The Continuum Project

EVALUATION OF APPROACHES FOR DESIGNING AND IMPLEMENTING ECOLOGICAL NETWORKS IN THE ALPS

ASSESSMENT REPORT

INCLUDING QUESTIONNAIRE AND FULL ANSWERS OF EXPERTS

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The Ecological Continuum Project was started in June 2007 by ALPARC (Alpine Network of Protected Areas), CIPRA (International Commission for the Protection of the Alps), ISCAR (International Scientific Committee Alpine Research) and the European Alpine Programme of the World Wide Fund for Nature (WWF) with the aim of maintaining or restoring ecological connectivity between important areas for nature conservation in the Alps. The project is financed by the Swiss MAVA Foundation for Nature.

During a pre-project (2007-2008) the Ecological Continuum Project compiles some basic information for following project for establishing ecological networks in the Alps, mainly

- to harmonize terminology, including a common definition of the "ecological continuum" to be submitted to the alpine states and the EU;
- to evaluate and assess existing approaches in view of their application in the Alps;
- to identify the most important, appropriate and promising pilot regions;
- to define a catalogue of measures for the implementation of an ecological network,
- to develop a strategy for the involvement of authorities and stakeholders;
- to develop a coherent communication campaign;
- to finalize a proposal for a main-project to be submitted to the MAVA Foundation.

Contents

Evaluation of approaches for designing and implementing ecological networks in the European Alps

SYNTHESIS & RECOMMENDATIONS

Framework and goals

Within the Continuum Project (pre-project July 2007-December 2008, see page 2), four aspects considering the planning and implementation of ecological networks in Alpine space have been deepened: The evaluation and assessment of existing approaches (Work package A ; WPA), the listing and description of existing measures (Work package B), first elements for communication on ecological networks and mobilisation of stakeholders in appropriate pilot regions (Wok package C) and preparing future projects on ecological networks (Work package D). See: http://www.alpine-ecological-network.org

This report summarizes the results of Wok package A, aiming at an overview on existing approaches and an assessment in view of their application in Alpine space and in pilot regions.

Workflow

Four approaches already in use have been selected for the evaluation: A) WWF Ecoregion approach; B) Connectivity between Protected Areas by ALPARC; C) Pan-European Ecological network PEEN and D) Swiss Ecological Network REN. On behalf of a questionnaire different aspects of these 4 approaches were assessed by 18 selected experts (14 scientists and 4 national representatives of the Platform Ecological Network of the Alpine Convention) as scale, data need, use for implementation, possible combinations. Additionally the experts were asked to give a general impression on actions needed. The answers to the questionnaire (see Appendix 2) had been summarised (Chapters 1-3 of this report) and verified at a Workshop in Zurich (10. and 11.12.2007).

The main goal of the Workshop in Zurich consisted in developing a procedure for pilot regions how to apply existing approaches for developing coordinated concepts for Alpine and regional ecological networks (EN).

Main concerns of ecological connectivity in the Alps

Following the experts assessment (chapter 1.1. below), **main concerns for conserving and improving ecological connectivity** in the Alps are:

- Fragmentation by urban development and intensive land and water use mainly in valleys and along river corridors and
- Issues of environmental / climate change such as changing habitats and migration, invasive plants and diseases.

Improving connectivity will only be possible by overcoming institutional and scientific gaps:

- Institutional gaps: Coordination and information across political and legal levels and interest groups towards implementation of connectivity measures, cross-border cooperation
- Scientific gaps: knowledge (mainly in functional connectivity), methodology and heterogeneity of data.

The experts set clear priorities, in which **type of regions** (defined by the Platform Ecological Network of the Alpine Convention) measures for establishing EN should focus on (chapter 1.2.):

First:

- Areas with high biodiversity values (Priority Conservation Areas PCA, Natura 2000, etc.)

- Riverine systems as connectivity elements of the wider landscape
- Densely populated areas in low altitudes
- Areas with high pressure through intensive agriculture, tourism, energy infrastructures, etc.

