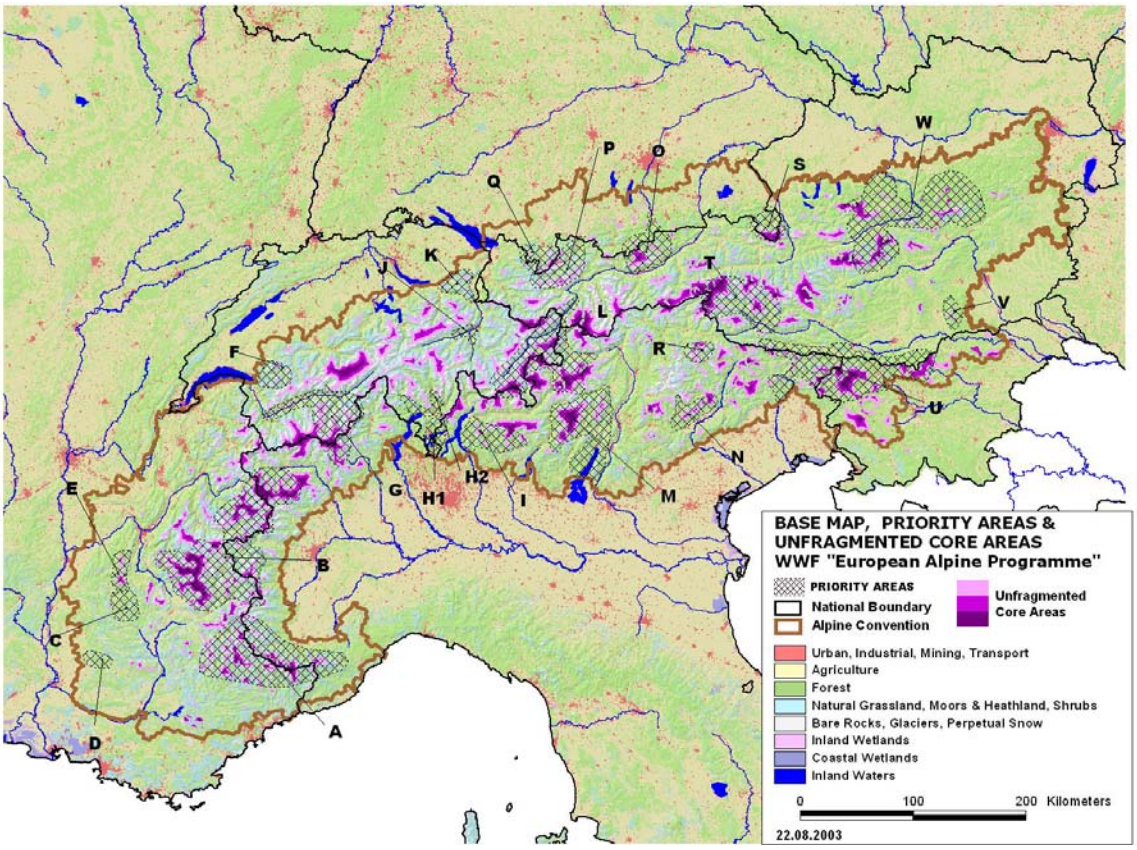


Fig. 29. Gap analysis for wilderness areas. Violet polygons are wilderness areas (here called *non-fragmented core areas*); black net polygons are priority areas.

The overlap of remote areas and priority areas is good but not complete, as with the gap analyses for other layers.

Remote areas, by being such, are mainly at high elevation, often around rocky peaks or covered in glaciers. Because they are relatively undisturbed (non-fragmented) and remote, it can be assumed that they ensure the occurrence of ecological and evolutionary processes and that biodiversity within them can take its course without hindrance. As already explained in 3.8, this is the reason why remote areas adjacent to core areas of maximum taxon overlap were also included in the boundaries of priority areas. Furthermore, wilderness areas often host some specific taxa (e.g. *Tetraonidae*) or habitat types (e.g. glacier forelands) and consequently in certain instances they may play an important role for biodiversity conservation. This is why the overlap of wilderness areas with priority areas is relatively good.

Yet, wilderness areas per se are not necessarily all important for biodiversity and do not always merit inclusion in priority areas. In other words, wilderness areas do not always meet the criteria according to which priority areas were identified (overlay of areas important for several taxa). And this is why the overlap of wilderness areas with priority areas is not complete, and the wilderness area layer was not used as a taxon layer.

The gap analysis for developed areas is shown in Fig. 30. Developed areas in this case are represented by the night lights seen from satellites, and they can be interpreted as high population densities.

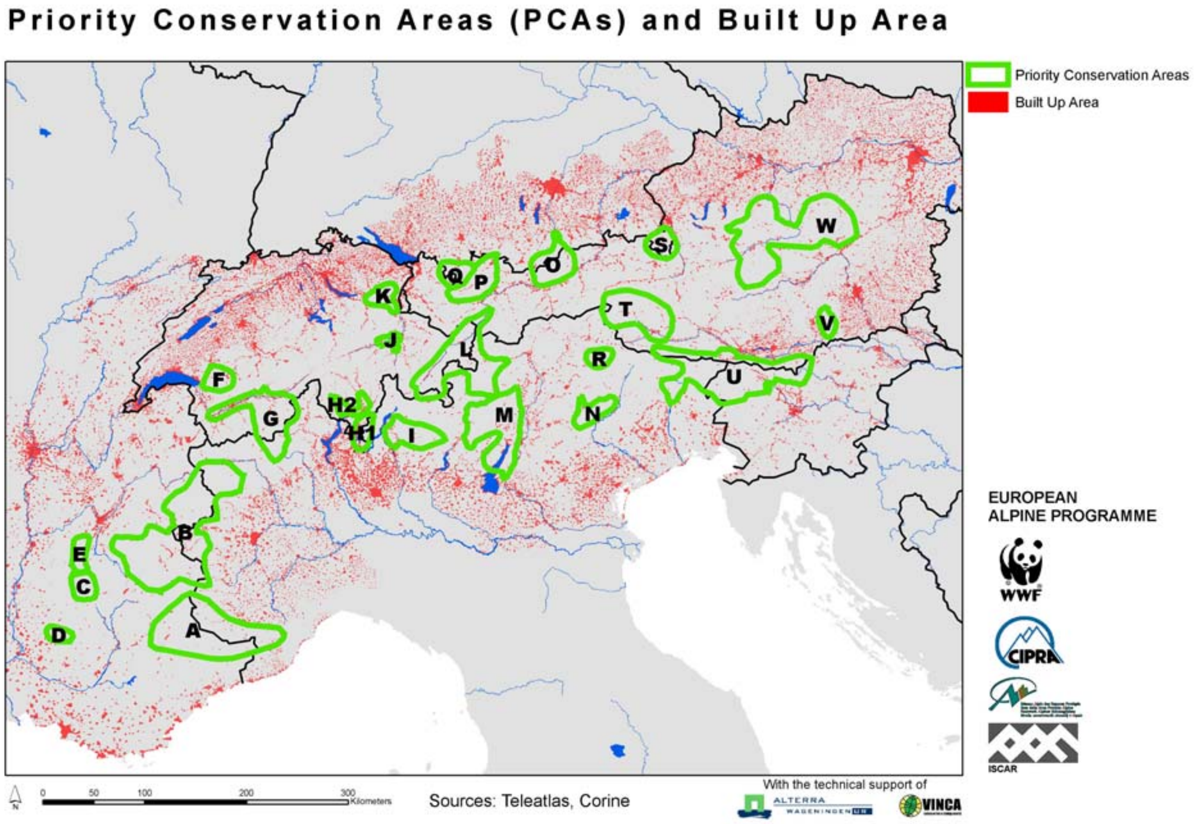


Fig. 30. Gap analysis for developed areas.

Less than 1% of the total land covered by priority areas can be classified as “developed” (see statistics in Annex 30). Generally, priority areas are located where developed areas are at their minimum. Two interesting exceptions are: area G (Alpi Pennine-Vallée du Rhône-Oberwallis) and area H1 (Sottoceneri-Colline Comasche-Alto Lario), both on the boundary between Italy and Switzerland. Here high biodiversity values coexist with high population densities.

Several gap analyses were conducted for a combination of categories of sites considered important (for example remote areas and developed areas, remote areas and protected areas, see Annex 37).

3.13 Additional information collected

As described in the preceding pages, several maps and analyses were produced during the eight steps of the methodology. Besides these, other useful information was collected, in particular:

- considerations on the importance of traditional agriculture for the biodiversity of the Alps
- an agro-biodiversity statement
- a map of the domestic animal breeds of the Alps
- vision and goals for the biodiversity of the Alps
- conservation goal, targets and urgent actions for the entire ecoregion
- conservation goals, targets and urgent actions for individual priority areas and subregions

- recommendations regarding the Alpine Convention.

They will be briefly described below.

The importance of traditional agriculture in the Alps was stressed on many occasions before, during and after the Gap workshop. This was a recurrent theme, a solicitation coming from different sectors: the scientific community, social scientists, civil society, representatives of the Alpine Convention and of the public administrations. Traditional agriculture generally implies extensive agricultural and farming practices, as opposed to more modern, intensive practices. Traditional agriculture started to shape the landscape of the Alps several centuries ago; the so-called cultural landscapes mostly depend on this practice. About 25% of the Alps' biodiversity depends on cultural landscapes and traditional agricultural practices (Grabherr 2000). Additionally, several Natura 2000 species and habitat types – widely recognized by experts and public administrations to be worth protecting – depend on traditional land use practices. Thus, there seemed to be no objection to including traditional agriculture among the important factors to treasure in the Alps for the final goal of biodiversity conservation. This consideration initially seemed strange to representatives of the North American conservation community, given that their general objective is to strive for the status of biodiversity which was present before human intervention. However, after discussions and examples they found the Alps emphasis on cultural landscapes rather interesting and appropriate to the regional situation, and considered it worthwhile to present this example to other ecoregions in the world with a comparable regional situation.

An agro-biodiversity statement was developed during the Gap workshop by a group of experts on traditional agriculture and farming. It emphasizes the importance of cultural landscapes as heritage, and of domestic animal and plant breeds as specific adaptations to the local environment. It also proposes different strategies for the use of domestic breeds depending on the conservation value of the various areas. The full agro-biodiversity statement is found in Annex 38. The following statement was also proposed for the vision and goals developed in Gap:

> *Extensive and ecologically-sound agriculture, whenever possible with locally-adapted breeds and plants, contributes to the protection of a fundamental component of Alpine biodiversity and reinforces also the conservation of the threatened Alpine agro-biodiversity.*

The map of the domestic animal breeds of the Alps has already been presented in Table 3 and Annex 13 (Fig. 6). This map was actually produced in advance and used during the workshop in Gap as a reference, especially when developing conservation goals and targets for the ecoregion and for the individual priority areas. The map could also rightly be considered a stand-alone product, testimony to the importance that traditional farming has for the Alps. The map is a good synthesis of the distribution of the most important or representative domestic animal breeds in the Alps.

A vision and goals for the biodiversity of the Alps were discussed during the workshop in Gap, where all participants were requested to submit their opinions. The following is a statement which synthesizes the input received:

Biodiversity represents an extraordinary value for the Alpine region and is strictly linked to the quality of human life.

The typical features of Alpine biodiversity are ensured by the existence of efficient and long-lasting biocenoses.

Alpine diversity results from a mosaic of the natural and the cultural landscape. Its survival is ensured by components as diverse as: sustainable management practices, pristine areas, a network of protected areas, ecological processes, the extensive use of agricultural land, and the presence of ecological corridors.

The human inhabitants of the Alpine region will ensure the conservation of the biological variety of the Alps by means of their ecologically-compatible behaviour.

Conservation goals, targets and urgent actions for the entire ecoregion were developed during the third day of the Gap workshop. The main conservation goal is to "preserve the biodiversity at the Alpine regional scale, covering the entire spectrum of the ecosystems of the region, maintaining functioning ecological links to the neighbouring ecoregions and including the Alpine specific cultural landscapes". Targets were identified for several themes: freshwater, forests, wide-roaming species, invasive species, agriculture, transportation and recreation. The group also identified urgent needs, or issues to address immediately for the conservation of the entire ecoregion. For a full transcription of the goal, targets and urgent actions at ecoregional scale, see Annex 39.

Conservation goals, targets and urgent actions for individual priority areas and subregions were also developed by the subregional groups during the third day of the workshop. These represent a preliminary list of the main themes to address in the individual priority areas (or generally in the subregion), without a detailed analysis. For full transcriptions see Annex 40 (subregions South-West and Central (Insubria) were analysed more in depth both at the priority area level and the subregion level. Subregions Central-North (North-West) and South-East were analyzed mainly at the subregional level. No information was reported for subregion North-East.)

Finally, recommendations regarding the Alpine Convention were developed by a group of experts and of observers at the Alpine Convention itself. First of all they highlighted the fact that the Convention, and especially the Nature Protection and Landscape Conservation Protocol, is an existing framework for:

- landscape planning and spatial planning, both at the local and at the pan-Alpine scale
- protected areas
- ecological linkages / corridors
- contrast to alien and invasive species
- international collaboration.

The solutions they advocated for biodiversity conservation within the framework of the Alpine Convention were:

- As part of the development and the implementation of the Convention, the Convention itself should somehow integrate more recent frameworks such as Natura 2000 and the Convention on Biological Diversity
- *Ad hoc* working groups should be established for concrete implementation
- Functioning structures should be established within the Alpine Convention (e.g. a Permanent Secretariat, a system for observation and information-SOIA, a budget, an integration of the EU)
- Corridors between mountain regions (Alps and other surrounding regions) should be identified and made to function
- The EU Common Agricultural Policy should be reformed to reflect the needs of biodiversity conservation
- The European transportation policy should be revised so that economic growth should not come at the expenses of an increase in transport (both of goods and for leisure), and by internalizing external costs with subsequent use of the funds for prevention, compensation and restoration of environmental damage
- The tourism policy should undergo a paradigm shift: no new winter sport development should be undertaken in intact landscapes and overall tourist activities should become more sustainable.

It should be noted that since 2002, when these recommendations were issued, there have been various changes:

- Natura 2000 was integrated into the ALPARC/Alpine Convention study of corridors among protected areas in the Alps (2004).
- An attempt was made to involve the Permanent Secretariat of the Alpine Convention in the 1st meeting of the *Ad Hoc* Working Group on the Programme of Work on Protected Areas of the CBD, which took place in Montecatini (Italy) in June 2005. Unfortunately, however, the Permanent Secretariat was unable to participate.
- *Ad hoc* working groups for concrete implementation have been created; one of them is that of ALPARC on protected areas and their corridors.
- The Permanent Secretariat of the Alpine Convention now exists, with headquarters in Innsbruck (Austria) and a technical secretariat in Bolzano (Italy).
- Corridors between the Alps and other mountain regions have been identified in 2005-2006 as part of the initiative of the Consortium on connection areas (see Chapters 5 and 6).
- The Common Agricultural Policy has been reformed. Whether the new policy will have a positive impact on biodiversity has yet to be seen.

4. Priority conservation areas: results

The results obtained on priority conservation areas are described in Chapter 3 and they can be summarized as follows.

Map results:

- important areas for major taxon groups: vegetation/flora, large carnivores, large herbivores, medium and small mammals (these three layers were combined into one map only), birds (including a consolidated map with all the IBAs for the Alps), herpetofauna, terrestrial invertebrates (insects)
- important freshwater habitat
- priority areas on which to focus conservation work
- preliminary wildlife/vegetation corridors among priority areas
- level of threat of the different priority areas
- level of ecological integrity of the different priority areas
- level of biological importance of the different priority areas
- gap analysis of priority areas with protected areas
- gap analysis of priority areas with Natura 2000 and Emerald sites
- gap analysis of priority areas with Important Birds Areas
- gap analysis of priority areas with Ramsar sites
- gap analysis of priority areas with remote areas
- gap analysis of priority areas with developed areas
- distribution of urbanization hotspots
- distribution of domestic animal breeds
- representation analysis by bio-geographic subdivision
- representation analysis by natural potential vegetation.

Non-map results:

- a vision statement
- criteria for corridor identification
- principles for an agro-biodiversity strategy within priority areas
- conservation goal, targets and urgent actions for the entire Alps ecoregion
- conservation goals, targets and urgent actions for individual priority areas and subregions
- a detailed analysis of biodiversity, threats and opportunities for conservation of priority areas
- a detailed socio-economic analysis of priority areas
- a network of scientists prepared to think at the scale of the entire Alps
- a network of public administrations and other parties willing to implement the biodiversity vision on the ground.

Other important non-tangible results, or conclusions worth highlighting include the following:

1) <u>The boundaries of the priority areas are an approximation</u>: they indicate general locations where it will be worthwhile to conduct a more detailed analysis (see Chapter 8).

2) As shown in 3.8, the boundaries of the priority conservation areas include developed areas. This is not a contradiction because <u>priority areas are not what is left to protect,</u>

but what is important for biodiversity and therefore deserves special attention. The needs of biodiversity can be met with conservation, restoration and appropriate management.

3) To elaborate upon the point above, it is relevant to note that about 85% of the Alps is important for at least one taxon or habitat type (on the map in Fig. 20 about 85% of the Alps are covered in some colour). It is therefore important to consider the conservation of the Alps as a whole and not only of the priority areas: non-priority areas are not go-ahead zones.

