COST Strategic Workshop, 7–9 April 2008, Innsbruck

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Source: Mountain Research and Development, 28(2) : 172-173

Published By: International Mountain Society

URL: https://doi.org/10.1659/mrd.1017

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The Continuum Project
Establishing Ecological Networks Throughout the European Alps

The Alps are one of the largest natural regions left in Europe and therefore of particular importance for biodiversity; but they are also home to 14 million people and one of the most visited areas in the world. This is not without impact on biodiversity. Habitat loss and fragmentation, climate change, changes in agricultural practices, and pollution are among the most important reasons for biodiversity loss and landscape destruction in the Alps. The creation of a functioning ecological network in the Alps can help to conserve extraordinarily rich alpine diversity. Two closely linked initiatives are working together to implement an ecological network: on the one hand the Ecological Continuum Project initiated in June 2007 by the Alpine Network of Protected Areas (ALPARC), the World Wide Fund for Nature (WWF), the International Scientific Committee on Research in the Alps (ISCAR), and the International Commission for the Protection of the Alps (CIPRA); on the other, the Ecological Network Platform of the Alpine Convention.

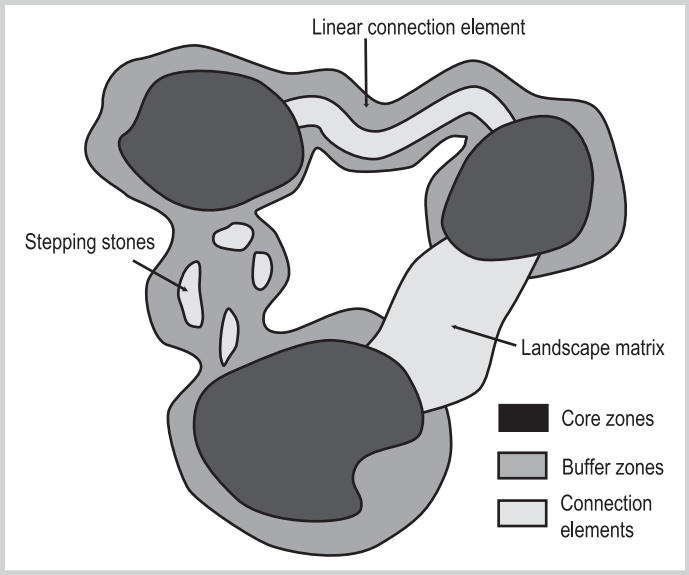

FIGURE 1 The concept of ecological corridors. (© Continuum Project)

The concept of ecological corridors

Natural and sufficiently large habitats constitute the core areas of an ecological network. These core areas can be connected to one another, for example through "ecological corridors" (Figure 1). Ecological corridors are linear connection elements allowing the passage of species between different living spaces, thus enabling genetic exchange between populations. Corridors are made of landscape elements and small features such as field ditches, forest strips or forest edges, dry stone walls, and rock piles. Sustainably managed farm- and woodland can also function as a corridor, and small but well-preserved biotopes create stepping stones in a corridor system. Especially in areas where human land use has created barriers, connecting elements must be preserved or re-established.

Ecological networks are not only beneficial for fauna and flora but also for people. Meadows and pastures lining a stream contribute effectively to flood protection; revitalization of water courses can turn jogging or a Sunday hike into an exciting nature experience; sustainably managed forests provide effective protection against avalanches; on heavily settled valley floors, ecological corridors act as green lungs and therefore provide better air and attract tourists. A well-structured landscape can define the character of an entire region.

However, networking can also entail risks: endemic species—ie species occurring only in the Alps—can be threatened by invasive species dispersing along the connecting elements. The quality of ecological corridors therefore plays a crucial role in minimizing this risk.

A multisectoral and multilevel challenge

Ecological connectivity is best attained through sustainable land use as well as harmonious coexistence of humans and nature, rather than restrictions or prohibitions. Many nature protection measures can contribute to ecological networks, provided they are promoted and supported by policy-makers at local, regional, and national levels in a coherent way:

- ***Land use and traffic planning:*** Even if ecological networks cannot be established without high-level decision making, their implementation requires local consensus. Land use and traffic planning play a key role in this context. Connectivity and other land use interests have to be considered on equal terms, at the

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FIGURE 2 A well-structured landscape offers a habitat for a variety of species. (Photo courtesy of Continuum Project)

outset of the local and regional planning process (municipalities, regional authorities).