Second:

- Border areas of the existing protected areas
- Areas linked to large-scale European networks such as PEEN, Alpine-Carpathian network, IBA etc.
- Large scale forest areas

Finally, main achievements of **successful connectivity projects** should be (chapter 1.4.):

- Establish and improve Alp-wide databases for application in cartography, conceptual work and monitoring
- Identify main problem areas on an Alp-wide level such as structural barriers, rivers and connections within PEEN
- Focus on main concerns such as areas with high pressures and areas with a high biodiversity, and rivers
- Build up awareness of public, stakeholders and decision- & policy-makers

Assessment of 4 approaches

A main goal of WPA is an assessment of 4 approaches mentioned (WWF, ALPARC, PEEN and REN) regarding their application in the Alps (details see chapter 2). These 4 approaches had been chosen because of their large spectrum of application, existing documents or their close relation to Alpine space. There exists a range of other approaches focusing on specific ecosystems (e.g. rivers, dry meadows) or species groups (e.g. ungulates, birds). All these approaches are valuable as well and appropriate for application in a given spatial or ecological context!

The 4 chosen approaches are aiming **different goals**:

WWF: Representation of natural communities within conservation landscapes / protected areas networks; Maintenance/restoration of viable populations; Maintenance/restoration of ecological and evolutionary processes; Conservation of blocks of natural habitats.

Source: WWF (2006): A biodiversity Vision for the Alps. Proceedings of the work underatken to define a biodiversity vision for the Alps. Technical Report. WWF European Alpine Programme, Milano (unpublished).

ALPARC: Overview of the current connectivity situation for protected areas across the entire Alps; Presentation of the strategies / measures / regulations adopted by Alpine countries and the EU which contribute towards implementing the regional networking of protected areas, establishing ecological corridors, and ensuring species migration at the national and cross-border level.

Source: Netzwerk Alpiner Schutzgebiete (2004): Grenzübergreifender ökologischer Verbund. Alpensignale 3, Innsbruck (German, French, Italian and Slovenian)

PEEN: The Pan-European Ecological Network PEEN is the first objective of the Pan-European Biological and Landscape Diversity Strategy. It is a coherent assemblage of areas representing the natural and semi-natural landscape elements that need to be conserved or managed in order to ensure the favourable conservation status of the ecosystems, habitats, species and landscapes of European importance across their traditional range. The components of the Network serve three functions, namely: To provide the optimum achievable quantity and quality of environmental space (core areas); To ensure appropriate interconnectivity between the core areas (corridors); To protect core areas and corridors from potentially damaging external influences (buffer zones).

Source: COUNCIL OF EUROPE (2007): The Pan-European Ecological Network: taking stock. Nature and Environment Nr. 146, Starsbourg

REN: The Swiss REN follows the same overriding objectives as the PEEN (recording and presenting the various functions of the landscape and its potential) and is designed to contribute towards the protection and restoration of habitats to ensure genetic exchange; the linkage of important habitats and their connection through ecological corridors; reducing the fragmentation of ecosystems; the linkage of ecological compensation areas in agriculture; the improvement of the quality and diversity of agriculture.

Source: Bundesamt für Umwelt (2004): Nationales ökologisches Netzwerk REN. Schriftenreihe Umwelt Nr. 373, Bern (German and French)

The following table reflects an overview on how the 4 approaches fit with the different criteria of the evaluation (1= fit; 2=partly fit; 3= do not fit; see also Chapter 3):

	WWF	**ALPARC**	**PEEN**	**REN**
Identification of problem areas	2	3	1	1
Application in scales:				
pan-alpine networks	2	2	1	3
regional networks	2	2	3	1
local networks	3	3	3	1
Data need	high	low	medium	high
Data availability	medium	good	medium	good
Data costs	low	low	medium	medium
Implementation /proposition of measures	3	3	3	3
Alpine space	1	1	3	2
Aims of connectivity:				
for species (functional)	1	2	2	1
between habitats (structural)	3	1	2	1
linking species & habitats	2	2	3	1
overcome barriers	2	2	3	1
in/between protected areas	1	1	1	1
environm. dynamics/change	3	3	3	2
for large carnivores	1	2	2	1

All 4 approaches can contribute to projects focusing on ecological connectivity, with the following specific profile:

WWF: analysing corridors for specific species on regional and pan-alpine scale; WWF takes into consideration biodiversity hot spots (PCA) in the context of the Alpine Ecoregion.