4) As mentioned under 3.12, the protected areas gap analysis is useful for public administrations and civil society in understanding the role played by protected areas in biodiversity conservation. However, the intention of ecoregion conservation is not to equate protected areas with those considered a priority for biodiversity: priority areas should be recognized for their species composition, and should not necessarily be turned into protected areas. The real challenge will be to envisage appropriate land tenure forms and management measures to ensure the coexistence of biodiversity with human activities: conservation takes place within a human landscape as well. This leads to the important formulation that ecoregion conservation is not just about conservation, but also about sustainable development.

5) Some think that, in certain cases, priority areas should be combined to form larger land units (see under 3.10, Elmauer's proposal). Combining priority areas would be especially appropriate when the areas are homogeneous and when they host – or potentially host – wide-roaming species. However, this may result in rather complex conservation or management work, given the vast areas involved. The point was made that "large-scale soft management is better than strict protection in small-scale areas". In other words: strict protection may be helpful, yet difficult to enforce and not always a rigorous requirement for the needs of the biodiversity present. On the contrary, appropriate management (*soft* protection as opposed to *strict* protection) may be the best response to the needs of the biodiversity in the area and would therefore be the preferred option, one which is also more manageable over a large area.

6) There is a synergy – and not competition – between the map of priority areas and the map of sites of the Natura 2000 and the Emerald networks. The two complement each other.

Overall, the process leading to the identification of the priority areas was a success. Participants at the Gap workshop, the largest of the events organized for the development of the biodiversity vision for the Alps, were overwhelmingly positive (for a summary of their workshop evaluations see Annex 41). The few comments regarding negative aspects were used to guide subsequent efforts, to improve the results and to learn lessons which will be helpful in the future.

The praise of Consortium partners (see *Foreword*) also upheld the worth of the initiative and of its results.

PART III – CONNECTION AREAS

5. Methodology for the identification of the connection areas of the Alps

5.1 Summary: brief description of the process

As described under 3.11 (*Step 7: Identify important corridors among priority areas*), a first attempt to identify the main connection areas of the Alps (then called *corridors*) had already been made in 2002 during the work on priority areas (see Fig. 24). That attempt, however, did not reach any final conclusions given that priority areas were yet to be finalized, criteria for corridors had to be further discussed and time for this task at the Gap workshop had been limited. Therefore, a new and more substantial attempt was made in 2005-2006, of which the current section is an account.

A detailed report (April 2006) solely concerning the connection areas of the Alps is also available for further information: *Identification of the main potential connection areas of the Alps. Technical report including: the workshop in Buchs-CH (19-20 September 2005), the expert input received prior to it, the suggestions gathered at the workshop in Berchtesgaden-D (7-8 November 2005), and the Consortium's conclusions*. In addition, a summary of the methodology and of preliminary results regarding connection areas can be found in Annex 42.

The work on connection areas was framed and conducted with the same partners which had cooperated for the identification of the priority areas and which together constitute the Consortium (WWF, CIPRA, ISCAR and ALPARC). As mentioned under 2.3 (*Brief description of the general process*) technical partners for this phase were VINCA in Vienna, AT for the GIS work and Alterra Institute in Wageningen, NL for guidance on ecological network theory and practice.

The Consortium's objective was therefore to complete the biodiversity vision for the Alps by identifying the main potential connection areas, which would integrate the priority areas already identified. The main potential connection areas thus identified would then be proposed to the Alpine Convention as the contribution of the NGOs to the implementation of the Nature Protection Protocol of the Alpine Convention itself.

By *main potential connection areas* of the Alps we mean the areas of Alpine importance or pan-Alpine scale where ecological connectivity exists, is potential or is needed.

The expressions "main", "pan-Alpine scale" and "Alpine importance" indicate that the connection areas identified have an important role for the ecological integrity of the Alps as a whole. The terms do not refer to their geographic extension nor do they mean that connection areas have to cross the entire Alps from west to east or north to south. It is their level of importance which is the point: an area of Alpine importance is an area which fulfils (or could/should fulfil) an important function for the Alps, and not simply for an individual site, a park, a community, a provincia (Italy), a région (France), a canton (Switzerland), a Land (German-speaking countries) or a country. A connection area, however, does not necessarily have to cross national boundaries.

The word "potential" indicates that the status of connectivity can range from fully functioning (connectivity exists; the area is actively used as an ecological corridor) to non-functioning (connectivity currently does not exist or the detailed analysis proves that it is not needed). The actual status of connectivity within each connection area will have to be determined through a more precise, subsequent analysis. Functioning connection areas simply need to be maintained; non-functioning connection areas may either be returned to activity with appropriate restoration or remediation measures, or be lost forever.

Keeping in mind the definitions above, the main potential connection areas of the Alps may be called more simply "connection areas".

The point of identifying the main potential connection areas of the Alps is to define where a more precise analysis is needed and therefore where and what kind of action is most required.

The identification of the main potential connection areas of the Alps for the completion of the biodiversity vision was coordinated with another initiative related to corridors in the Alps: that of ALPARC, which seeks to identify connections among Alpine protected areas. In 2004, the Alpine Convention gave ALPARC the mandate to develop a model for the establishment of connections among protected areas by means of precise corridors, special measures or other *ad hoc* procedures. This project was a way of contributing to the implementation of the Nature Protection Protocol of the Alpine Convention. ALPARC identified eight areas (mostly trans-national) in which to test the model (these areas overlap generously with some priority areas identified during the biodiversity vision, Fig. 31).

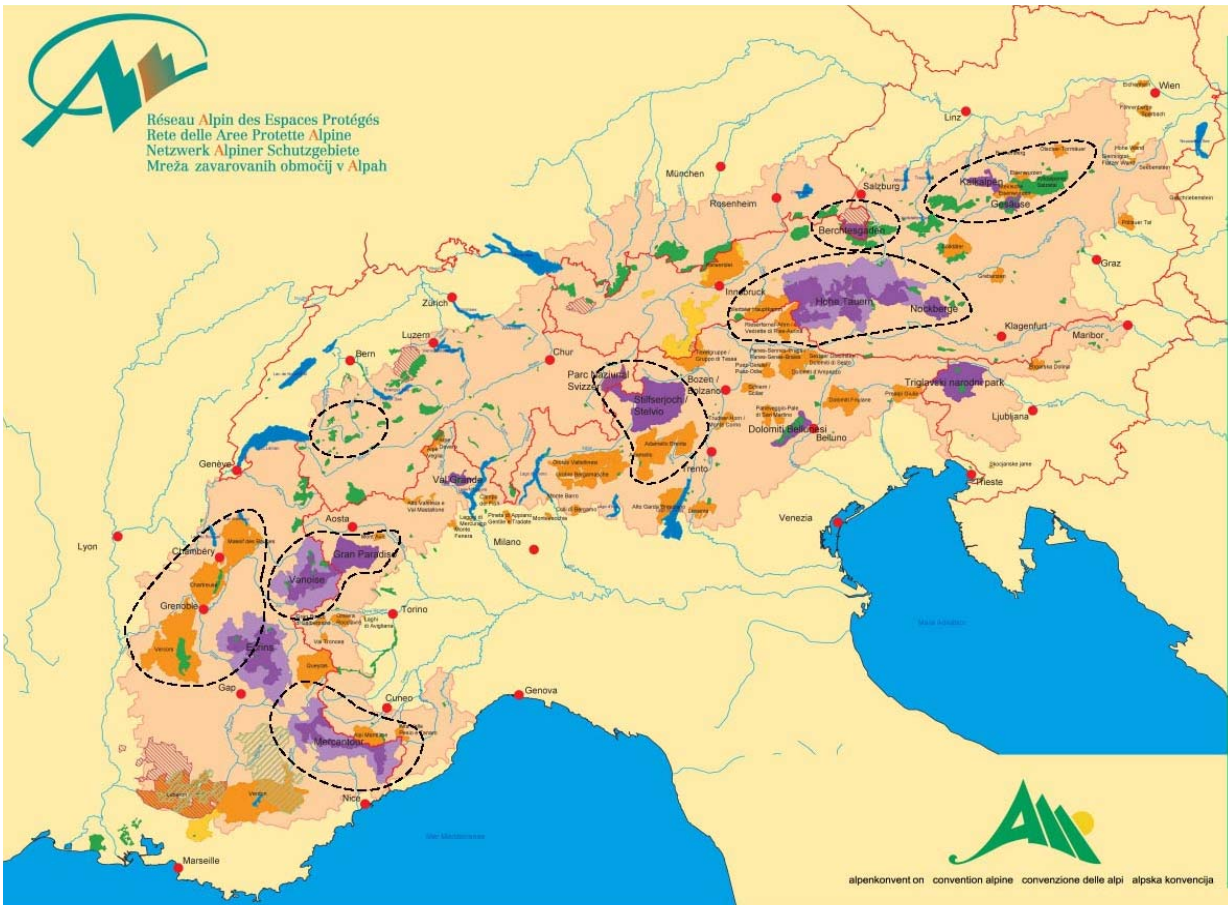


Fig. 31. Map of the eight areas selected by ALPARC to test a model for the identification of corridors among protected areas.

For these areas more detailed analyses were conducted (in a sort of "zooming in") and concrete proposals were developed for the implementation of specific measures and of links among protected areas. The results were published in 2005 in *Alpine Signals #3*, and a few pilot areas should begin to concretely implement the results of the model in 2006.

To avoid confusion, it was agreed that corridors identified at a more precise scale (e.g. according to ALPARC's approach) would be called "corridors" *sensu strictu*; while corridors identified according to the biodiversity vision principles, at a rough, non-detailed scale and only approximately located (e.g. according to the Consortium's approach) would be called "main potential connection areas" (connection areas) or "macro-corridors".

The model proposed by ALPARC for the identification of corridors at a more detailed scale is a good tool to move from (overall) vision to (local) action. Furthermore, it is good preparation for when the biodiversity vision, with the connection areas, is complete (its approach can be used to zoom into the connection areas).

The connection areas will complete the biodiversity vision. The priority conservation areas and the protected areas as such are not an ecological network; they are more similar to core areas. Furthermore, some priority areas and some protected areas are considered too small to effectively conserve the biodiversity they were created to protect. Through the identification of the connection areas we would "provide more space" to the priority areas that are too small and which need to be larger for the needs of the biodiversity they were deemed important for; we would capture the ecological and evolutionary processes otherwise very difficult to map and provide for; and we would ensure that the Alps will always be connected to the regions adjacent to them (the Alps as a whole – like the individual priority areas – should not be seen as an island either; rather, they should be seen and managed as a key part of, strictly interlinked with, the rest of the continent).

In addition, the identification of the connection areas of the Alps would provide a context for local initiatives towards ecological networks and land-use planning. Local initiatives are more and more frequent but often lack an understanding of their functional role within the broader ecological network and are rarely in coordination with one another.

In the connection areas that have been identified, the quality of connectivity and the location of the corridors will be further analysed and a concrete, detailed proposal for types of land tenure and land use that ensure the connectivity function will be made.

The connection areas of the Alps were identified in 2005-2006 according to experts' knowledge and experience (expert approach) and based on certain given criteria (see Terms of Reference in Annex 43), through a workshop which was held 19-20 September in Buchs-CH, and through further consultations with experts after the workshop.

5.2 Data collection, scope and scale issues, GIS issues

Data collection, scope, scale and GIS issues for connection areas are similar to those for priority areas (see 3.2).

No new, original collection of data was undertaken for the identification of connection areas. Most data and reference maps were available from the previous identification of priority areas (e.g. elevation, land cover, remote areas, Important Bird Areas, priority areas and protected areas). Some data sets (and therefore the corresponding maps) had simply been updated since

Gap, using more recent data (e.g. Ramsar sites, barriers). Reference maps and new data were taken from information or studies already available (e.g. national ecological networks for Italy, Switzerland and Germany). Experts were consulted to propose connection areas according to their knowledge of the Alps, and some of them provided existing maps and studies related to connection areas, corridors and ecological networks for subregions of the Alps.

While there was no new data collection, new mapping from existing data was undertaken, to highlight potentially important background information for the identification of connection areas or to appropriately synthesize data or present analyses which may otherwise have been too difficult to read or overlooked (e.g. different overlays of priority areas, protected areas, remote areas, built-up areas, and areas recognized as important for biodiversity).

As for priority areas, the geographic scope of data collection, analysis and mapping was the entire Alpine range according to the boundaries defined by the Alpine Convention. Besides this area, however, the regions adjacent to the Alps were also considered as a necessary geographic addition for the identification of connection areas between the Alps and their surroundings (see 5.5) and thus for the clarification of the functional role of the Alps within the wider continent (see Fig. 32 for the Alps in the wider context).

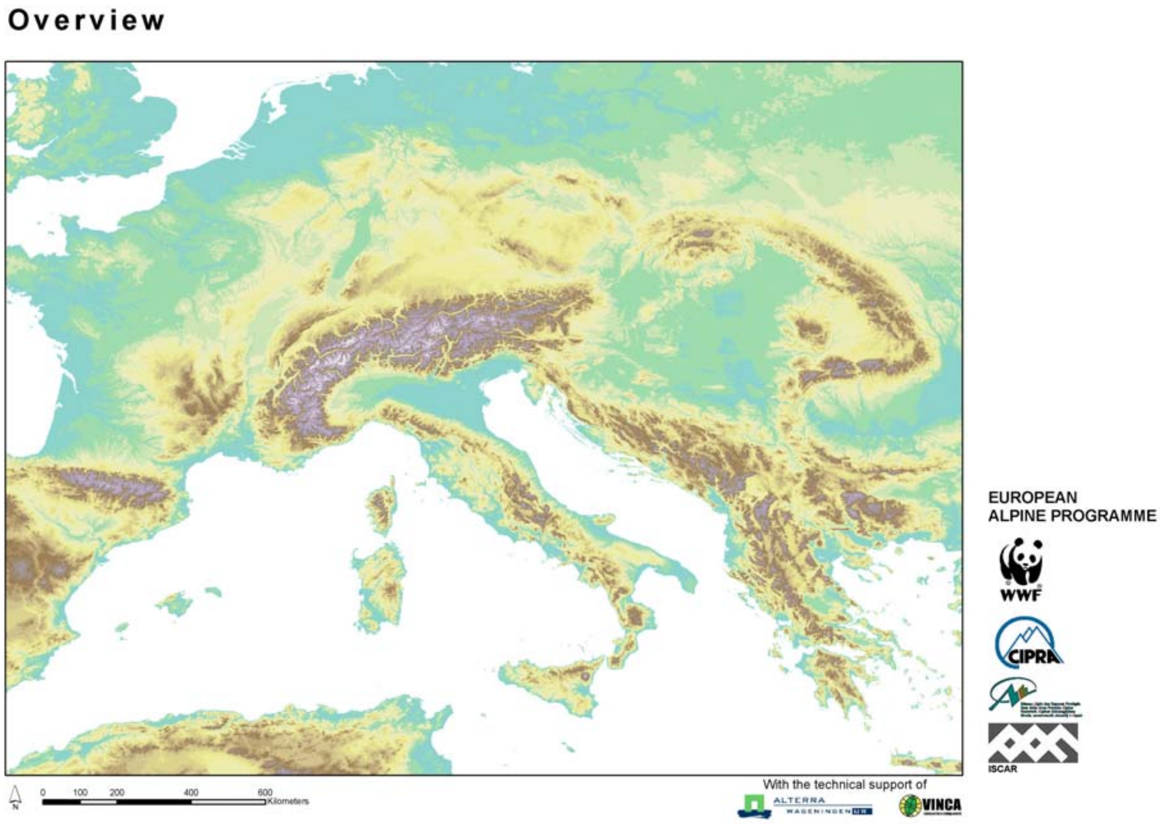


Fig. 32. The Alps in the wider geographic context.

Given that connection areas were to be integrated with priority areas to complete the biodiversity vision, and that priority areas had been identified at a 1:500,000 scale, the scale for the identification of connection areas was confirmed at 1:500,000. This rough scale is also recommended by the biodiversity vision process, it provides an overall context and allows for further and more detailed analyses during a subsequent phase.

The projection used remained Lambert Equal Area Azimuthal with parameters 9 and 48.

5.3 Reference maps and data sources

At the workshop in Buchs (19-20 September 2005) the following maps, produced by the GIS expert prior to the workshop mainly in A0 format, were available as reference material:

- A copy of experts' individual input and a table briefly describing this (for the summary table and the maps see Annex 44a and Annex 44b)

- A0 map showing the synthesis of experts' inputs prior to the workshop. As many experts provided their own maps instead of using the base map provided by the organizers, this information had to be transposed or translated to one map. The process of transposing the information was undertaken by the GIS expert Christoph Plutzar (VINCA, Vienna) prior to the workshop, with the support of Irene Bouwma (Alterra Institute, Wageningen) (see Annex 45). All contributions received were transformed into arrows of different length, colour and direction

- A0 map showing the "barriers" of the Alps (major railways, railways, cities and settlements) (see Annex 46)

- A0 map of priority conservation areas and protected areas in the Alps (see Fig. 25 under 3.12, top map)

- A0 elevation map of the Alps (see Fig. 7 of Annex 13).