- ***Agriculture—the backbone of the landscape:***
  Farming has a crucial impact on biodiversity in the Alps. Many habitats originated from traditional human land use (Figure 2). Intensive agriculture and urban expansion on valley floors can create obstacles to fauna migration. On the other hand, traditionally farmed fields at higher altitudes have outstanding biodiversity value. The latter are increasingly threatened by abandonment of farming practices. It is therefore crucial to engage farmers in networking projects. Thorough information will make farmers aware of the importance of connecting habitats. Their work practices can thus be adapted to the needs of biodiversity and connectivity.
- ***Hunters and foresters:***
  Hunters and foresters can be ambassadors for ecological networks based on their traditional role and activities. Sustainability plays a significant role in their line of work. In this respect, they play an important role in raising people's awareness of the importance of sustainable forest and wildlife management.
- ***Water management:***
  Water courses are considered linear connecting units in ecological networks, providing animals with shelter and food. They also help in orientation during migration. This important role can be secured in the long run only by conserving well-maintained river courses, ensuring high-quality water, and revitalizing riparian zones. Functional floodplain forests and wetlands play an equally important role.
- ***People:***
  Ecological networks are not only a large-scale matter. Everyone can contribute, for example by tending a near-natural garden, using areas in a sustainable manner, or hiking in a more nature-friendly way.

Well-connected habitats are important beyond the local scale. Some species, such as the wolf, the lynx, and the bear, need wide natural areas. This also applies to large ungulates such as deer, and large birds such as the bearded vulture and the golden eagle. To conserve these species in the Alps, collaboration is needed. Concrete actions for the establishment of an ecological network, however, will occur predominantly at the local level. The impact of global phenomena such as climate change is increasingly significant and therefore requires the development of a pan-Alpine strategy. Establishing an ecological network can be a cornerstone in a consistent response to global climate change. Facilitating the passage of species displaced by shifting climatic zones will help them find new suitable habitats and allow them to modify their range, thereby improving their chances of survival.

The Ecological Continuum Project

ALPARC, CIPRA, ISCAR, and WWF's European Alpine Program have been carrying out joint activities for the conservation of Alpine biodiversity since 2002. The 4 organizations introduced a new approach to Alpine nature conservation by looking at biodiversity from an *Alps-wide* as opposed to a *national* perspective. Taking this approach a step further, a new project—the Continuum Project financed by the Swiss MAVA Foundation for Nature—was started in June 2007 with the aim of creating or restoring ecological connectivity between important areas for nature conservation.