ALPARC: analysing landscape and land-use structures from a connectivity perspective on a regional level, ALPARC has a focus on ecological linkage in and between protected areas. Because of using available data, this pragmatic approach delivers not very precise but low-cost results.

PEEN: is appropriate for analysing connectivity on large scale (highland-lowland, several mountain ranges) and between areas of European importance.

Swiss REN is the best developed approach on regional and local level; the mapping of REN is ambitious and data and cost-intensive; REN maps provide a good basis for planning measures at regional and local level; it is also possible to break down the concept on analysing obstacles (approach of REN Isère/France).

Regarding the two main dimensions of connectivity, the spatial dimension (pan-alpine to local scale) and the habitat dimension (structural / functional), the 4 approaches show a clear complementarity:

Dimensions	structural	mix	functional
pan-alpine		PEEN	WWF
regional	ALPARC	REN	
local		REN	

Depending on the regional situation and the goals to reach in view of connectivity, each of the approaches can be valuable for developing EN. That's why, the question for developing EN is not "Which approach?" but "Which goals?".

Proposed procedure in pilot regions

Based on the assessment of the 4 approaches, WPA intended to develop a procedure for the application of existing approaches in pilot regions. Experts made suggestions how to proceed (see details Chapter 4.1. and see Appendix 3: Question 10).

This procedure was discussed and tested at the Zurich Workshop with experts and participants from the Consortium (participants see Appendix 1). For each step a matrix helped to structure the results of discussions (Chapter 4.1 - 4.4.). The proposed procedure includes 4 steps:

1. Problem analysis and setting aim:

- Identifying main problem fields in the area considered (pan-alpine, regional, local) and setting aims for solving the problem

2. Define focus activities:

- Definition of focus activities in main problem fields

3. Select appropriate approaches:

- Assess which of the methodologies (including data need) fits with the aims of a focus activity

4. Prepare implementation:

- Develop procedures to start selected focus activities

1. Problem analysis and setting aims has to reflect the situation in the pilot region. This analysis requires the cooperation of stakeholders (agriculture, forestry, hunting & fishery, tourism, traffic, landscape/nature protection, etc.). In this context it should be discussed if certain indicators (biotopes or species) should be focussed on and how far functional connectivity can be integrated. Problem analysis should be supported by geographical data (GIS) and other available data from administrations and from scientific projects. If necessary data-bases have to be completed or improved (consistency, quality). A sufficient data basis is important for a well supported analysis. At least three main analyses should cover each pilot region: 1) An analysis of the still existing potential for connectivity (-> preservation); 2) an analysis of barriers (ecological and anthropogenic) from local to European relevance; 3) an analysis of the continuum between all types of protected areas and biodiversity hot spots. If ever possible, the methods for these analyses should be strengthened and harmonised: Swiss

REN for potential connectivity, PEEN/REN Isére for barriers and ALPARC for the continuum between protected areas. In this phase of the project, communication will be crucial (see Wok package C of the Continuum Project).

2. Define focus activities: Establishing EN is a multi-level topic and a concentration on specific aims, on areas with high need for action or on most effective measures will be necessary. Therefore, a broad discussion on focus activities should be held with stakeholders in the pilot region. A feasibility study should not be forgotten at this stage of the procedure. A debate on focus activities should include all dimensions (pan-alpine, regional, local) independent of borders. In this context, other than purely ecological arguments also need to be considered: Maybe a certain species of regional interest is appropriate for the promotion of EN (flagship species) or some stakeholders are ready to implement particular measures (e.g. some framers, tourist agencies or a hydropower company).

3. Select appropriate approaches: As far as aims and corresponding focus activities are tied, appropriate methodologies have to be selected. Beyond the 4 approaches evaluated in this project, a range of complementary methodologies should be considered (chapter 2.5.).

***4. Prepare implementation projects*:** The last methodological step will consist in planning implementation projects and measures. The procedure differs widely depending on the type of activity, but the evaluation of the project with appropriate indicators has to be considered as well. In this phase of the project, available experience from implemented measures will be helpful (see Work package B of the Continuum Project).

Of corse this proposed procedure has to be tested and further improved in pilot regions.