Other reference maps were produced by the GIS expert during the workshop itself, made available in A3 format (Annex 47; the number besides the maps listed below corresponds to the figure number in the same Annex 47). These were:

1. Map of priority conservation areas, protected areas and other areas acknowledged as important for biodiversity in the Alps (IBAs, Ramsar sites, remote areas, sites important for bird migrations)

2. Map of priority conservation areas and other areas acknowledged as important for biodiversity in the Alps (IBAs, Ramsar sites, remote areas and sites important for bird migrations), but no protected areas

3. Map of priority conservation areas, areas recognized as important for biodiversity (IBAs, Ramsar sites, remote areas, sites important for bird migrations) and built-up areas in the Alps

4. Map of Important Bird Areas (IBAs) and Ramsar sites in the Alps

5. Map of elevation and sites important for bird migrations in the Alps

6. Map of priority conservation areas and protected areas in the Alps (when protected areas are adjacent to priority areas, they are merged into larger dissolved polygons) and related land cover statistics (Annex 48)

7. Map of priority conservation areas and remote areas in the Alps

8. Map of priority conservation areas in the Alps and synthesis of expert inputs

9. Map of land cover in the Alps.

Existing maps which were also available at the workshop as reference material:

- Map and report of the Swiss REN (the Swiss ecological network)
- Map of the Italian REN (A3) (Annex 49)
- Map of ecological corridors in Germany (Lebensraumkorridore für Mensch und Natur – Indicative map of a German habitat corridor network, May 2004)
- Map with the corridors identified along the border of Germany (Vermessungsverwaltung der Länder und BKG 2004)
- A poster map of all protected areas in the Alps, with their names and categories (by ALPARC)
- A map of Slovenian protected areas
- A map of Italian protected areas
- Topographic maps of France and Italy, for orientation.

The data sets used for the creation of the maps on barriers, elevation, land cover, priority areas and protected areas are described in Table 6.

Table 6. Description of the data sets used to create the maps on barriers, elevation, land cover, priority areas and protected areas for the Buchs workshop.

Data set	**Sources**	**Description**
Barriers	Corine Land cover, Tele Atlas, Digital Chart of the World	Map showing built-up areas, motorways, major roads and railways
Elevation	GLOBE (Global Land One-km Base Elevation)	Digital Elevation Model raster map with a spatial resolution of 1km.

Land cover *Same as the land cover map used for the priority areas, see also Table 3*	Liechtenstein: Pelcom Switzerland: Switzerland land cover reclassified to Corine level 2, European Topic Center on Land Cover ETC/LC – EEA Other: Corine Land cover	The land cover data set was assembled from different sources. Because of the different classifications of the input data, it was necessary to build a consistent legend. The result was a raster map with a spatial resolution of 250m showing eight classes: - Urban, industrial, mining, transport - Agriculture - Forest - Natural grassland, moors & heathland, shrubs - Bare rocks, glaciers, perpetual snow - Inland wetlands - Coastal wetlands - Inland waters
Priority Conservation Areas and Protected Areas	WWF, The Alpine Network of Protected Areas	Polygons showing the priority conservation areas, nationals parks, regional nature parks, reservation areas and other areas under special protection. All protected areas come from the ALPARC data set from 2002. A new, updated protected areas data set is available as of 2005 but right to use it was not granted by ALPARC and the Permanent Secretariat of the Alpine Convention because copyright was still unclear.

5.4 Methodology and rationale

Objective of the initiative

The objective of the initiative was to identify at the macro-level (Alpine scale) the main existing and potential connection areas of Alpine importance both among the priority conservation areas and protected areas and between the Alps and adjacent regions, mainly based on an expert approach (see 5.1). Terms of reference were developed to guide the experts' work (see Annex 43, as already mentioned in 5.1).

Expert approach

The emphasis on the expert approach is relevant because it is similar to the approach used for the identification of the priority conservation areas. Given that the two elements (priority areas and connection areas) have to be combined in one overall picture, it is important that the same procedure be followed in both cases. The expert approach does not compromise scientific rigor, as experts have to account for their decisions and will be likely to base their assessments on scientific data (experts used forms to record their considerations and to make the identification of connection areas as transparent as possible). Furthermore, the expert approach does not preclude reliance on other approaches as well, in combination with experts' knowledge. For example, experts may be guided in locating connection areas by the presence of certain types of natural areas (IBAs, Natura 2000 sites, Ramsar sites, acknowledged stopovers during bird migrations, etc.) and land morphology (this is the reason why new reference maps with such information were produced in A3 format at the workshop, as described under 5.3). Results of the expert-based approach may later be compared with a model-based analysis.

Other initiatives to consider and synergies

The identification of connection areas in the Alps had to take into consideration other initiatives at the national, European or global level which are related to corridors (in addition to the initiative by ALPARC and the Alpine Convention, already described under 5.1):

- Development of national ecological networks in the Alpine region (Switzerland, France, Italy, Germany/Bavaria)

- Development of a Pan-European Ecological Network (PEEN) since 1995 under the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) (the map for the PEEN for Central and Eastern Europe is complete, and that for South-Eastern Europe is drafted. No map for Western Europe exists yet, but a contact was established with the PEEN council to make sure a synergy is in place between this third PEEN map and the Consortium initiative on the connection areas of the Alps)

- Development of the Natura 2000 network and specifically Article 10 of the Habitats Directive that underlines the need for development of corridors

- The discussion that is taking place in the framework of the Convention on Biological Diversity regarding the need to enhance connectivity among protected areas or other areas important for biodiversity.

In fact, the intention was to capitalize on what already exists and to maximise synergies. If initiatives exist to identify corridors at a national or local scale, their results should be considered in the light of the objectives of this pan-Alpine initiative. This is the case for the national ecological networks already identified by some Alpine countries (e.g. Italy and Switzerland), or the regional ecological networks identified for some portions of other countries (e.g. Bavaria, southern France), and it relates to the policy relevance principle described below. It is certainly not easy to integrate the conclusions of such national/regional ecological networks, because they are based on different approaches, data and scales; in addition, not all corridors identified at a more detailed scale (i.e., of national or regional importance) may be relevant for the Alps as a whole (i.e., they are of Alpine importance). However, these ecological networks are likely to be the result of thorough scientific thinking and are often entrenched in national policies, therefore they have some power, at least at a national level and deserve to be looked at with attention. Their contribution to the identification of connection areas in the Alps has to be evaluated on a case-by-case basis. An imminent project of the Consortium aimed at developing a standardized methodology for the identification of the ecological network of the Alps and at resolving some of the issued which are still pending after this effort will also look at whether and how the results of the national ecological network can be incorporated into the ecological network for the Alps (see Chapter 8).

Assumptions and decisions

Thanks to suggestions provided by experts during conversations before and after the Buchs workshop, the following assumptions and decisions were made for the identification of connection areas in the Alps:

- Plants. Most botanists consulted thought that at the rough scale of 1:500,000 it would not be appropriate to identify connection areas based on individual plant species. The colonization of new environments by plants is a very slow process and could be taken into consideration when working at a more detailed scale. Of course this is not to say that habitat or vegetation types should not be used for the identification of connection areas.

- Invasive plants. Experts thought that connection areas should not be identified based on the risk of plant invasions either. While invasive plant species do not seem to be a major problem in the Alps at this point, management capacity should be in place to respond to the spread of new species, should this be detected (as suggested in specific guidelines developed by the Swiss government). In general, invasive plants tend not to spread along "natural" corridors, but rather along man-made or "disturbed" corridors such as intensive agriculture areas, roads, highways and railways (an exception could be the – albeit limited – invasion of *Reynoutria japonica* on the riparian areas of the natural course of the Tagliamento River). Invasive species – mainly ruderal species, if any – would take a long time to colonize new areas along natural corridors (which can be assumed to have the least possible anthropogenic disturbance and the most natural areas). Furthermore, invasions of alien plants tend to originate in the lowlands and do not adapt well to mountain conditions. For details about invasive plants see the position of the Mountain Invasion Research Network (MIREN) in Annex 50.

- Invasive animal species and river connection areas. Some connection areas, especially aquatic corridors in the southern Alps, may facilitate the dispersion of invasive, alien species and in particular the upstream colonization by such species from the Po River Valley (lowland) to the mountainous Alpine region. This risk should definitely be taken into consideration, especially when designing management actions for the connection areas identified. In the case of the river corridors, the *nodes* (points where smaller rivers join a larger or lowland one) are especially critical.

- Climate change. It surely is an important factor that needs to be considered when discussing connection areas (it also affects the hydrological system). However, given the rapidly-evolving science and the many uncertainties around this topic, for the time being this aspect was not taken into account. It was suggested to focus on the short-term needs and at a later stage take into account the long term requirements in the light of climate change.

- Plants and climate change. Given that plants cannot be protected against climate change and global warming some experts thought that we may overlook plants at this scale. Global warming may actually increase diversity at the level of plant species. It is possible to predict which types of vegetation will be able to stand warmer conditions and which types will be replaced, therefore it is *vegetation* and not *plants* we should focus on at this point, as explained above. A suggestion was made to consider the effects of climate change on the distribution of individual plant species for the *prioritization* and *management* of the areas identified, rather than for their *identification*.

- Invertebrates. Experts in this field thought that it would not be useful to study most invertebrates at this scale (1:500,000). In addition, invertebrates use a wide range of dispersal mechanisms, making identification of possible connection areas difficult. However, for flying invertebrates the same areas used by migratory birds could apply: more attention should therefore be paid to bird migration areas and routes. In the future it could be interesting to investigate whether groups of colonizing invertebrates (e.g. *Carabidae*, *Ortoptera*) could be appropriate focal taxa for the identification of corridors.

- Amphibians. Experts in this taxon also thought that the scale of analysis for the potential connection areas (1:500,000) would not apply to amphibians. This taxon may be looked at with more attention when working at a more detailed scale.

- Ecological connectivity between the Alps and the surrounding lowlands. During the identification of the river connection areas in the southern Alps, it was stressed that the bio-permeability of the two regions (Alps and lowlands) is very different. In the Alps the bio-permeability is still high and the issue is *conservation* (in some cases also *mitigation* and *compensation* of existing barrier effects); in the lowlands (in this case the Po River Valley) the bio-permeability is heavily degraded and the issue is rather *management* and *restoration*. The implications of this for ecological connectivity should be further investigated.

As a result of these assumptions and considerations, it was decided to identify the connection areas of the Alps focussing mainly on the ecological needs of certain taxa (mammals and birds), and on the distribution and quality of habitat and vegetation types (terrestrial and aquatic), landscape structure and other as described further on in the report.

Principles and approaches for the identification of connection areas

During the first phase of this initiative three different principles were defined according to which connection areas could be identified, and which could be integrated into the experts' approach: 1. ecological need, 2. feasibility and opportunity, 3. policy relevance and political acceptance (they are not necessarily independent of each other) (see Fig. 33):

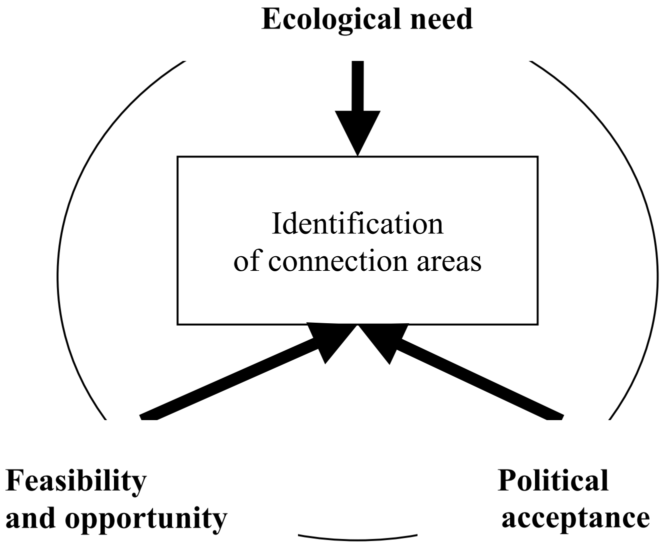


Fig. 33. Identified principles for connection areas.

1. Ecological need for connection areas among the priority areas and the protected areas, and between the Alps and the adjacent regions. This principle is based on the assumption that connection areas should be identified based on the ecological need to connect priority areas for species, habitats and other ecological processes. Prior to the workshop experts were asked to suggest where the best options were for connections, based on ecological criteria (see Terms of Reference). The input received showed that two sources were used by experts (see also Annex 44a for the table *Description of the input and the maps received from the experts prior to the workshop*, and Annex 44b for the actual maps):

    a. Expert knowledge from the field, either from the experts themselves or from existing studies (historical or actual dispersal and migration routes of large carnivores or herbivores, need to connect populations of large carnivores and herbivores in order to ensure population viability, interviews with game wardens etc.);

    b. Knowledge based on modelling studies (mostly habitat suitability for large carnivores, herbivores).

    Sometimes the suggestions received were based on a combined approach of modelling and expert interpretation.

2. Feasibility and opportunity for developing connection areas. This principle is based on the assumption that connection areas should be identified based on current land use tenure and/or intensity (occurrence of natural habitats, population density and occurrence of large cities, occurrence of barriers such as roads, railroads etc.). It identifies where the best options remain among the priority areas for connection areas given the current land use and tenure, as well as the existing pressures. This principle is developed and described in detail by the Alpine Convention (*Alpine Signals 3*, as already briefly described under 5.1), and is the basis for ALPARC's identification of more precise corridors among protected areas.

3. Policy relevance and/or political acceptance for connection areas. This principle is based on the assumption that connection areas should be parts of identified national or regional ecological networks (REN), which are now official governmental policies of the national or regional administrations.

    Switzerland[11] and Bavaria have developed national or regional ecological networks (REN) which are now official governmental policies of the national or regional administrations. Furthermore in France[12] and Italy[13] scientific studies on ecological networks exist. Also, four of the countries surrounding the Alps – namely Slovakia[14], the Czech Republic[15], Hungary[16] and Croatia[17] – have developed national or regional

[11] BUWAL 2004 Nationales ökologisches Netzwerk REN. Schlussbericht. Schriftenreihe Umwelt 373.
[12] Espaces naturels et ruraux, 2002. DATAR. Ministère de l'Agriculture et de la Pêche & Ministère de l'Aménagement du Territoire et de l'Environnement.
[13] http://www.gisbau.uniroma1.it/ren.php.
[14] IUCN 1996. National ecological network Slovakia. P. Sabo (ed). IUCN, Bratislava.
[15] Buček, A., J. Lacina & I. Michal, 1996. An ecological network in the Czech Republic. *Veronica*. 11th special issue.
[16] IUCN 1995b, National Ecological Network - proposal for environmental and nature-friendly regional planning, IUCN, Gland, Svájc és Budapest, Magyarország.

networks. According to some experts who sent in material in advance to the workshop as well as discussion in the workshop, this could be one of the bases for identifying macro connections in the Alps.

The national and regional networks are often founded on scientific studies regarding occurrence of species, migration and dispersal routes (modelling, expert knowledge) and in some cases on political consultation. However, by definition, national networks are identified or designed on a national scale, and they do not have the wider Alpine region as their context.

It should be stressed that the three principles outlined above are not independent of each other. For instance, if land use over a large surface is very intensive and most large vertebrates have disappeared due to lack of suitable habitats, the ecological need to develop connection areas for these species is limited. However if areas are still in a pristine condition the need to create or possibly even identify connection areas is absent. (This is not to say that those connection areas no longer functioning but formerly connecting habitats should not be restored.)

Of these three principles, it was decided to identify the connection areas according to the ecological need principle and based on a combination of the species approach and the habitat approach. It was further decided to evaluate the results obtained from the ecological need principle using the feasibility and opportunity principle. This method will help to answer the question "which of the connection areas that have been identified according to the ecological need principle are more feasible than others according to the situation on the ground and at an administrative level?". The connection areas identified with this method would then be validated by the input already received and that will be received in the future.

By a very basic definition, the species approach bases the identification of connection areas on the needs of species and communities (need for migration, for dispersal, for genetic exchange, etc.); the habitat approach bases the identification of connection areas on the distribution, composition, structure, size, condition and context of the habitat or landscape types; the habitat approach is linked to the concept of ecological function and continuum (given the data available at the workshop and the fact that no detailed habitat information was available, land cover was used instead). The reasons for adopting not only the species approach but also the habitat approach were:

1. The priority areas are identified according to the maximum overlap of areas important for different taxa (see 3.8). As a result most of the areas do not correspond with the actual distribution of large carnivores or large herbivores (as described in 3.7). Therefore identifying connection areas based solely on an assessment of whether the priority areas and protected areas are large enough for the maintenance of viable species populations was considered by some experts difficult or not significant;

2. Many large carnivore species are very mobile and not restricted to specific habitat types: using them as target species to identify connection areas might not work. Furthermore, for most large carnivores, recognized barriers may have no significance. From a political point of view large carnivores are a sensitive issue, and using them might not be wise;

[17] http://www.cro-nen.hr/.

3. On a macro-level it might be wiser to look at altitude, existing habitats and resistance of the landscape in general instead of specific species requirements, which might be more suitable on the micro-level.

The procedure used in the workshop allowed participants to relate the different principles to each other and to indicate synergies and discrepancies.