Foundations are currently being developed in a pre-project (until

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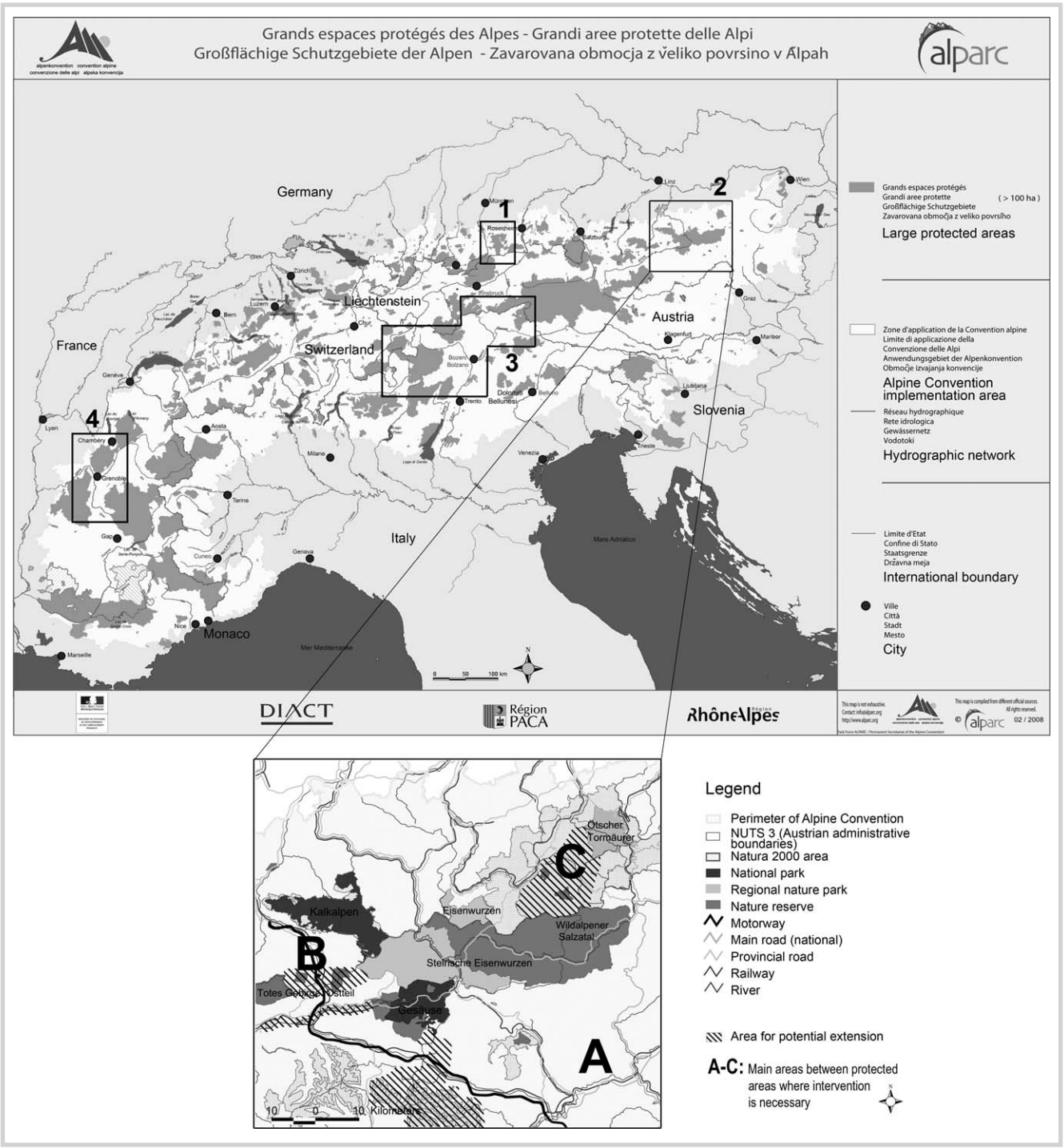
FIGURE 3 Protected areas in the Alps and location of the 4 pilot areas, with 1 of them enlarged. (© Continuum Project; maps adapted by *MRD* for this article)



end 2008) for long-term implementation of a consistent ecological network in the Alps. The findings of the Swiss National Research Program NRP48, "Landscapes and Habitats of the Alps," are being integrated. One important objective of the pre-project is to elaborate a joint Alpine methodology for connecting important areas and develop a catalogue of possible measures to enhance connectivity.

In a first step the Continuum Project evaluated and assessed methodological approaches currently used or proposed for establishing ecological networks. Four approaches—the Pan-European

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Ecological Network approach (PEEN), the Swiss Ecological Network (REN), WWF's Ecoregion approach, and ALPARC's Protected Area approach—were assessed by 16 experts (scientists as well as members of the Ecological Network Platform), based on a questionnaire. The suitability of the 4 approaches differs clearly regarding aims, scale, data needs, and implementation. The results of the expert assessment were verified in a workshop in December 2007 in Zurich (Switzerland), leading to recommendations on priorities (where are ecological networks most needed?), methodology (what are the most appropriate approaches to achieve the different goals?), and procedure (how can regional projects for ecological networks be developed?).

A second objective of the Continuum Project is to carry out initial concrete actions in 4 pilot areas. The areas are dispersed across the Alpine Arc (Figure 3, showing the Arc and the pilot regions [1–4]).