1. Introduction

1.1. Main problems identified regarding connectivity in the Alps

Question 1: What are the three most important problems when improving ecological connectivity in the Alps?

All answers to question 1 see Appendix 3.

The answers can be summarized under 5 topics:

a. Urban development, intensive land use

The Alps are a geographical entity with main-fold continuums of diversified natural habitats, most of them still intact and well functioning in coherent ecological networks. More and more human activities and constructions are interfering with ecological connectivity, especially in corridors.

As main problem is regarded the fragmentation of habitats due to human development in large alpine valleys. Growing settlements, tourism and traffic infrastructures as well as intensive agriculture cause barrier effects along the valleys for different taxa and degradation of landscape diversity and functions (ecological and aesthetic). The expansion of settlements around cities is affecting more and more valley slopes, which are often key habitats for many taxa. In suitable farmland, habitat quality is still decreasing, and intensification caused a large-scale decline of many species inhabiting nutrient-poor open land (e.g. birds, grasshoppers, butterflies, reptiles).

Another problem is a practical one, which relates to the topography of the area, and the distribution of urbanized areas. Urban development and intensive land use is developing mainly in valley grounds. Alpine valleys play a crucial role as connecting areas between protected areas, but also between highland and surrounding lowlands. In many cases socio-economic pressure will render difficult the implementation of ecological network in such areas.

b. River corridors

Catchments and rivers are key units for ecological connectivity. Main problems concerning connectivity are:

- Hydropower infrastructures: Loss of longitudinal connectivity, habitat (and genetic) fragmentation due to dam construction and change in the flow regime
- Land reclamation, flood protection: Loss of lateral connectivity, primarily through channel regulation, floodplain modification
- Loss of vertical connectivity, primarily through the channel modification and flow regulation (clogging, intense bio film development, lack of sediment transport, vertical incision of river channel, hydrological decoupling from hill slope). Restoring the sediment regime in altered systems is an important issue also identified by the EU Water Framework Directive

c. Institutional gaps: Coordination and information across political levels and interest groups towards implementation of connectivity measures

Politicians and decision makers are rarely aware of consequences of biodiversity loss. Following, there is no political will and not enough resources (money, land, humans) and local agreement for measures (e.g. to allow natural dynamics). Thus, coordination, communication and information across political levels (from regional to international) – concerned ministries, authorities and interest groups – are essential for the implementation of connectivity measures. Ecological connectivity should be involved into the spatial planning system across regional and national borders. Concerned political and

administrative sectors as well as stakeholders should participate at the processes. In many countries (e.g. in Austria), decision making is dependent of communities, and following, the implementation of cross-border planning and measures is difficult, as community and economic interest do not fit with regional concepts.

d. Scientific gaps: Methodology, heterogeneity of data background, open questions

To improve ecological connectivity in the Alps, the harmonization of different initiatives is needed. Clear common goals are (still) missing and there are no answers for the following questions: where is connectivity appropriate; for which taxa; how will ecological connectivity improve biodiversity and ecological persistence. Knowledge on fauna, flora and habitats, evaluation tools, data sources, methods, scales and references are very heterogeneous regarding different regions. There is also a lack of theoretical knowledge concerning practical effects of connectivity on habitats or species conservation.

It is necessary to make clear, who will set which standards for good/acceptable connectivity. This includes the questions, which approach should be chosen for which situation and whether this approach should be species (functional) or habitat (structural) orientated. The standards have to be accepted by the scientific community as well as by practitioners and stakeholders.

e. Other items: invasive plants/diseases, climate change

Improvement of ecological connectivity in the Alps also improves the distribution of diseases and "pests" and invasive plants along corridors.

Regarding the effects of climate change, the safeguard of lateral and altitudinal ecological continuums will be a crucial element in adaptation to changing conditions for many species and populations, mainly in urbanised areas and in areas of actual and potential tree-line.

1.2. Main types of areas where the Continuum Project should focus on

Question 2: The connectivity project wants to act in a pragmatic way and work with areas where there is a high need for connectivity and where measures for improving ecological connectivity are most efficient. On what types of areas should the project focus?

All answers to question 2 see Appendix 3.