Further criteria for the identification of connection areas

To add more criteria to the methodology, during the Buchs workshop a brainstorming session was held to clarify and list the participants' opinions and assumptions regarding the need for connection areas, the criteria for their identification and the definition of the various levels of importance (Alpine, international, national and local) (see Annex 51 for a detailed transcription of the brainstorming sessions). This information integrated that already provided in the Terms of Reference (see again Annex 43).

1. *Why do we need connection areas*? Or: *For which ecological processes do we need connection areas?*

   The input of the group allowed the identification of four types of processes that require connection areas:

   - Processes related to the ecological needs of species (daily or seasonal movements, dispersal, genetic exchange/reproduction/genetic variability, migration, colonization of new or formerly-occupied habitats, to ensure population viability, connection areas as additional habitat for species, connection areas as refuges for species, connection areas as resource)
   - Processes required for the maintenance of habitats, for instance to maintain hydrological processes and other processes characteristic of natural or untouched areas
   - Resilience to climate change
   - For co-operation among managers of protected areas (a social link rather than a geographic one).

   Also several problems related to connection areas were highlighted. Among others, the potential risk that connection areas might facilitate the spread of invasive species and diseases and that they may lead to the return of species that are unpopular amongst stakeholders living in the area (e.g. large carnivores). Obviously these aspects have to be taken into consideration when planning for, and managing, connection areas.

2. *For what do we need connection areas?* Or: *Which criteria can we use to identify connection areas?*

   An important general remark was made that criteria depend on the purpose of the connection area: is it for a specific species, group of species, habitat type or ecological process?

   Also, the group felt that for the identification of main connection areas, especially at a macro-level (rough scale), one criterion would not suffice. It would be better to integrate the species approach with the habitat/landscape approach and therefore to identify connection areas that consist of several habitat types (landscape connection areas). Such areas would benefit an array of species.

The following criteria were suggested for the identification of connection areas.
Based on species:

- Landscape permeability and naturalness
- Existing dispersal routes, known dispersal distance of species
- Seasonal or daily migration routes or stepping stones for species (e.g. for birds through mountain passes)
- Areas between source areas (existing habitat) and target areas (potential habitat) for species
- Species with large area requirements or large dispersal capacity
- Species that are restricted to specific habitats
- Species that are sensitive to barriers
- Areas needed for the life cycle of certain species.

Based on habitats:

- Areas with a high non-fragmented cover of the specific habitat types (continuous habitat/well connected habitat) – most obvious for forests
- Areas with a high diversity of landscape structure
- Areas with a high coverage or percentage of natural areas/natural complexes
- Areas with low anthropogenic influence/absence of barriers (this may coincide with areas with a high diversity of landscape structure)
- Elevation.

Based on ecological processes:

- Hydrological cycle (groundwater, rivers)
- Areas with high elevation range or climatic circumstances
- Remote areas.

Based on social factors:

- Cooperation/support from decision makers
- Social acceptance by stakeholders in the region
- Administrative co-operation among regions.

3. *How can we distinguish among Alpine, international, national and local connection areas?* Or: *What qualifies a connection area of Alpine importance?*

   Several criteria were suggested to distinguish among connection areas of different levels of importance:

   - The scale of the species-related processes they support: for the Alps, species or processes that connect the Alps to adjacent regions, or for which the Alps are an important stepping stone, or for which the Alps are an important habitat. In general, international connection areas should support long-distance processes (dispersal, migration routes, recolonization). National connection areas should support regional or local processes.
   - The size of the connection areas themselves: local corridors are small and finely detailed, Alpine and national corridors are wider and less precisely located.
   - The status of the species or processes the connection areas are relevant for; species or processes which are important for the entire Alps, species that have an international protection status or are of Alpine importance, are unique for the Alps, etc.

Recording

In order to ensure transparency, coherence and good documentation of the connection areas defined, the experts were asked to use a flow-chart to record their decisions and to write down their considerations. Annex 52 provides the flowchart and form the experts used in the workshop. Annex 53 and Annex 54 provide summaries of the information assembled for each identified corridor (a summary of the description of each individual macro-corridor). This includes the information collected prior to the workshop, compiled at the workshop itself, or integrated after the workshop. On the form the experts also had to indicate whether the areas they identified corresponded with the expert input provided in advance of the meeting as well as with existing national network studies.

Internal and external connection areas

Through preparatory consultation with experts, the first workshop in Buchs in September 2005 and subsequent consultations, two draft maps were produced: one for external connection areas (connecting the Alps to adjacent regions, see under 5.5 and Fig. 34) and one for internal connection areas (connecting priority conservation areas to each other, where appropriate, see under 5.6 and Fig. 35).

Both maps are preliminary, need further peer-review and by no means should they be considered final; however, the map of external corridors is more reliable than that of internal corridors. The scientific methodology by which the maps are produced has to be refined.

5.5 External connection areas

A few connection areas between the Alps and the adjacent regions were identified, before, during or after the Buchs workshop (Fig. 34). They are called *external* connection areas because they extend beyond the boundaries of the Alpine region per se. They connect the Alps with:

- South-Eastern Europe (the Drava River, the Sava River, respectively areas 1 and 2 in Fig. 34)
- the Dinaric Alps towards Slovenia and Croatia (areas 3 and 4)
- the Carpathians (through Austria and Slovakia, area 5)
- the Bohemian Massif (in Austria, the Czech Republic and Germany, areas 6 and 7)
- the Jura Mountains (in Switzerland and France, areas 10 and 11) and from here to the Black Forest (Germany, area 8) and the Vosges (France, area 9)
- the Massif Central (France, area 12)
- the Apennines (Italy, area 13)
- the Po River Valley and the Adriatic Sea (Italy, areas am1-6, am10-15).

The belts/ribbons on Fig. 34 indicate the connection areas between the Alps and the adjacent regions (external macro-corridors). Annex 53 provides a description of the connection areas and the reasons for their identification. Some of these connection areas are considered to be functioning, others are considered potential and need further investigation.

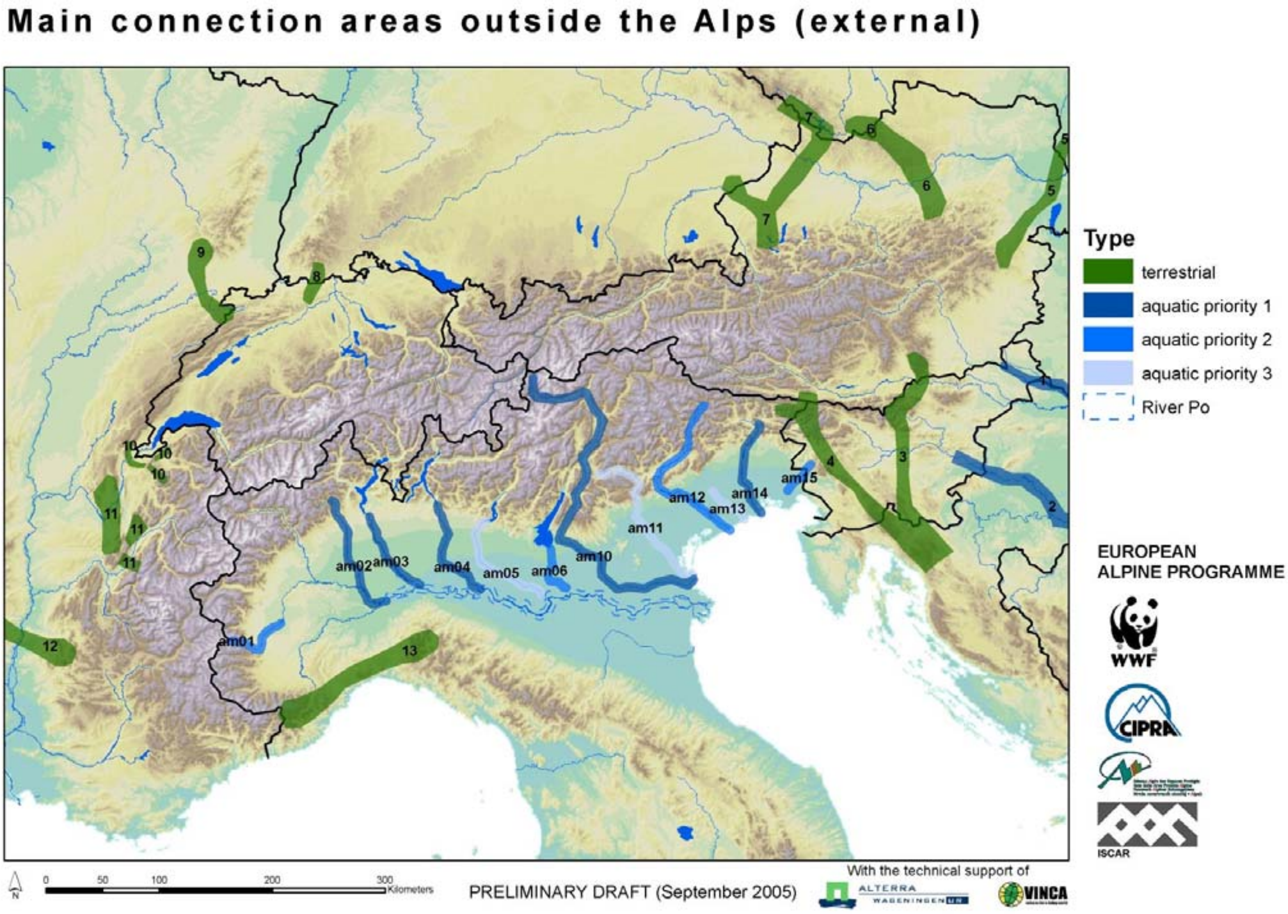


Fig. 34. The main potential connection areas connecting the Alps to adjacent regions (external macro-corridors). The map is a preliminary draft and cannot be considered final. It distinguishes the main potential connection areas in terrestrial (green) and aquatic (blue). River macro-corridors have been identified only for the southern Alps and they were temporarily ranked according to three levels of priority: they should also be identified for the northern (Swiss and German) Alps and for the north-western (French) Alps (to this end, see suggestions under 5.7).
1: Drava River. 2: Sava River. 3: Dinaric Alps East. 4: Dinaric Alps West. 5: Alps-Carpathians.
6: Alps-Bohemian Massif. 7: Kobernausserwald Corridor. 8: Jura-Black Forest. 9: Jura-Vosges.
10: Alps-Salève-Jura. 11: Alps-Chartreuse-Jura. 12: Alps-Massif Central. 13: Alps-Apennines.
am01: Upper Po River. am02: Sesia River. am03: Ticino River. am04: Lower Adda River. am05: Oglio River. am06: Mincio River. am10: Adige River. am11: Brenta River. am12: Piave River.
am14: Tagliamento River. am15: Isonzo/Soca River. (am13: Livenza River is not included in the map because it was considered of secondary importance. However, it remains among the descriptions of Annex 53.)
More details on the individual external connection areas can be found in Annex 53.

This draft map met with more agreement than the map of internal macro-corridors (described below under 5.6): all macro-corridors presented will most likely withstand further peer-review, but new ones are needed to complete the picture (e.g. northbound from the Alps). For this reason, the suggestions made under 5.7 for additional macro-corridors should be integrated into the final map of the connection areas of the Alps.

The identification of the external connection areas was considered a positive aspect of this pan-Alpine approach by representatives of the Pan-European Ecological Network (Henri Jeffreux, at the Berchtesgaden meeting on 7-8 November 2005). They found it interesting because it somehow contributes to addressing the issue of global warming, and because it reflects the approach of other European initiatives such as PEEN and Greenbelt, which are efforts to identify and develop connectivity across Europe. As an example, the PEEN map for the Rhine basin shows connections between this basin and the Alps.

5.6 Internal connection areas

For the identification of internal connection areas, the experts at the Buchs workshop were divided in two groups – one for the Western Alps and one for the Eastern Alps[18]. Most internal connection areas identified in the Western Alps have “W” in their code, and those identified in the eastern Alps have “E”. Macro-corridors without “W” or “E” were not identified at the workshop but before or after it.

Fig. 35 outlines the main potential connection areas identified in a preliminary way within the Alps (internal macro-corridors). Annex 54 presents a description of each one of them.

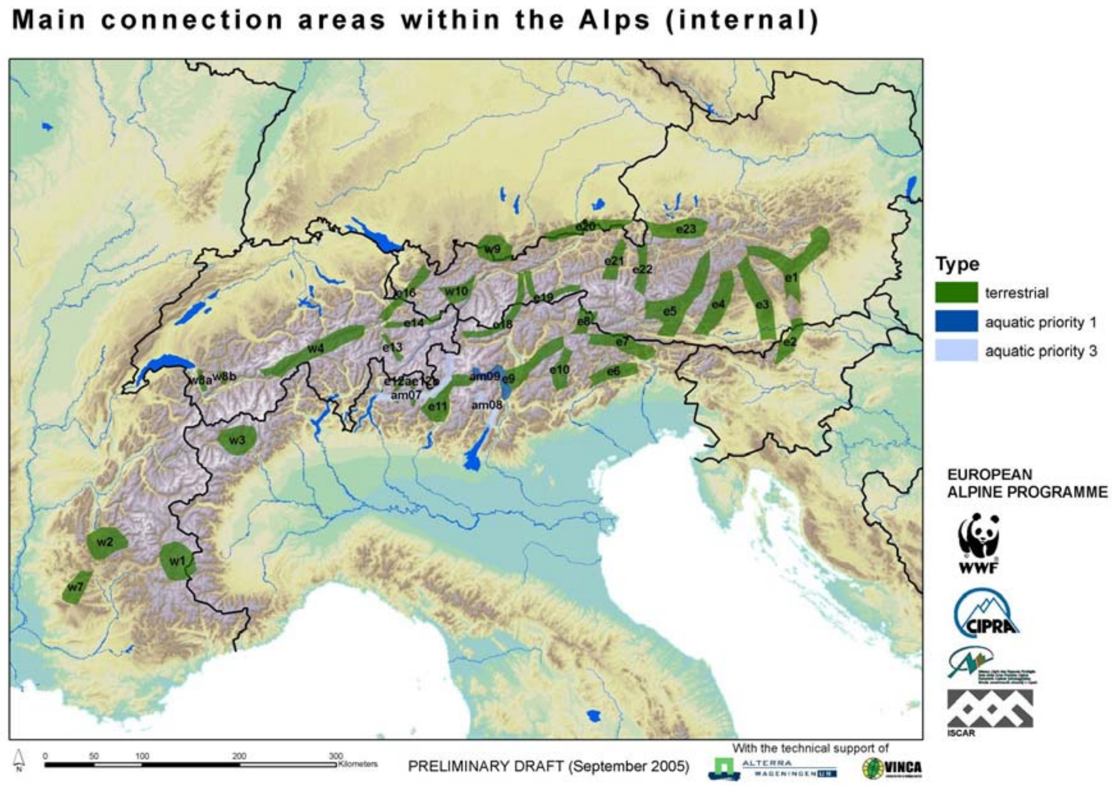


Fig. 35. The main potential connection areas within the Alps, connecting priority areas to each other, when necessary (internal macro-corridors). The map is a preliminary draft and cannot be considered final. It distinguishes the connection areas in terrestrial (green) and aquatic (blue). For some suggestions on additional corridors, see under 5.7. Details on the individual internal connection areas can be found in Annex 54.

Overall the experts in Buchs were able to use the flowchart (Annex 52) but they did experience some difficulties. The following issues were highlighted concerning the use of the flowchart as well as the overall approach:

[18] Experts for the Eastern Alps: Toni Nikolic, Michael Proschek.
Experts for the Western Alps: Hervé Cortot, Christoph Küffer, Fridolin Zimmermann.

1. Quality of the data used to identify non-fragmented areas/low human pressure areas (land cover, population density, barriers - are they really barriers? - roads and railways, remote areas, protected areas - IUCN categories I, II? -, internationally protected areas (e.g. Natura 2000) and acknowledged areas such as known bird migration sites). Should all these data layers be considered equally? The maps provided at the workshop considered them all at the same level of importance;

2. Categories of areas important for biodiversity. In most cases the maps provided at the workshop lumped together all categories of areas recognized as important for biodiversity (IBAs, Ramsar sites, remote areas, known bird migration sites, etc.). Should the map resolution be sharper and allow to distinguish among these categories?

3. Experts' input. The experts' information received prior to the meeting was not ranked according to any criteria but described neutrally (scale, species or habitat-based, geographic coverage, etc.). Should it all be considered equally?

4. Expert approach ('hand drawn') versus GIS analysis. The identification of the connection areas was based on a visual interpretation by combining different data sources, filtered by experts' knowledge. A GIS analysis prior to the workshop could have facilitated this process and improved the location of the connection areas;

5. The group's combined expertise and its ability to identify areas in certain parts of the Alps. Clearly the combined knowledge of the experts present at the workshop did not cover some parts of the Alps. In the future it would be better to try to form more complete groups. At this point in the process it is therefore necessary to consult other experts who are familiar with the parts of the Alps which were not "covered" at the workshop. It will also be most appropriate to open the consultation process to validate the results obtained so far;

6. Maps and orientation. Maps (both those used for reference and the working maps used to draw connection areas) should show topographic references to help experts to orient themselves and to assist in the identification of connection areas. Topographic references were not shown on the maps used at the workshop, but they were in the new working maps which were prepared for the subsequent expert consultations (see Annex 55).