- **Berchtesgaden–Salzburg transboundary region (1):**
  This comprises the Hagengebirge, the Salzburger Kalkhochalpen nature reserves, and Natura 2000 sites. The area is of great environmental interest and part of one bio-geographical entity. Many transboundary cooperation projects such as data exchange and scientific research already exist. With the Continuum Project this cooperation is now being broadened.
- **The eastern Austrian region (2):**
  The region around the Kalkalpen and Gesäuse national parks, with its large forest cover, small cultural landscape structures, low fragmentation, and high biodiversity, is perfectly suited for the project. In addition, the area is an important link to other Alpine regions and the Carpathians (Figure 3). Based on the results of the 2004 ALPARC study, the Kalkalpen and Gesäuse national parks and other protected areas have already initiated the establishment of an ecological network.
- **Engadine–Alto Adige–Valle dell'Adige (3):**
  This pilot region will consider connectivity in 2 areas at the border between Italy and Switzerland. The first area runs along the Adige River valley, which is densely populated and intensively used by irrigated agriculture, and the Inn valley, which crosses migration routes from the south and east. The second area aims to connect existing protected areas: Adamello Brenta–Stelvio–Swiss National Park, and from the Nature Parks in South Tyrol (Italy) to the Hohe Tauern National Park in Austria. For these protected areas a main concern is to establish transboundary ecological networks to assure biological exchange and large migration areas (eg for brown bear).
- **The French Département de l'Isère (4):**
  The Département de l'Isère in the French Rhône-Alpes region is an intensely anthropized area with a strong need for rapid intervention to prevent human settlement from spreading continuously from Valence to Geneva. The valleys of this region are main migration routes of pan-Alpine significance—especially for birds; they are also of great importance for local migration of individual species between the regional massifs and the main large protected areas (Les Ecrins National Park, and Vercors, Chartreuse, and Bauges nature parks). The Département de l'Isère has been working on ecological networks since 1996. A map of all ecological corridors in the region has been serving as a basis for various implementation activities such as bridges and tunnels for game, speed limits, public relations work, and integration in planning processes. For all future Alpine projects it is extremely valuable to capitalize on this experience.

The Ecological Network Platform

The Ecological Network Platform is a key instrument for implementation of the nature protection goals of the Alpine Convention; its aim is to help partners advance work on an Alps-wide ecological network. The Platform was established under the Alpine Convention in 2007. The Platform members are expert governmental staff from all Alpine countries, as well as observers from the Alpine Convention and NGOs. The goal of the Platform is the establishment of an Alps-wide transboundary network of protected areas and their respective connecting elements by engaging with experts, policymakers, and other relevant groups.

Through the Platform, crucial information on measures and methodologies are being shared, refined, and compared between all Alpine countries. The Platform provides an important link between policymakers, the scientific community, and practitioners, and also enables efficient cooperation with other sectors. Within the Platform, experts work in 3 key activity areas: scientific support for the establishment of an ecological network, project-oriented implementation, and promotion of an Alps-wide ecological network. Concrete tasks are the enlargement and integration of transboundary protected areas within the framework of existing activities, for example the development of the Natura 2000 and Emerald networks; the elaboration of methodologies for the connection of habitats, and support for the implementation of connection measures for Alpine species and habitats. Some regions have already started transboundary work. These efforts are being supported and further developed through Platform activities.

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A third objective is to raise awareness among decision-makers about the importance of the ecological continuum—a prerequisite for the inclusion of biodiversity aspects in planning and policy decisions. Ultimately, the Continuum Project will make an important contribution to the work of the Ecological Network Platform (Box 1) of the Alpine Convention, which aims to further develop regional and transboundary connectivity projects within the Alps. Plans are to continue the project until 2009 and integrate further implementation sites. Corresponding projects are in preparation.

Benefits beyond the Alps and for global biodiversity conservation

While endeavoring to establish or maintain an ecological network in the Alps, connectivity to adjacent mountain ranges cannot be neglected. The Alps–Carpathians corridor, for example, is vital for large carnivores. Connections with the Balkan mountain areas or the Apennines, as well as the French Central Massif, the Pyrenees, and the Jura play a key role for the dissemination of many species.

Admittedly, the idea of ecological networking is nothing new. Many conventions, agreements, and initiatives already exist, although awareness of these is sometimes lacking. Internationally, all Alpine countries have committed to the conservation and sustainable use of biodiversity through the Convention on Biological Diversity (CBD). Mountain regions belong to the areas in the world with the highest biodiversity; ecological networks extending over the whole Alpine Arc can therefore make an important contribution to fulfilling global commitments. At the European level, things are becoming even more concrete: a pan-European ecological network is currently being established, in which the Alps will play a key role. The identified Natura 2000 or Emerald sites in the different countries are important building blocks of this project. International collaboration is particularly important for ecological networks. The governments of the Alpine countries are therefore collaborating with conservation organizations and the scientific community within the framework of the Alpine Convention for the implementation of ecological networks enabling undisturbed natural processes.