The answers (see table below) reveal a preference for safeguarding or improving connectivity mainly in areas with high biodiversity (not only protected areas!), riverine systems, urbanised areas and areas with high land use pressures, and less in large forest areas, around protected areas and in areas of interest for PEEN.

Some experts recommend, that the project should focus on the identification of barriers within important corridors and concentrate on such problem areas, or, inverse, focus on identifying still open corridors and concentrate on their conservation.

On the other hand, some experts highlight the risks of pragmatic approaches: Ecological connectivity cannot be simplified by setting territorial priorities or choosing some priority habitats or species. Problem areas have to be found by quantitative analysis or by taking into account needs for connectivity in a regional and local context, and pragmatic measures should not only be implemented in areas with the lowest potential or (land use) conflicts.

Legend: Type of area: defined by the Platform Ecological network of the Alpine Convention

Priority: h= high, m = medium, l=low

Type of area	Priority			Comments
	h	m	l	
Areas with high biodiversity values (Priority Conservation Areas (PCA), Natura 2000, etc.)	**8**	2	1	Areas with high biodiversity values (e.g. Priority Conservation Areas PCA, NATURA 2000 sites) have a very important status for improving ecological connectivity in the Alps since they work as core areas *and* connectivity areas. The problem pressure is not so strong like in other areas: Priority areas are already identified, data long-term monitoring led to good data availability, public awareness towards biodiversity maintenance is often good, social acceptance for measurements is increasing and some projects or attempts were already undertaken to increase connectivity. Nevertheless, an alpine-wide project could probably boost such initiatives as long as the maintenance of regional natural treasures is integrated. High biodiversity regions contain important source populations, which have to be preserved to improve ecological connectivity. Without maintaining habitats for source populations, no dispersal will occur anywhere, even though measures are implemented in other areas.
Riverine systems as connectivity elements of the wider landscape	**7**	3	1	Riverine systems (including land strips on both sides) serve as key corridors for aquatic *and* terrestrial organisms, matter (water, sediment, nutrients, organic matter), and energy (stream power). Thus, river-floodplain corridors can be considered as keystone ecosystems for maintaining local and regional diversity and ecosystem processes. Furthermore, a correlation to densely populated low altitude areas exists. Since rivers are already existing linear features, there is no debate about where to create a connectivity zones. An amelioration of the existing situation can often easily be done. But measures are only efficient, if the immediate surroundings of rivers are considered. There are two priorities to focus on: (1) to enlarge existing free-flowing sections, (2) to focus on key "ecological nodes" (e.g. tributary confluences, backwater-main channel intersections, alluvial zones) for enhancing connectivity.
Densely populated areas in low altitudes	**6**	3	2	Densely populated low altitude areas obviously concentrate a great part of the problems encountered and often build long continuous total barriers along valleys. Negative ecological effects because of high fragmentation are permanent and difficult to reverse. These areas cause problems to restore since the costs to install/maintain zones of connectivity are often very high and the social acceptance for connectivity projects might be low.
Areas with high pressure through intensive agriculture, tourism, energy infrastructures, etc.	**6**	3	1	In areas with intensive land use through agriculture, tourism and energy infrastructures problem pressure is strong and fragmentation is high. Monocultures (especially in big valleys), tourism and high wire cables are a big problem (e.g. for birds). But the impacts through tourism and energy use are seasonal and generally reversible and permeability is quite high. Traditional agricultural landscapes, which are of high interest for tourism, also preserve elements of connectivity due to natural constraints. Surfaces with intensive agricultural use are degraded only temporally; the connectivity of such areas can be improved or restored and partial barrier effects are reversible. Already small connectivity projects may substantially increase the inter-linkage between zones of high biological interest (e.g. expending semi natural structures in intensive agricultural land from 2% up to 4% might be a success. But including such measures in an alpine wide strategy is impossible. It must be included into agro environmental subsidies systems. Areas with high land use pressures have often a high need for connectivity measures, but such measures have, even with a high input of resources, very little chances for success.
Border areas of the existing protected areas	4	**5**	-	Border areas are an important link to core areas (often large, long border) and ideal for improving connectivity. Studies were carried out about the functioning of “membranes” (borders, buffer zones of protected areas, etc.) for connectivity, particularly on larger (more detailed) scale. The problem pressure is medium because they are frequently less modified than distant areas. Depending on the distance between borders of existing protected areas, these zones can often easily be connected without huge investments in time and money. Moreover, border zones often already act as connectivity areas for several species and habitats.