More specific remarks:

- For connection areas: use arrows or blended colours, not rigid boundaries (connection areas should *merge* into the priority areas and not stop at their borders);

- There are also bottleneck situations within the priority areas themselves, to be taken into consideration;

- Do not exclude *a priori* areas with barriers (especially roads and railways); for some species they are not actual barriers. By excluding them *a priori* we could overlook areas otherwise suitable as ecological connections;

- In addition, some barriers might even be real barriers, but there may be simple solutions to increase their permeability (green bridges, for example). Excluding these areas would simply lead to mistaken results;

- It is necessary to clearly describe the need for connection areas among priority areas and protected areas, as in some countries and for certain connection areas the issue may be sensitive, both on a political level and amongst stakeholders (on this issue a brainstorming session was held during the Buchs workshop, see under 5.4);

- The scientific soundness of the identification of the connection areas has to be ensured.

5.7 Other analyses

Several other analyses were conducted on, or related to, the connection areas of the Alps:

1. Overlay with other layers of information
2. Comparison with maps of the Pan-European Ecological Network
3. Comparison with the corridors identified in 2002
4. Protected areas important for biodiversity and connectivity
5. Suggestions for extension of priority area boundaries
6. Comparison with other corridors suggested.

These are briefly described below.

<u>1. Overlay with other layers of information</u>

As an exercise, the main “internal” and “external” potential connection areas identified in a preliminary way at the workshop were integrated into one map and overlaid onto other levels of information (priority conservation areas, protected areas, areas under other types of protection or otherwise recognized as important for biodiversity, expert input, remote areas). The following maps (Fig. 36 to Fig. 40) show the results of these other analyses.

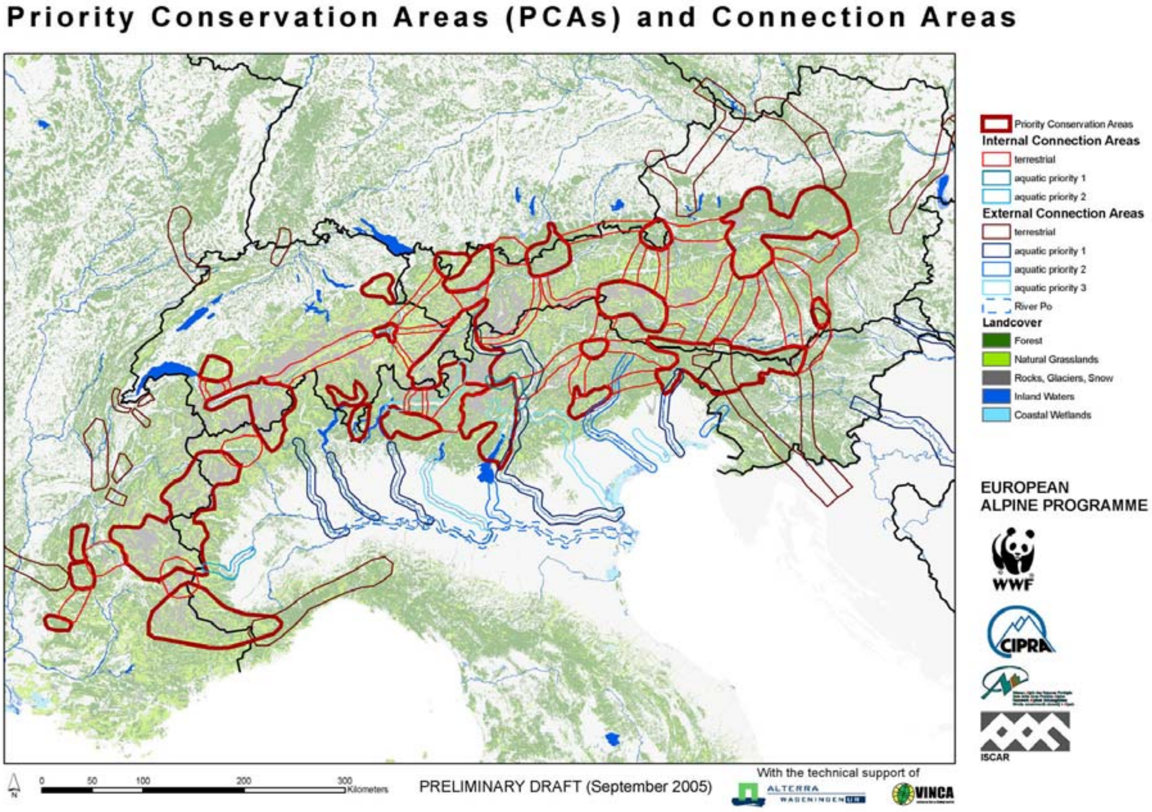


Fig. 36. The main potential internal and external connection areas identified at the workshop, with the priority conservation areas.

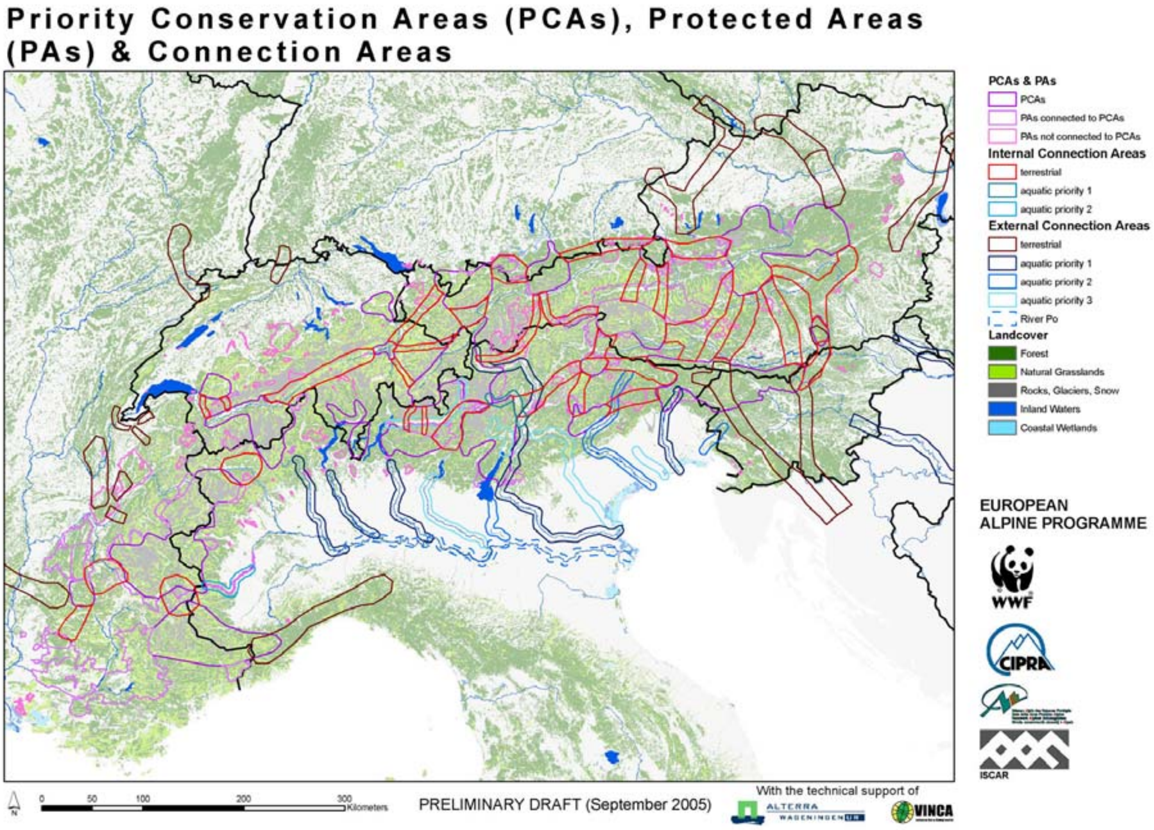


Fig. 37. The main potential internal and external connection areas identified at the workshop, with the priority conservation areas and the protected areas.

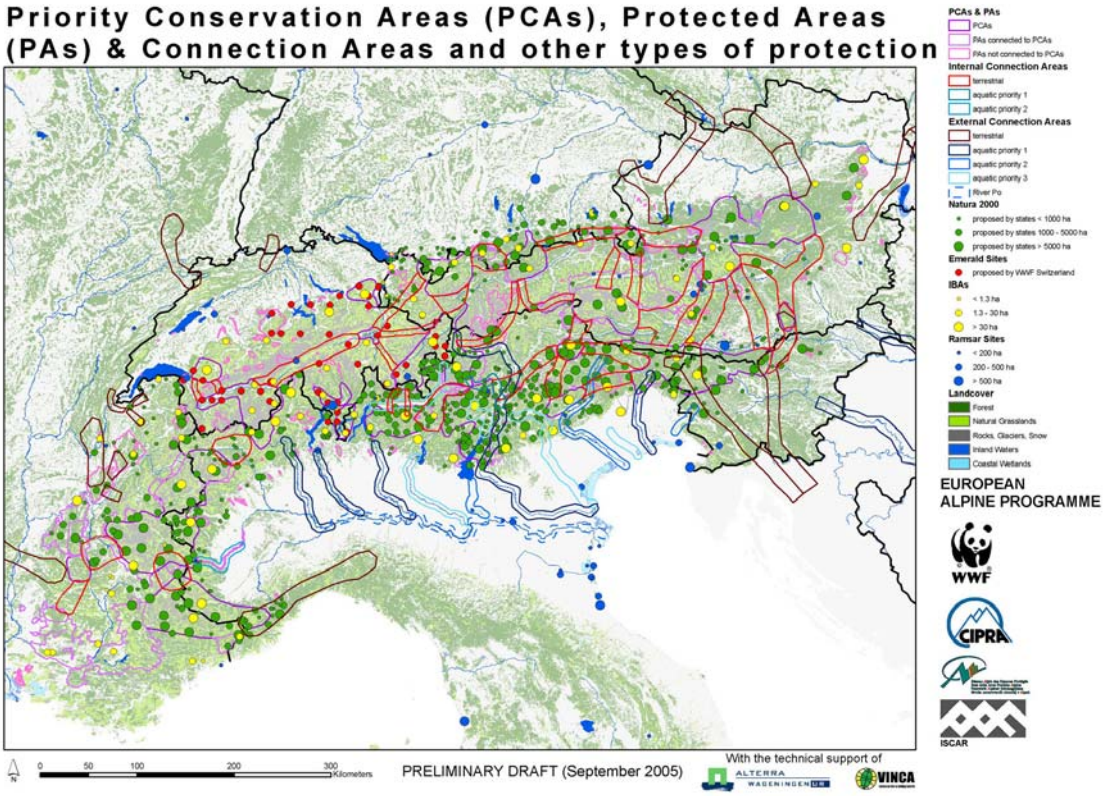


Fig. 38. The main potential internal and external connection areas identified at the workshop, with the priority conservation areas, the protected areas and other forms of protection (Natura 2000, Emerald Network, Important Bird Areas-IBAs and Ramsar sites).

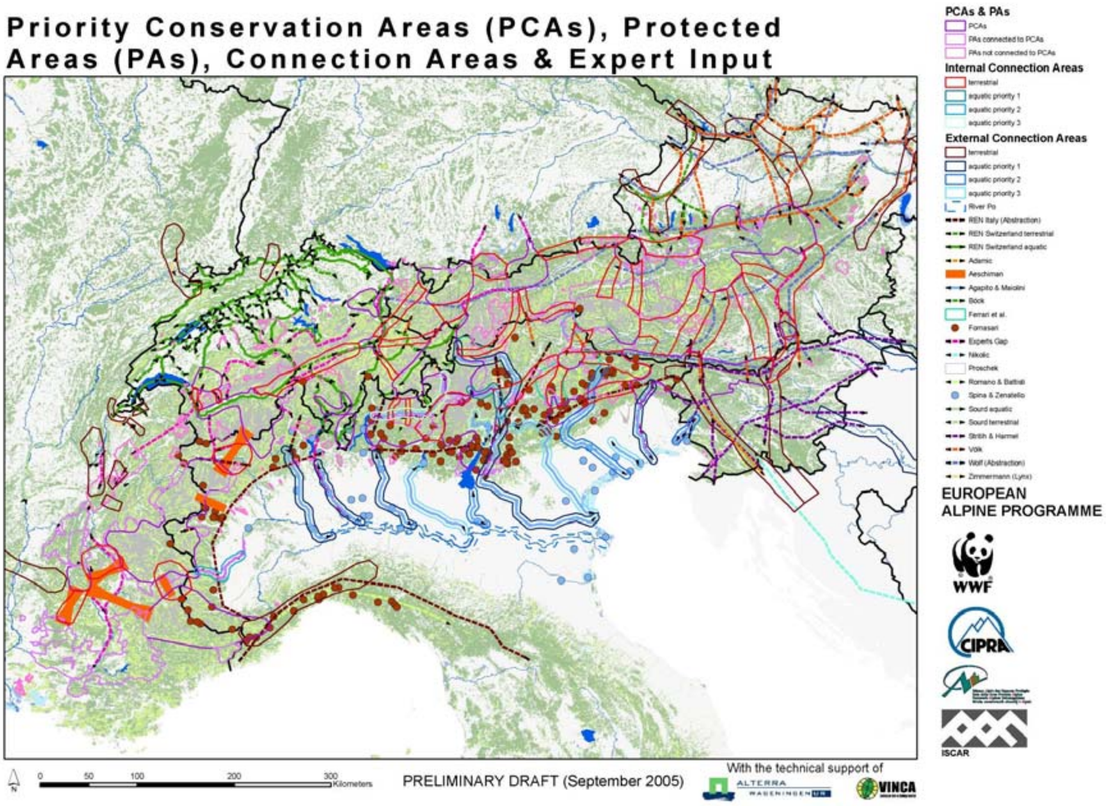


Fig. 39. The main potential internal and external connection areas identified at the workshop, with the priority conservation areas, the protected areas and the input received from the experts prior to the workshop. (Errata corrige: among the experts input, Spina & Zenatello should be corrected to Zenatello, Baccetti & Serra.)

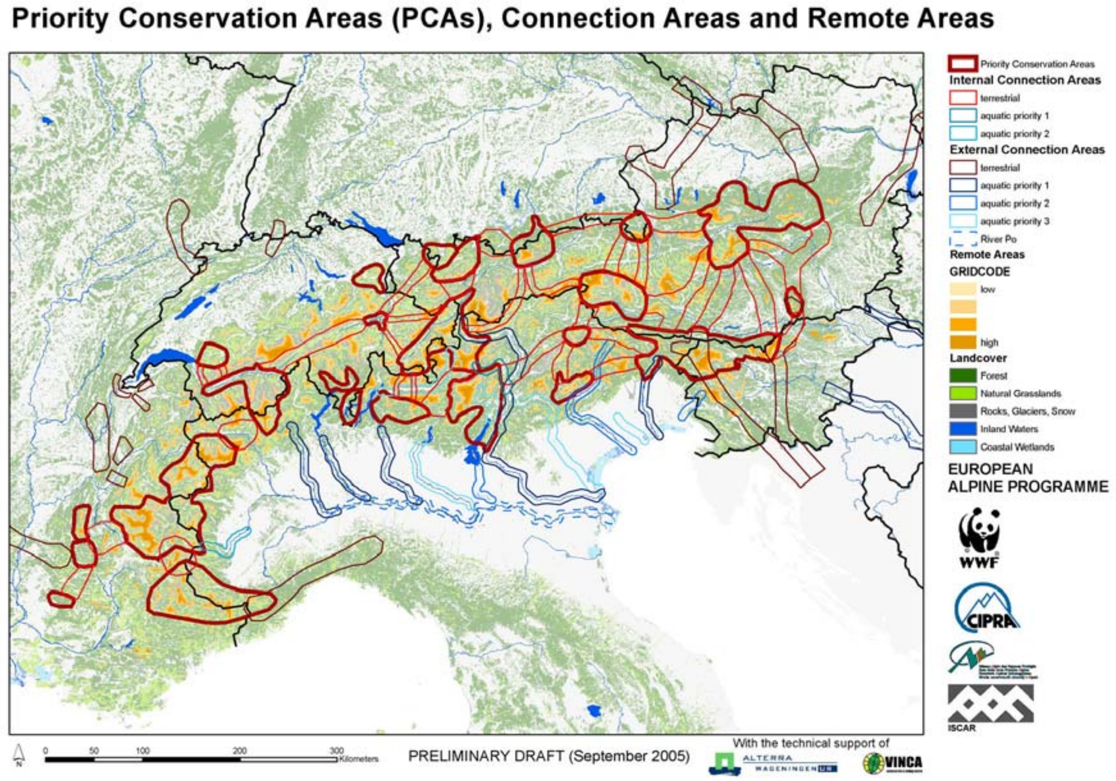


Fig. 40. The main potential internal and external connection areas identified at the workshop, with the priority conservation areas and the remote areas.