Further information

Website of the Ecological Network Platform in the Alps:
www.alpine-ecological-network.org

ACKNOWLDEGMENTS

The authors are grateful to Susanne Wymann von Dach, Associate Editor, *MRD*, for helping them compile and edit the material for this article.

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doi:10.1659/mrd.1010

COST Strategic Workshop, 7–9 April 2008, Innsbruck
Global Change and Sustainable Development in Mountain Regions

COST—European Cooperation in the field of Scientific and Technical Research—supports strategic workshops in order to give participants an opportunity to elaborate future research needs. A Workshop on "Global Change and Sustainable Development in Mountain Regions" was convened at the Congress Hall in Innsbruck, Austria, from 7–9 April 2008. The event attracted 342 scientists, experts, practitioners, students, and scholars from 29 European and 10 non-European countries. It featured keynotes, discussion groups, and presentations of ongoing projects. The keynotes were presented by leading experts in their respective fields and focused on currently striking research questions. The format of the discussion groups ensured that every participant had the possibility of articulating their experiences and ideas. The project presentations gave an overview of ongoing activities and were used as a networking opportunity.

The conference led to the following conclusions:

- Ongoing global change (climate, demography, economy, society, politics, and culture) concerns the whole world and is having both positive and negative effects.

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- Mountain regions are particularly sensitive to global change. Comprehensive monitoring systems can help to elaborate strategies that lead to regional sustainable development in mountains.

- Long-term ecological research projects should include strong socioeconomic components and be based on harmonized international strategies. Future research activities should rest on the following pillars: *research + monitoring + education.*

Research needs

Research needs were formulated for the following key topics of global change and sustainable development in mountain regions:

1) Climate change
Monitoring of climate change, development of locally valid climate scenarios using appropriate downscaling instruments. Adaptation strategies need to include aspects of natural hazards.

2) Demographic change
Demographic change—ageing, migration, household changes, etc—is obvious and may be regarded as a second key driver of change in mountain regions. Depopulation and marginalization of remote areas cause many problems related to ecology, economy, and social coherence.

3) Land use and land use change
The desired level of sustainable land use requires updated concepts of land management. Research on land management and ecosystem services is a central need. At present, the profits generated from agricultural and forestry products do not ensure sustainable land management. Marketing schemes for ecosystem services are increasingly required. Decisions on land management need to be based on a credible process of participation.

4) Tourism
Tourism in mountain areas is affected by climate and demographic change and other effects of globalization (new destinations, growing mobility, and new target groups). These global changes have positive and negative effects. There is a great need for research on new concepts and adaptive strategies. Tourism in mountain regions is closely connected to ecology and to traditional forms of land use. Therefore, climate and land use change are decisive factors for the development of this sector.

5) Water
Water is a central ecosystem service. As with climate change and the effects of socioeconomic globalization, demand will rise but production will slow down, and adaptive strategies need to be found. Juridical, ownership, and governance questions must also be taken into account.

6) Transport
The growth of transport generates problems for the European Alps, whereas other mountain regions presently lack accessibility. Transport and transit questions must be examined in a regional context and with a view to future traffic corridors in Europe.

7) International comparison
The European Alps are an intensely studied mountain region. Experiences and results cannot be simply extended to other mountain ranges. Instead, the Alps can serve as a reference for comparative studies across continents.

8) Science–policy interface
Research can no longer be done in an ivory tower. A strong theory–practice combination is also needed as a well-functioning interface with policy.

The need for interdisciplinarity

As participants in Innsbruck had different disciplinary backgrounds and came from almost all mountain regions of the world, the discussions demonstrated very clearly that future research must be designed in an interdisciplinary manner, as mountains are very complex systems. Furthermore, it became very clear that the statuses of development and the problems of different mountain regions are far from similar: therefore, strategies for confronting global change must be defined within the local or regional context.

The outcome of the conference will support numerous existing international networks dealing with ecological and economic challenges in mountain regions. Among other things, the results will be acknowledged and used by The Mountain Partnership (FAO), The Alpine Convention, the Carpathian Convention (UNEP), the International Scientific Committee on Research in the Alps (ISCAR), the Mountain Research Initiative (MRI), and many others.

The presentations can be found on the meeting webpage at http://bfw.ac.at/mountain/. The page also links to the website of the Mountain Research Initiative, where webcasts of the keynote presentations are available free of charge.

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doi:10.1659/mrd.1017

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