Areas linked to large scale European networks such as PEEN, Alpine-Carpathian network (key corridors), IBAs etc.	3	**4**	3	These areas should of course be included to use synergies. But no special efforts are necessary as those areas are already inscribed in other networks. Many important reflexion needed at the start of the project have already been undertaken and much data is available, often already in the right format.
Large scale forest areas	-	3	**5**	Large-scale forest areas are supposed to be functional and in general, forests are increasing. But disruption of the forest continua on valley slopes (e.g. by tourist infrastructures) can cause regionally problems for umbrella species, (e.g. the break down of capercaillie populations) and creates barriers for wildlife.
Others				Future regime shifts as a consequence of average change in temperature and flow and an increase in flow/temperature extremes (e.g. how to enhance ecosystem resilience, e.g. by providing thermal refugia for many Alpine species during hot summers? Areas with endangered species by the climate change and e. g. species of Birds Directive, Habitats Directive, the Red List of the IUCN and the Red Lists in the different countries Ecotones, transition areas, i.e. regions with (steep) environmental gradients (e.g. forested/non-forested; sub alpine/alpine; wet/dry) to include rich habitat diversity, as complementary areas to stable, large-scale habitat types (e.g. large forested areas) that promote (umbrella) species requiring large home ranges or allow for (seasonal) dispersal Still existing open and not/little urbanised areas of importance for connectivity between pristine habitats for wildlife (key-corridors) have to be identified and safeguarded by spatial planning with high temporal priority, especially in areas with a high pressure for urbanisation.

1.3. Priorities in setting aims for improving connectivity in different types of areas (general and specific)

Question 3. What are the most important aims which can be reached by improving ecological connectivity in the Alps? Please set priorities and give reasons for general aims and specific aims

All answers to question 3 see Appendix 3.

General aims	**priority**			**Comments**
	h	m	l	
Improve both, habitat connectivity and connectivity for specific species or populations	**12**	1	0	It would be most appropriated to improve both, habitat connectivity and connectivity for specific species or populations as it includes both, the species and the habitat approach. But it is the most difficult as most complex aim. Habitat connectivity is especially needed for plants, fungi and smaller animals, whereas larger animals and birds need a connectivity for specific species or populations (e.g. stepping-stones, corridors). Connectivity is species-specific and therefore habitat connectivity per se is not something to always favour. Often we do not have information for all species and therefore we have to rely on habitat connectivity as a surrogate. In general the habitat approach is suitable to find connectivity need for most species. For some species the population level has to be considered for finding their needs of connectivity. Selected species are appropriate for working in specific areas. To focus on selected species may be in contradiction to integrated landscape analysis. This aim guarantees a general approach with selected species.

Improve/preserve habitat diversity and connectivity between habitats	**4**	2	0	Diverse habitat types offer niches for a large set of species, while corridors in-between provide areas for dispersal (-> range shifts) The most important reason for species extinction or population decline is habitat loss. The negative impact of fragmentation on populations is in most cases accompanied with habitat loss. In real life, there are only very few examples that show population extinction or decline as a result of pure fragmentation processes. Therefore, I argue that the ecological continuum project should focus strongly on the quality of habitats. And the most sensitive habitats in the Alps (e.g. nutrient-poor, extensively used meadows, dry meadows) are often not covered with protected areas. Preserving, or even better improving habitat diversity includes the protection of endangered species and of (today) common species living in these habitats. It's a more complete approach and should be preferred of the pure species approach. But the specious approach should be used well directed and related to specific regions. But it is always an important aspect of a general, landscape-oriented approach.
Improve / preserve habitat connectivity for (endangered) species or (isolated) populations	1	0	**2**	Would be better than nothing, but preserving the connectivity would more or less just keep the status quo. However, many conservationists would prefer a "habitat approach" over a "species (flagship) approach" Increasing connectivity may also facilitate the exchange of non-native species.
Other general aims				Prevent "common" biodiversity erosion through global climatic changes and increase ecosystem resilience (e.g. re-colonization potential after major disturbance events), maintain biodiversity at both local and regional scales. Allow for environmental dynamics within conservation/connectivity areas (-> ecological and/or evolutionary processes). Connectivity of large area habitats (e.g. forest) and line-like habitats (e.g. freshwater). Increasing the degree of connectivity between contrasting ecosystems (e.g. land-water, high Alpine and lowlands; hillslope-alluvium; etc.). The link between the contrasting systems is very crucial, e.g. for less productive systems the link to highly productive systems is very important. Information of the public and authorities.