2. Comparison with maps of the Pan-European Ecological Network

As described under 5.4, in the framework of the Pan-European Biological and Landscape Diversity Strategy two regional maps were produced that identify the Pan-European Ecological Network (PEEN) for Central & Eastern Europe and for South-Eastern Europe (that for Western Europe has not yet been produced). A brief analysis was undertaken to verify whether the connection areas identified for the Alps correspond with these maps. In particular, the objective of the analysis was to assess whether the external connection areas identified for the Alps were seamlessly connected to the ecological network of the adjacent Central and South-Eastern Europe, or in any case whether internal and external connection areas for the Alps had other types of relationships with the portions of PEEN already identified. (Given that the PEEN maps currently available are only those for Central & Eastern Europe and for South-Eastern Europe, this analysis included only the eastern and south-eastern portions of the Alps.)

The results of this brief analysis were rather interesting and encouraging. For Central & Eastern Europe (Fig. 41):

1) Connection area 5 of the Alps (external macro-corridor between the Alps and the Carpathians) was also identified on the indicative map of the Pan-European Ecological Network for Central & Eastern Europe.

2) External connection areas 6 and 7 of the Alps (respectively Kalbhalpen Corridor – or connection with the Bohemian Massif – and Kobernausserwald Corridor) were not identified on the PEEN map, although the Bohemian Massif in the border region was

indeed identified as a core area due to its current international protection status as well as its size. According to the methodology followed in the PEEN project, this area should be connected to a larger forested area in the vicinity.

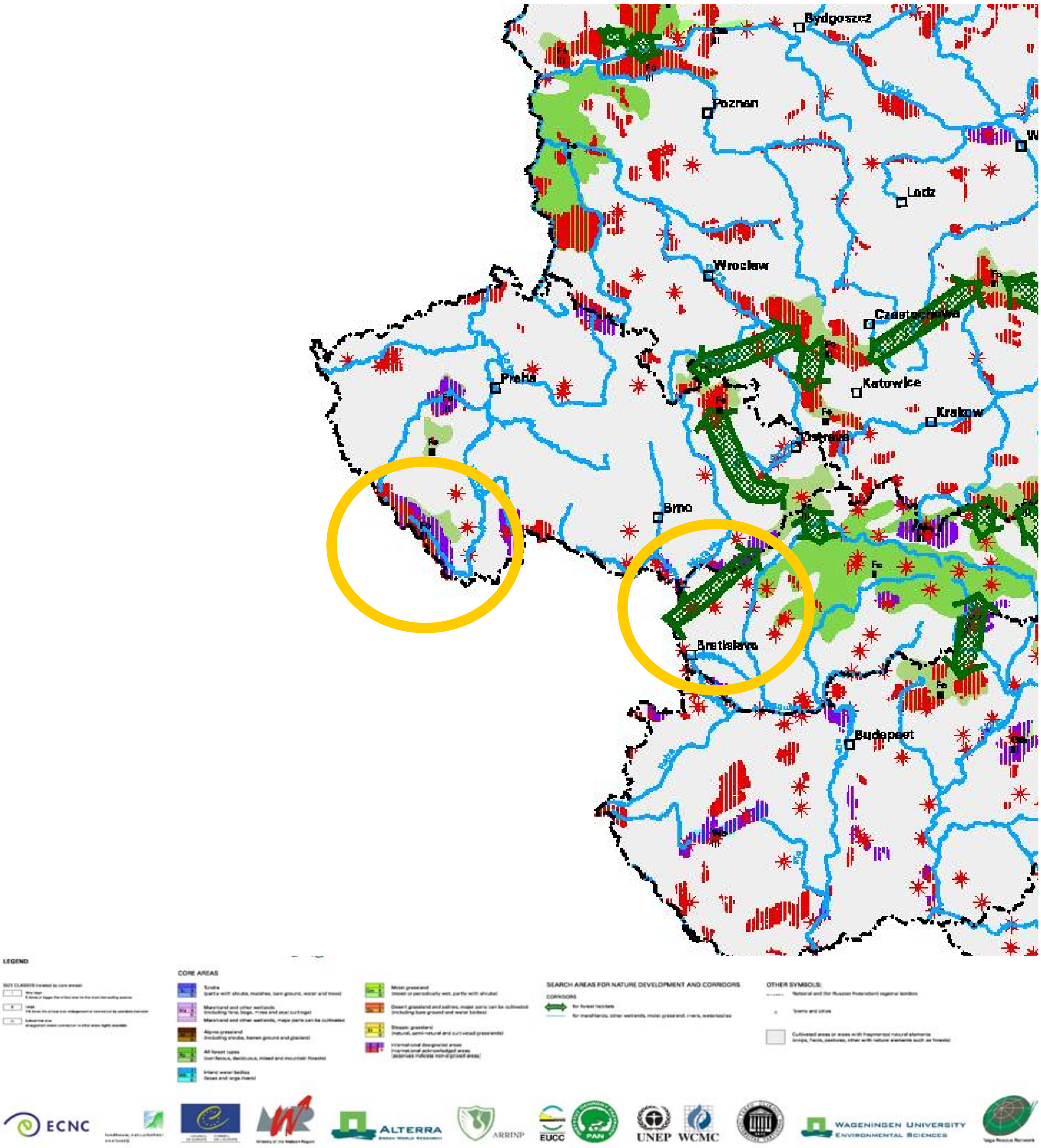


Fig. 41. Comparison of the connection areas of the Alps with the indicative map of the Pan-European Ecological Network for Central & Eastern Europe. Orange circles indicate where connection areas were identified in the Buchs workshop.

For South-Eastern Europe (no figure included as per ECNC's request given that the map is still a draft):

3) For South-Eastern Europe the map is not complete yet, only a draft version is available. On this draft version, the area covered by connection area 4 of the Alps (external macro-corridor Dinaric Alps West) is indicated as one continuous core area that connects the Julian Alps with the Dinaric Alps (the area is not severely fragmented). This coincides with the assessment made during the Buchs workshop according to which this area is an important connection area between the Alps and the Dinaric Arc. The difference is that, as a result of the methodology used in the PEEN project, PEEN considers this same area as one core area and not as two separate areas with a corridor in between.

4) Connection area 3 of the Alps (external macro-corridor Dinaric Alps East) was also identified as a corridor in the draft version of the PEEN map for South-Eastern Europe.

3. Comparison with the corridors identified in 2002

During the workshop which was held in 2002 in Gap, France, when the identification of priority areas started, a preliminary identification of some corridors among priority areas had also been undertaken (Fig. 24 in 3.11).

These corridors cannot but be considered preliminary because they were established among priority areas which were then not yet final (and which have since undergone changes in boundaries). However, it is interesting to see whether there is any correspondence between these corridors and the connection areas identified in 2005-2006 (Fig. 42). In the description of the individual connection areas (Annex 53 and Annex 54), any such correspondence is indicated.

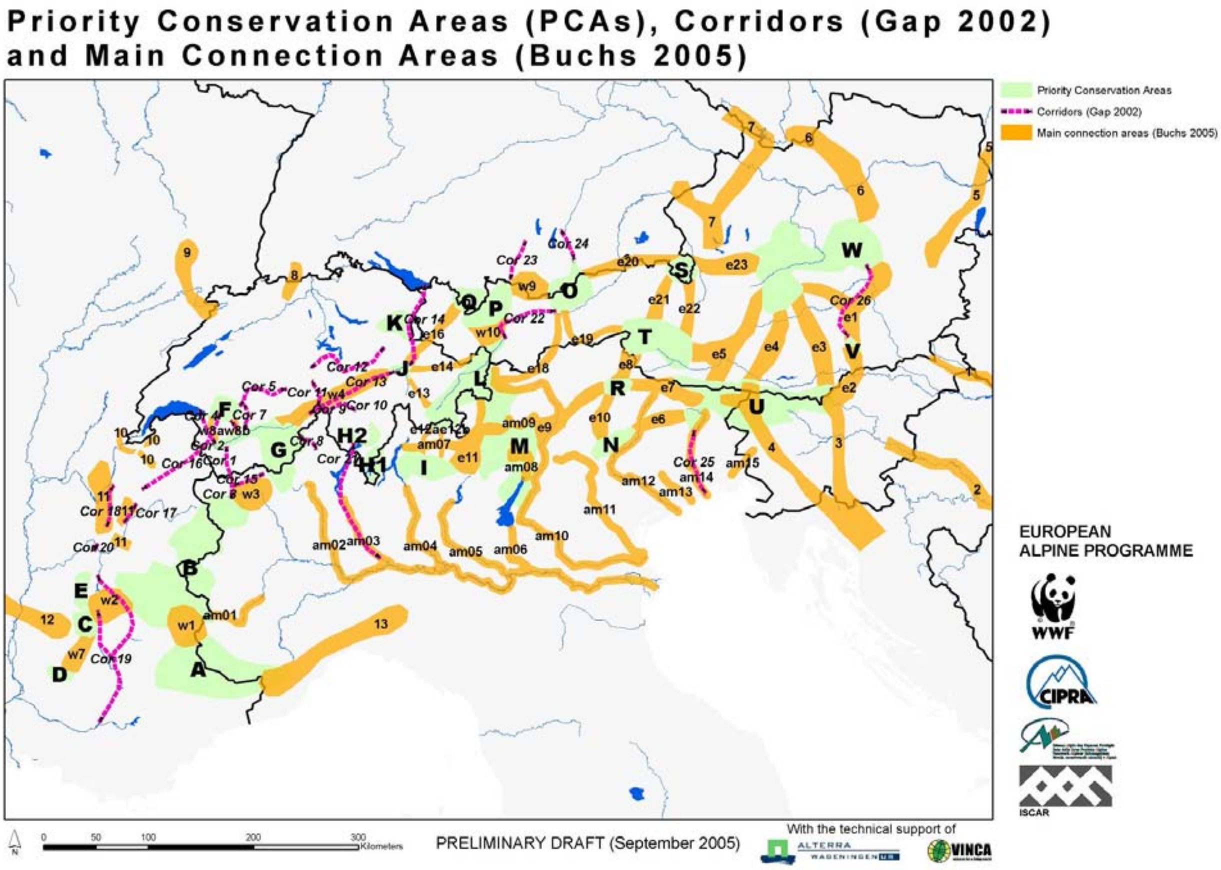


Fig. 42. Overlay of the preliminary corridors identified in Gap in 2002 with the connection areas identified in 2005-2006. Light green areas are priority areas; orange areas are connection areas identified in 2005-2006; pink areas are corridors identified in 2002.

In addition to the corridors on the map above, four more areas were identified in Gap, which should be considered as external corridors; they are all French rivers:

- Rhône,
- Drôme,
- Bez
- Roubion.

They were selected and mapped as important freshwater areas, but only their portion within the boundary of the Alpine Convention are found on the final maps, while the remaining portion outside of the boundary was deleted. Given the relative scarcity of information on macro-corridors in the French Alps, these become valuable suggestions and should be added to the final maps of the connection areas of the Alps.

4. <u>Protected areas important for biodiversity and connectivity</u>

Since the Buchs workshop, a further assessment of protected areas has been undertaken: ALPARC determined which protected areas would be most important for biodiversity and connectivity, and produced a map of such areas (Fig. 43).

The criterion for including certain protected areas was their protection status. Thus the map includes the core zones of national parks, nature reserves and Italian nature parks. Italian nature parks were included due to their specific mission for nature protection. Other categories of protected areas were not included because their protection measures were considered to be too weak to ensure effective conservation of biodiversity and connectivity.

Future analyses will have to take into consideration this new layer.

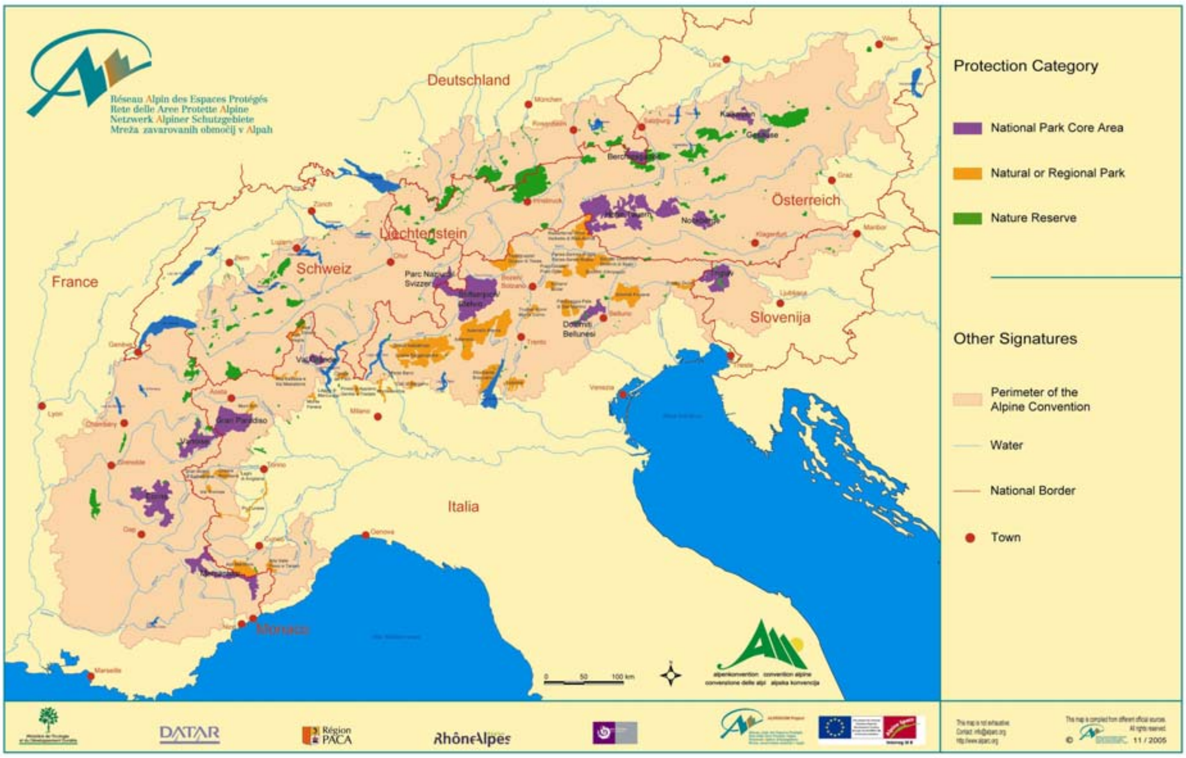


Fig. 43. Map of protected areas that are important for biodiversity and connectivity (source: ALPARC November 2005).

5. Suggestions for extension of priority area boundaries

A review of Kai Elmauer's study *Analysis of priority conservation areas in the Alps: biodiversity, threats and opportunities for conservation* (2004, revised 2006) was undertaken, looking for indications of needed corridors or for potential suggestions to extend the boundaries of priority areas.

During this study, experts and literature sources were consulted to collect information about the 24 priority areas identified in the Alps (see Fig. 21 in 3.8). As a result of these consultations, some suggestions emerged.

Given that most of these are justified according to habitat continuity or presence of stepping stones for some species, these suggestions could now be considered for the identification of new connection areas. .A list of such indications is found in Annex 56.

6. Comparison with other corridors suggested

In September 2002, during the Alpbach meeting, some corridors – additional to those already identified in Gap (see Fig. 24) – were recommended for consideration. These were:

- the Rheintal
- the Brenner (which should continue south from Bolzano compared to the line identified in Gap)
- the Ennstal
- a corridor from Innsbruck to Munich.

These recommendations should be considered for the future refining of the maps of connection areas.

Moreover, in April 2006 WWF Austria recommended that two more connection areas be considered: the Lech River Valley and the Isar River Valley, originating from priority areas P and O respectively and both extending north of the boundary of the Alpine Convention. These suggestions came in too late to be included in the maps of external connection areas presented in this report, and were not accompanied by any criterion or reason for identification. However, it seems appropriate to consider them for the future refining of the maps. It should also be noted that these two river corridors were already included in the map of the corridors identified in Gap in 2002 (where they were named Cor 23 and Cor 24, see Fig. 24 and Fig. 42).

6. Connection areas: results

The work undertaken before, during and immediately after the Buchs workshop is a first test of how to proceed and therefore methodology and results should be validated and reviewed by other experts.

Despite these points of caution, there is general agreement that the analyses undertaken so far are a good first start and a solid basis for further work (some connection areas are "robust" indeed, such as those connecting the Alps to the surrounding regions, as described below).

In addition, the activities initiated a thought process leading to connection areas at a pan-Alpine scale.

<u>Reliability of the maps of external and internal connection areas</u>

Several factors contributed to these incomplete results: discussion among the experts prior to the workshop had been limited and conclusions were not reached on some methodological issues; the group of experts at the workshop was quite small and not all competences and geographic areas were represented; the quality of the data used in the workshop was uneven; the need for connection areas was not always clear for all priority areas; a sound scientific base was at times difficult to ensure; the overall issue of ecological networks is rather complex.

However, the map of external connection areas (Fig. 34) is generally more reliable than that of internal connection areas and it benefits from general consensus. If anything, this map may be incomplete (e.g. the river corridors on the northern Alps were not even considered), but almost all potential connection areas that are found on it will probably withstand future peer-review. Connections from the Alps to adjacent regions are better known by the scientific community and are easily identified. This is probably due to the fact that as a result of the more intense land use surrounding the Alps, the possibilities for connection are limited and therefore easier to identify.

On the contrary, the map of internal connection areas (Fig. 35) is definitely tentative. The main reason is that criteria for their identification were hard to define and then to apply. What is more, the limited number of experts from the western Alps consulted prior to the workshop, or the limited number of experts from certain portions of the Alps who were present at the workshop itself, makes the preliminary results for the internal corridors of the Alps particularly weak.

This approach was a test and it now has to be formalized and peer-reviewed.

<u>Advice of experts on data quality and data priority</u>

First of all the experts at the Buchs workshop commended the thoroughness of the data collection undertaken: all the necessary data was made available. However, they would have preferred to have reference maps with fewer layers on each one, rather than the complex overlays proposed by some of the reference maps (such as the maps provided in A3 format and described under 5.3).

Then the experts evaluated the quality and suitability of the data made available – the reference maps – for the identification of the main connection areas within the Alps (internal). The quality and suitability of the reference maps used had to be assessed according to three different objectives: identification of non-fragmented areas, identification of barriers, comparison with the results of other works (see Annex 57 for the worksheet used at the Buchs workshop). Only three experts gave their opinions, thus the results of this assessment may not be fully significant. However, based on the completed forms (see Annex 58) it can be concluded that the major problem was not data quality but the order in which the data was considered for the identification of connection areas.

Advice of experts on the GIS analyses required

The following analyses were suggested towards the validation of identified main connection areas using the feasibility and opportunity principle. The order of the actions also indicates their priority.

1. Comparison of the identified connection areas with the natural land cover classes of Corine/Pelcom and others (natural areas) without taking into account the protection status;

2. Comparison of the identified connection areas with the existing national and international protected areas (preferably taking into account their IUCN status), or with other areas recognized as important for biodiversity or connectivity (e.g. Ramsar sites, IBAs, acknowledged important areas for migratory species, etc.). For protected areas, it would be appropriate to use ALPARC's map of the protected areas important for biodiversity and connectivity (Fig. 43 under 5.7);

3. Comparison of the identified connection areas with the wilderness (remote) areas;

4. Comparison of the identified connection areas with human population pressures;

5. Comparison of the identified connection areas where barriers exist.

Also, more discussion is required on how the results on connection areas should be communicated afterwards, especially towards decision makers.

Suggestions for next steps and methodology

The overall method for the identification of connection areas used in the workshop is promising (namely, focusing on the ecological need principle and then using the feasibility and opportunity principle to assess the connection areas identified, paying attention to the political acceptance principle). Using only one of the proposed methods would be too limited and would not use all available information (see Fig. 33 again). Therefore the following steps and methodological procedure are suggested for each of the three principles:

Step 1. Ecological need principle. This is the most significant principle according to which connection areas should be identified. It will therefore be important to strengthen the ecological underpinning of the connection areas identified and to assess whether any area or criterion is missing. Based on the worksheets of the Buchs workshop, the biological reason for identifying several of the corridors in the Alps is already known. Yet, the following actions are still required:

- *Action 1:* Check the identified connection areas (and the reasons for their identification) with the available habitat-related information (valley bottoms, land cover, other areas, etc.) to verify whether their location should be slightly modified (e.g. to include an important wetland). Focus especially on the comparison of the identified connection areas with the distribution of the natural land cover classes of Corine/Pelcom and others (without taking into account the protection status);

- *Action 2:* Check whether any macro-corridor identified with experts' input (and accounted for) is not covered by the connection areas identified (and if so, decide whether they need to be added);

- *Action 3*: For a large part of the Alps – but not for the entire Alpine range – important dispersal routes for large carnivores and herbivores are known (e.g. Austria and Switzerland, see for example the work by Völk and Zimmermann) as well as migratory routes or sites important for bird migrations (e.g. Italy, see for example the work by Fornasari; Zenatello, Baccetti & Serra). Consider gathering this information for the entire Alps to fill in the gaps (several experts have expressed their willingness to assist with this).

Other analyses to consider are:

- Analysis to identify areas with a high coverage of non-fragmented habitats outside priority areas for different ecological groups[19] (the most obvious ones are the species related to forests);

- Analysis of the landscape permeability for different ecological groups with a different sensitivity for barriers (different models are available to do this);

- Analysis to identify areas with a high diversity of landscape structure;

- Analysis to identify areas with range in elevation or climatic circumstances.

With the above analyses, the best possible connection areas based on the ecological need principle can be identified.

Step 2. Feasibility and opportunity principle. This is the principle according to which the identification and location of the preliminary connection areas can be validated (this principle is used to assess the *feasibility* of the connection areas already identified according to the ecological need principle). The following additional GIS analyses should be run, divided into

[19] This approach was developed by Alterra and is currently being tested by the ETC-TE for Europe. Basically it involves distinguishing different ecological groups for which dispersal distances and minimum area requirements for viable populations are specified.

two categories: I. Convergence with existing instruments; II. Divergence from existing settlements and infrastructures:

I. Convergence with existing instruments

- *Action 1*: Verification of whether any identified connection area is part of a national REN;

- *Action 2*: Comparison of the identified connection areas with the existing national and international protected areas (preferably taking into account their IUCN status or based on the ALPARC map of protected areas important for biodiversity and connectivity, Fig. 43), or with other areas recognized as important for biodiversity or connectivity (e.g. Ramsar sites, IBAs, etc.);

- *Action 3*: Comparison of the identified connection areas with the wilderness areas or areas where natural disturbances can occur. (Wilderness areas – or remote, non-fragmented areas – are areas relatively undisturbed and removed from human impact. They often correspond to mountain tops, glaciers, etc., and can therefore even represent natural barriers. Here biodiversity is not necessarily "rich" (e.g. wilderness areas per se are not priority areas for biodiversity, but they may include important focal species.)

II. Divergence from existing settlements and infrastructures

- *Action 4*: Comparison of the identified connection areas with human population pressures and existence of barriers.

With the above analyses, the most feasible connection areas based on a feasibility/opportunity principle can be selected, among all the identified connection areas.

Step 3. Political acceptance principle. This principle should not be used to validate or identify the connection areas, but to add a new layer of information to the areas identified, to better describe and possibly rank them, to assess how they can be presented to external audiences and to devise the most appropriate measures for implementation. The following analyses should be undertaken:

- *Action 1:* Evaluate the overlap of the connection areas identified with existing national and regional networks. This will provide an indication of the support that could be expected from decision-makers in certain countries for identified connection areas (very similar to Action 2 of Step 2);

- *Action 2*: Criteria should be established to integrate existing official national and regional ecological networks into the identification of connection areas. This could be one of the objectives of the future common project of the Consortium to define a formal methodology for connection areas and corridors. The issues to explore in depth are the different scale, data and approaches used for the various RENs, as well as the differences in approaches among them and the identification of connection areas of Alpine importance.

Another methodological suggestion was offered by experts who were not at the Buchs workshop (Luigi Boitani and Guy Berthoud, with slight differences but within a common approach), and this should be taken into consideration as well. It is about keeping the data for different taxa (birds, mammals, etc.) separate, as was done for the identification of priority areas, and then overlaying them onto one layer. The analyses according to the species approach and the habitat approach should be kept separate, and overlaid only at a later stage. This could be done as an additional action under Step 1 and Step 2 above, or further investigated under Phase 3 of the *Follow-up* below.

Follow-up

New common project of the Consortium to clarify methodological issues. Given the complexity of the issues and the need to harmonize and coordinate the variety of approaches currently taken for the ecological network of the Alps, it was decided to launch a common project to further explore various issues. The different approaches include: the main potential connection areas of the Alps (Consortium), the corridors among protected areas (ALPARC and Alpine Convention), the Pan-European Ecological Network (European Centre for Nature Conservation) and the national and regional RENs (individual countries or public administrations).

The future project will take shape in summer 2006. The objective of such a project will be to define a standard, formal methodology to identify ecological networks at different spatial scales, and to agree upon a conceptual framework for the coexistence and interaction of such different approaches, when they are all valid. The formal methodology could also be used for other large regions in Europe.

PART IV – GENERAL CONCLUSIONS

7. Conclusions

The work undertaken to define a biodiversity vision for the Alps was one of the first attempts at analysing and mapping the Alps as a whole. Other efforts existed which covered the entire Alps, for example professor Bätzing's social and demographic analysis, or the System of Observation and Information of the Alps (SOIA) within the Alpine Convention, or the studies on the areas suitable for large carnivores of the Large Carnivore Initiative for Europe (LCIE), but these were uncommon. The Consortium's effort was the first to focus only on biodiversity, involving the scientific community at large. Even the biodiversity analysis conducted by BirdLife International with the identification of IBAs was not as regional based as the analysis conducted by the Consortium. BirdLife undertook its analysis at the country level, and had not consolidated the data for the Alps until the Consortium did so. In defining the biodiversity vision, the focus on consolidating and harmonizing data from different sources, gathered at different scales and collected according to different criteria was enormous.

In addition, the scientific community was forced to think at the scale of the entire Alps (the pan-Alpine scale). Before this initiative very few scientists were familiar with work on such a scale, as scientific institutions tend to concentrate on their local, regional or national situations and are generally interested in the geographic area indicated by their names (for example, a national wildlife institute focuses on national wildlife issues, a regional museum on the conservation issues of the region). Experts from the entire Alpine range worked together, made assessments together and came to shared conclusions. The vast majority were thankful for the opportunity to explore a new approach and an unusual scale of analysis.

The scientific community was also forced to synthesize the detailed knowledge it possesses, forgoing the minute and rigorous level of detail contained in their various studies, atlases, databases and personal knowledge. While initially this may have seemed to them like a missed opportunity, they were able to use their knowledge to the benefit of a much larger region than they would have otherwise covered, and they contributed to results with implications which went far beyond their individual ranges. The experts were able to synthesize their knowledge across taxa, habitat types, issues and subregions and thus overcame the difficulties of combining different levels of information and of detail.

The scientific community of the Alps made the decisions. The Consortium proposed a methodology, but did not have any control over the results. As one expert put it during a discussion at the Gap workshop, this was a remarkable achievement given that scientists from across the Alps had been gathered to think about the future of the Alps without being driven by a political agenda.

The effort of developing a biodiversity vision for the Alps, with the organization of workshops and of other types of consultation and priority-setting exercises, allowed information exchange and contact among the experts. The different parties involved in the various phases of the biodiversity vision will thus be able to strengthen their network and their partnerships: a network of scientists now exists prepared to think at the scale of the entire Alps, and fully aware of the potential of doing so.

Finally, developing the biodiversity vision for the Alps with such a varied range of players has given rise to a network of public administration and other organizations willing to implement the biodiversity vision on the ground.

7.1 Involvement of experts and of other parties

None of the activities and results described in this report could have taken place without the involvement of several experts from different countries, organizations and areas of expertise. As a matter of fact, considerable effort was devoted to engaging the appropriate external experts during all phases of the process: defining the methodology, framing the activities, setting criteria, identifying areas, reviewing and improving preliminary results, peer-reviewing the reports.

Only the participants in the process were in control of the results, not the four partners of the Consortium and organizers of the initiative. The Consortium (WWF, CIPRA, ALPARC and ISCAR together), and in particular WWF, proposed a methodology taken from the template of ecoregion conservation, which was then reviewed and adapted to the situation in the Alps with the input of other experts.

As already described under 2.3, the four main workshops (Gap, Alpbach, Zürich and Buchs) and the several minor consultations held for the development of the biodiversity vision were organized by the Consortium, with the technical support of additional partners (WWF US, Conservatoire Botanique National Alpin, University of Vienna, VINCA and Alterra Institute). All these organizations included internal experts which contributed remarkably to the process.

There were several other steps in the process in which numerous external experts and observers were involved. In particular, additional external experts on biodiversity and socio-economic issues from the wider scientific community were consulted and invited to participate in the process. They were asked to contribute conceptually before the workshops, to take part in the workshops, and then to help to fill in the gaps or to peer-review the results after the workshops. Experts were invited upon recommendation by the four partners of the Consortium or by other experts. Experts who were not personally known and who had not been invited directly, but who contacted us with an offer of cooperation, were also involved, provided they had the competence needed and could do some preparatory work in advance.

At the Gap workshop in May 2002, over 60 participants from all Alpine countries participated. They selected focal species and key habitats and established criteria to identify the most important areas for the various taxa and the key habitat types, and hence the priority conservation areas in the Alps. For each taxon and key habitat, a working group was created with members from different Alpine countries to achieve consistency throughout the Alps. The spatial information provided by the experts was digitized and input into a GIS database. Additionally, gaps in data and knowledge were identified. The identified gaps in the data were addressed in a review process after the workshop by contacting additional experts and collecting missing data from existing sources.

In June 2002 an update letter was sent to all participants in the Gap workshop and to several other people who had not been in the workshop but who had been involved in different ways or whom it was appropriate to keep informed (Annex 59). The update summarized the preliminary results obtained in Gap (through several colour maps in A3 format) and the next steps, and asked for some feedback.

At the Alpbach workshop, preliminary results were presented and discussed at a dedicated session during the Forum Alpinum in September 2002 in Austria. About 20 experts participated and provided concrete suggestions on how to complete or improve the draft maps.

Once the information on taxa and key habitat priority areas was completed, the boundaries of the conservation priority areas (CPA) were delineated at a workshop held in Zürich in March 2003 with a working group of six including three landscape ecologists.

In April 2003 a second update letter was sent to experts who had participated in the previous phases as well as to observers and others. Again, it provided an update on the results and a brief description of next steps (Annex 60).

Overall, over 100 people contributed to the identification of priority areas, in workshops or in other ways.

In February 2004 the publication *The Alps: a unique natural heritage* was announced through a simultaneous press release in all Alpine countries and distributed to several hundred experts, observers and representatives of civil society, the scientific community and the public sector. It presented the results on the priority areas and the intended next steps, while an accompanying letter solicited the recipients to express their interest in becoming involved in concrete activities within the priority areas (Annex 61a, Annex 61b and Annex 61c). From the expressions of interest which were received, some new projects and partnerships were launched.

Two detailed analyses of priority areas were undertaken: one by Kai Elmauer on the biodiversity aspect from March 2003 to August 2004 and the other by Dominik Siegrist and Priska Hänni-Mathis on the socio-economic aspect from December 2003 to August 2004. Both involved extensive consultation with general and local experts throughout the Alps and covering different sectors of expertise.

The Buchs workshop in September 2005 was the main experts' event dedicated to the identification of the connection areas of the Alps. The workshop itself involved only a small number of experts, but about 50 experts overall contributed to this identification and to defining the methodology, considering those who provided input before, during and after the workshop.

The limited number of experts taking part in the Buchs workshop was a choice: the intention was to engage a restricted number of experts in ecological corridors and networks and to have them work together smoothly and rapidly.

For the development of the biodiversity vision the emphasis was on involving biodiversity experts rather than socio-economic experts. Socio-economic experts were mainly consulted for the preparation of reference maps, for the second part of the Gap workshop when preliminary actions were identified for the conservation of priority areas, and for the socio-economic and political analysis of priority areas (completed in August 2004). As for the biodiversity experts, invitations were issued according to several categories of expertise, such as: scientists, administrators, NGOs, non-university scientific institutions (museums, etc.), European Union (Natura 2000, European Landscape Convention, etc.), and Alpine Convention.

Throughout the process information on progress and next steps was regularly conveyed by the members of the Consortium to third parties through their websites, general assemblies and conferences.

Technical reports were peer-reviewed before their final versions were issued. The technical report on connection areas mentioned in 5.1 was drafted by WWF, Alterra Institute and VINCA, reviewed by the other partners in the process (CIPRA, ALPARC and ISCAR) and peer-reviewed by the scientists who had participated in the process (all participants were asked to please peer-review the document; about one third provided comments). The final draft was ready in March 2006 and the final version was completed in April 2006.

The technical report which you are now reading, on the full biodiversity vision of the Alps, was drafted mainly by WWF and VINCA, reviewed by the other partners in the process and then peer-reviewed by some experts willing to undertake this task. The final draft was ready in July 2006 and the final version in September 2006.

7.2 What priority areas and connection areas are

Priority areas are areas in the Alps most important for biodiversity *according to the criteria used during the biodiversity vision process*: they are the areas important for the largest number of focal taxa or habitat types. Other important areas exist in the Alps, which were selected according to other criteria. For example: IBAs are the most important areas for birds; Ramsar sites are the most important wetlands. However, priority conservation areas are the most important areas in terms of "density" of biodiversity, or where the largest number of focal taxa and habitat type coexist.

Main connection areas are the areas in the Alps potentially most important for connectivity. They may not correspond to areas of overlap of several taxon areas, but they complement priority areas in ensuring resilience, viability of populations, ecological and evolutionary processes, genetic exchange, migration and dispersal. In addition, they ensure the Alps are functionally connected to adjacent regions.

Priority areas and main connection areas:

- represent the results of the joint work of the scientific community in the Alps;
- are defined at a 1:500,000 scale; their boundaries are an approximation;
- are identified to represent the needs of all major taxa and take into consideration all levels of threats;
- are of Alpine importance. Other areas exist that may be important at national, regional, or local level, but these are irreplaceable or unique at an Alpine level and will ensure the ecological integrity of the entire Alpine range;
- represent geographic priorities (focal areas) for conservation, restoration and management, with the objective being to benefit biodiversity as a whole. The best strategy should then be decided after an in-depth analysis;
- provide a context for local action;

- allow strategic planning by highlighting priorities;

- do not imply complete protection or the creation of new protected areas to cover their entire surface;

- should not be considered in isolation – protected areas versus areas to develop: special attention should be paid to the priority areas and the main connection areas, however the entire Alpine range should be looked at with attention;

- are not in competition with the Natura 2000 or the Emerald networks: indeed, they provide a context for these networks and complement them. Areas of overlap should be considered an opportunity for funding and for joint work.

7.3 Critical issues

Some issues turned out to be critical during the process of identifying the priority conservation areas:

- Scale. The scale of work of 1:500,000, while deemed most appropriate to providing an overview of the entire Alps in a short time and yet in a meaningful way, was cause for some adjustment in thinking on the part of few scientists, conservative and perfectionist by nature. However, to be able to have a pan-Alpine view of important biological areas – a context which was still missing for the Alps – the rough scale could not be compromised. Most scientists agreed and those who were not used to such scale quickly adapted to it;

- Synthesis of detailed data. Given the huge amount of knowledge and data existing for the Alps, some scientists regretted not being able to work at a more detailed scale, leaving out most of the local data they possessed. Detailed data, however, are difficult to manage when working at a scale of 1:500,000 and are not helpful when the purpose is to develop an overall picture with approximate locations and with an indication of where the *priorities* are. What is more, details become more meaningful when the area they refer to is placed in a wider context. After some discussion, then, despite the fact that the level of detail of work was new to most scientists, they superbly met the challenge and provided excellent overview maps. They did so *synthesizing* what they knew, and relying on their knowledge and experience rather than on their databases (their unrecorded knowledge, which was the focus of the methodology);

- Accuracy of the maps. Some experts who were involved in defining the biodiversity vision expressed concern about the inaccuracy of some maps. While inaccuracy was an issue in the first drafts of the maps (given that some experts were not able to contribute as expected and that some data were still missing), this was definitely improved in later drafts and still further in the final versions of the maps. To date, only the map of internal connection areas is still inaccurate, while the maps of priority areas and of external connection areas are considered complete and accurate. The current map of external connection areas should be integrated with the corridors identified in Gap in 2002, with the suggestions for the extension of priority area boundaries and with the other corridors suggested (this is described under items 3, 5 and 6 of 5.7 *Other analyses*, and summarized in Chapter 6 *Results on connection areas*). In addition, it should be kept in mind that the work at the scale of the entire Alpine range is at a low level of detail, and this should not be confused with inaccuracy. At this scale (1:500,000), additional information or small changes in taxon areas are not likely to lead to significant changes in the overall map of priority areas. Detail will become very important when looking at the individual priority areas and main connection areas when defining concrete actions;

- Heterogeneous criteria. The criteria used to define taxon maps differed from group to group and some experts were concerned that this might be a flaw in the methodology. This, however, should not be seen as problematic – provided that criteria are appropriate for each taxon and consistent *within* each taxon (and not *across* taxa). After all, why should criteria for the identification of areas important for mammals be similar to those for insects?

- Focal species. In some instances the focal species selected were widely distributed throughout the Alps. In these cases, it is difficult to identify meaningful taxon areas without highlighting the entire ecoregion. Appropriate criteria for the identification of important taxon areas should therefore be set for these focal species (e.g., not the entire potential distribution area of a species but the limited areas where the species reproduces, etc.). The spatial needs of wide-ranging species can then be addressed when determining the boundaries of the priority areas and identifying the main connection areas. Alternatively, it may be better to select focal species that are not so widely distributed;

- Boundaries of priority areas. Priority areas which have been identified from an overlap of taxon areas tend to favour small areas with multiple overlays. Indeed, the areas of maximum overlap are often determined by taxa that do not require large spaces (e.g., invertebrates), and the space requirement of wide-roaming species is thus not incorporated into the boundaries of the priority areas. To minimise this problem, the area needed for the minimum viable population size of wide-ranging focal species should be calculated and incorporated into the boundaries of the priority areas; or the largest extent of the important areas of any given wide-ranging focal species could be used as a boundary for the priority areas;

- Involvement of socio-economic experts. To delineate the biological areas of importance the key experts are biologists, and biologists did participate actively in the process. A few socio-economic experts participated in the process of identifying priority areas – especially for the preparation of the reference maps and for the working groups at the Gap workshop on threats and on goals and targets – but their role was not prominent. The point was made that the biodiversity vision would become too difficult to realize without an assessment of what is feasible from a societal point of view. Concerning this, however, it should be noted that first biologists decide on the biological priorities; then socio-economic experts will play a huge role in deciding in which biological landscapes to focus subsequent action and what exactly can be done. The chance of creating a map of pure biological interest is precious and should not be jeopardized by taking out biological areas that are not viable for conservation due to socio-economic considerations. The overall picture of what should be conserved and what has already been lost would not be complete and negotiations for conservation would have a weaker basis.

7.4 Strengths of the approach

The approach described in this report presents several strengths.

First of all, it is a rapid way to achieve results as it relies on the knowledge of experts – especially that which is unrecorded – which synthesizes complex and detailed data. The expert-based approach works well when the scientists are at ease with group work, are knowledgeable about the entire ecoregion or at least a large portion of it, and are familiar with working at a large, rather than a fine, scale.

The approach provides results at a relatively low cost given that: a) it does not require field work as it uses existing data and knowledge; b) it requires relatively little personnel time as the process is short; and c) it is not technology-intensive.

And yet the method is robust, as can be proven in four different ways:

1. the sensitivity analysis performed on the taxon overlay demonstrates that limited changes in the layers or in their weight do not imply significant differences in the overall results. Priority areas did not change significantly when taxon sub-layers were included as separate layers (e.g. assigning more weight to the taxa with sub-layers: mammals and insects) or when the wilderness area map was included in the overlay (see 3.8);
2. the flora/vegetation map is plausible even if it may look uneven, with flora and vegetation together and with apparently different criteria applied to the western and to the eastern Alps (see 3.7);
3. after seeing the results, the participants in the workshops were satisfied with them, despite some critical points and objections in the process. After all, it is natural that some biologists feel uncomfortable going through this process: the goal is to aggregate biological knowledge of all taxa into a message clearly understood by policy or decision makers and it may therefore be seen as an indistinct area between science and policy;
4. the results are in agreement with the findings of at least two other prioritization exercises: a) the irreplaceability analysis of the Italian National Ecological Network (Rete Ecologica Nazionale – REN) for the Alpine region, which identifies areas in the western pre-Alps and in the eastern Alps; and b) a study from 1974 on the future of the Alps by IUCN and the Italian Alpine Club, which identifies areas similar to the priority areas for future protection (see *References*, UICN and Club Alpin Italien).

It was pointed out that some of the method may sound subjective and unscientific. The key – and the strength of the approach – is the scale: if results are achieved for the entire Alps at this rough scale which can generally be agreed upon, then small details in the way these results were achieved should not be given too much weight, as they may very well belong to a different (i.e. more detailed) scale of analysis.

7.5 Lessons learned

During this long process, some things worked very well, others could have been better. In any case, several lessons were learned.

The involvement of partners in the process from the beginning was invaluable. WWF took the lead, and the other three partners of the Consortium each took on different responsibilities according to their fields of expertise and operations. The Consortium was thus rather efficient in adapting the standard methodology to the Alpine situation, engaging a wide spectrum of experts from all Alpine countries, collecting data, communicating with third parties, taking the conclusions to appropriate fora. As a result, the overwhelming endeavour of developing a biodiversity vision for the Alps became manageable.

The contribution of the scientific community was also of great value. An exercise such as identifying the priority conservation areas of the Alps could have been undertaken behind closed doors, but the results would have lacked the thoroughness they currently have and the whole process would have not benefited from the engaging discussions which took place. The criticism of the scientists has always been an important aspect of the process: it has strengthened convictions regarding the methodology and results when it was positive; it has forced reviews and further thinking when it was negative.

Other lessons were learned specifically about the workshops:

1. Involve the experts as early as possible in the process for data collection, definition of criteria and preliminary drafts. If the experts collaborate on the data collection, more data, and more suitable data, can be gathered. If criteria are well defined in advance, the workshops can be devoted to the working sessions and as a consequence the expected outputs will be more complete: indeed, knowledge gaps remaining after the workshops require time and complex logistics to fill. If the majority of experts are involved early on in the production of preliminary drafts, the negative impact of the absence of some experts from the workshops will be offset;

2. Be prepared for cancellations and have substitute experts ready to attend the workshops. Cancellations are natural, but the organizers should be prepared for them and have alternative experts ready. All invited experts should be made aware that their cancellation will be likely to cause problems and they should be responsible for finding a replacement with the same expertise, if possible. If experts are involved early on in the process, they will feel ownership for the output and cancellations may decrease; their absence may be less of a problem if they have had the chance to contribute in advance. Absence of a key expert from a workshop, however, will limit the constructive discussion among the scientists present;

3. Involve the workshop moderator as early in the process as possible, or invest appropriate time and resources to bring him/her up to date with the process, objectives, etc. A knowledgeable moderator who is well respected by scientists is the best insurance for a smooth and successful workshop. A scientific background is an asset but not a requirement; an understanding of the needs and way of thinking of the scientific community is a must;

4. Ensure all facilitators of working groups are involved in the workshop preparation and attend a specific training session immediately before the workshop. There should be no uncertainty as to the output required, the next steps and the level of detail of the working groups. These issues should be addressed in the pre-workshop training session, together with a detailed overview of the workshop programme and a run through of the methodology;

5. Plan a process for filling the gaps. Prior to the workshops develop a clear process for filling in data gaps and conducting a peer review of the final product. Present this process during the vision workshop, and assign specific responsibilities to experts.

This will build confidence in the products, and will also ensure continued engagement of experts towards developing a conservation strategy;

6. Nominate one person to record all points made during the discussions in the plenary sessions**.** These notes should then be incorporated into the proceedings. The organizers of the workshops are often too busy to ensure smooth working sessions and other details: it is therefore important to designate one person who is responsible only for recording the discussions in the plenary sessions and to keep track of the changes to the programme;

7. Nominate one person to archive all documents (maps, datasheets) as they are collected from the working groups**.** This person should know at all times what maps are available, in how many copies and where they are. He/she should be responsible for preparing the set of maps for each group and for each working session. He/she should also be responsible for checking all datasheets when they come in, making sure they are linked to the appropriate map layers, to the moderator of the group and to the group members; and ensuring datasheets are complete and legible. If some of this information goes missing at the workshop, it will be very time-consuming, difficult or even impossible to collect it afterwards;

8. Ensure each working group includes an organizer or moderator well acquainted with the methodology. This will avoid uncertainty and side-tracking during the working sessions, allowing the group to focus on the objectives and on the proper methodology. Moderators must be good facilitators who can keep the group focused on the tasks and moving forward;

9. Allow adequate time to discuss and agree upon criteria to be used for each step of the process. This will avoid different interpretations of instructions within subgroups and will ensure greater confidence and buy-in for final overlays and products;

10. Ensure that the decision-making line is clear. Nominate one person to be the contact person to, and advisor of, the general moderator of the workshop: the moderator should not be side-tracked by participants who are not familiar with the methodology. Nominate a core group of people who will make decisions on the spot regarding changes in the methodology or the programme. Such decisions should be quick and effective and not require pooling the opinions of too many people;

11. Hold a debriefing meeting with the organizers and the group facilitators at the end of each day. This will prevent the accumulation of errors or misunderstandings and will ensure that the programme for the following day is clearly understood and well planned;

12. Prepare clear material for the working groups. Prepare datasheets for each session of the workshops. This will refine the focus of group members and better organize their contribution. Make sure sheets are adapted to the specific ecoregion context and that there is agreement on definitions of terms for all datasheets to avoid confusion in small groups. Instructions for the working sessions should be written and copies should be made for all, moderator and group members.

8. *Outlook: the future of conservation in the Alps*

8.1 What the biodiversity vision is

The biodiversity vision of the Alps, with the identification of geographic priorities (priority conservation areas and main connection areas), provide governments and other administrations with a tool to implement several international conventions, including: the Alpine Convention, the Convention on Biological Diversity, the Ramsar Convention on wetlands, the Bern Convention on wildlife and the natural environment, the Bonn Convention on migratory species.

The biodiversity vision *integrates* (and does *not* replicate or replace) the Natura 2000/Emerald network. The biodiversity vision identifies areas with *high biodiversity value*; Natura 2000/Emerald identifies sites that are important for single habitat types or species. Conservation of Natura 2000/Emerald sites prevents extinction of individual species or habitats, but it does not preserve the ecological integrity of ecoregions according to the four pillars of ERC listed under 1.4 (viable populations, representation, ecological processes, large blocks of natural habitat).

The biodiversity vision represents a necessary step towards identifying in detail the ecological network at sub-national level, as an integral part of a wider national and pan-European ecological network. Only working at the scale of the biodiversity vision allows us to “design” an ecological network on a broad scale (ecoregion), which is one of the most meaningful scales.

From an ecological point of view, parks are not islands, communities are not isolated from their environment, and individual sites need to be managed keeping in mind the wider landscape in which they are found. The biodiversity vision thus provides a context to protected areas and other individual sites and advocates for their integrated management within the surrounding landscape (as strongly recommended by the Convention on Biological Diversity).

For protected areas, ecoregion conservation represents a helpful tool for the organization of different categories of protected areas into a “system”, identifying common strategic objectives and the role of individual areas within the biodiversity vision.

The biodiversity vision facilitates a helpful gap analysis of the current "system" of protected areas, highlighting gaps and identifying areas for new protection in relation to the strategic objectives of biodiversiy conservation.

The results of the ecoregion process achieved so far (up to the biodiversity vision) have been possible only thanks to the macroscopic scale and the pan-Alpine point of view which were adopted. Individual public administrations – given their restricted land jurisdiction – by definition would not have had the wider vision needed for this exercise. The four partners of the Consortium (WWF, CIPRA, ISCAR and ALPARC) – present in all Alpine countries – represent a point of view which embraces the entire Alpine range. This broad point of view is strengthened by alignment with the principles of the Alpine Convention.

The scale of analysis of the biodiversity vision (to identify priority areas and main connection areas) is 1:500,000, thus rather coarse. Far from being a weakness, this has allowed macroscopic conclusions to be drawn at a pan-Alpine scale. Public administrations, scientific institutions and NGOs now have the opportunity to identify and analyse areas in more detail and place them in a pan-Alpine perspective.

8.2 Next steps

The map of priority areas and main connection areas is a starting point for conservation work. With a biodiversity vision (a desired scenario and a shared set of priorities) the foundation has been laid for a conservation programme. Vision and programme together will allow for strategic planning of biodiversity conservation and sustainable development in the Alps.

The development of the biodiversity vision of the Alps opened up a debate on how best to ensure the conservation of the Alps. This debate had already been launched by the Alpine Convention, but it had somehow remained restricted to its forum and had not yet filtered out to the world outside it. The biodiversity vision process described in this report has brought the discussion to other fora.

The results of this work will be offered to the Alpine Convention as the contribution of NGOs to conservation in the Alps (and in particular to the implementation of the Nature Protection Protocol). By developing a vision together with partners from several different sectors we are also creating a single, unified, clear and powerful voice with which to communicate to decision makers and policy makers. They, in turn, can benefit from this clarity, as decision making has had too little biological input and has been beset by unclear messages from various interested parties.

Having a clear, shared vision will make it easier to share roles and responsibilities. Not one single public administration or decision maker or NGO or community will be able to accomplish the vision alone: sharing responsibilities and action is the only way to get it done. Those involved in the process so far will be able to build a stronger network, form partnerships and devise a strategic division of labour to achieve the shared vision.

In addition to communicating priorities to decision makers, this process has strengthened the sense of belonging of Alpine scientists and of other groups. This feeling of ownership will undoubtedly lead to more concerted actions, actions aimed at the specific issues raised during the process.

Several next steps are planned or envisaged:

- The biodiversity vision developed with conservation experts is now ready to be taken up by other interested parties (communities, administrators, etc.) who will find the best way to work towards its achievement in accordance with the needs and knowledge of other sectors;

- For priority areas and connection areas more detailed analyses at a landscape level are needed to plan the most appropriate actions for conservation, protection, restoration, management and sustainable development;

- A model for the development of an action plan for biodiversity at the scale of a priority area is being developed in transnational area H1 (Sottoceneri-Colline Comasche-Alto Lario, shared by Italy and Switzerland). The action plan will integrate other existing policy tools and will try adapt approaches already used elsewhere to the specific local situation;

- Other concrete projects for the implementation of the vision are taking place in other priority areas. For example in area L (Engadina-Stelvio/Stilfser Joch) with activities for the conservation of dry meadows, or in area M (Brenta-Adamello-Baldo-Alto Garda) for the inclusion of biodiversity into a certification process. Several other examples exist;

- As for research, a new common project of the Consortium (WWF, ISCAR, CIPRA International and ALPARC) is under preparation, which will focus on defining a standard methodology for the identification of corridors in large ecoregions. A pre-proposal for a large-scale project is currently being developed. The results on connection areas described in this report will inform the project, and conclusions of the project can then be used by other ecoregions.

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PART V – ANNEXES