Specific aims	**Priority**			**Comments**
	h	**m**	**l**	
Identify and overcome important ecological barriers (terrestrial and aquatic)	**6**	3		With the overcoming of ecological barriers many problems can probably be solved and it's particularly important regarding needs of measures. It seems that e.g. large carnivores can travel far distances through areas that are under high pressure (population). The real problems seem to be the total ecological barriers. If need be, there could be a focus on priority taxa groups. I consider this as a methodological aspect. This point is probably a sub-aspect of the following aim. The question of ecological barriers must in any case be implemented in the reflections of the connectivity in and between protected areas.
Focus on connectivity in and between protected areas and priority conservation areas	**6**	2	1	The focus only on already existing conservation areas will be not enough. The presently protected areas mostly cover habitats at high altitudes that are less endangered than lower lands. Also, nature reserves must not necessarily contain the important source populations (e.g. farmland birds, insects). Corridors should be completed by potential source areas (as at least priority conservation areas are assumed to be). To focus on connectivity in and between protected areas is very important because good data is available, high social acceptance, good monitoring possibilities. Protected areas have a high biological interest (that's why they are protected) and linking them in an appropriate way would clearly improve their quality. It not only a matter of scale but also of system dynamics (i.e. land-use change within

				and between protected areas differs)
Focus on priority species (groups): which ones?	**4**	2	1	The project should try to aim higher and focus on the connectivity of habitats and one should avoid fragmenting the landscape further. However, when it comes to restoring or improving connectivity, the project should do it for the species depending on it. Obviously, the choice is clear if one has to choose what to protect, a very connected or a very fragmented landscape, without knowing anything about the habitat and the species. But the answer is not that simple when one has to set priorities, and the persistence of many species is at play. I would focus on particular species that are a) protected by legislation, b) representative of the Alps, and c) threatened by habitat loss and fragmentation at a particular scale. Some of these species would have connectivity needs at a Pan-European scale, others at the scale of the Alps, some at the National level, others within smaller protected areas. - Mainly aquatic; e.g. "Bodensee-Seeforelle", long-distance migrating species like salmon or *Hucho hucho* - Umbrella species, large carnivores, large herbivores - Insects: butterflies - Birds, amphibians and reptiles - Vegetation: dry meadow species To keep the level of complexity at a reasonable level, we will have to focus on priority species (groups; by the way: "focussing on priority species" is more a strategy than an aim). Criteria for selecting the species are: - requirements of species to habitat quality and spatial distribution (species with high demands that may serve as umbrella species) - species of conservation concern - species, for which the region has a special responsibility (endemic species, hosting a high proportion of European or World population) There are already many attempts to select species of special concern. The Continuum Project should rely on this work, i.e. regarding the lists of priority species of birds (Keller & Bollmann, 2004) or species for which a region has a high responsibility (endemic species). Identify and overcome important ecological barriers are also important aims.
Improve connectivity for the survival of large carnivores	2	0	**4**	There are problems with connectivity (large carnivores still migrate in the Alps), but with social acceptance. At I local /regional context, the social acceptance of such projects would be quite low.
Other specific aims				Promotion for extensive exploitation in agricultural areas Identify existing corridors and man made barriers. Ecological network concept should be broad enough taking into account existing areas where nature can move and man made structures which are hindering possible movement. In first cases the activities are focused to conservation principles in the second one to the restoration measures. We mustn't forget that our aim are ecosystems and not only particular species. If we are looking one group we can easily fall into the trap when a corridor for one species becomes a barrier for another. Improve connectivity in "normal landscapes" (valleys and slopes).

Additional comments are concerning the prioritisation (hierarchy) of aims. The prioritisation is seen as problematical in following terms:

- The general aims incorporate the priority aims for designing ecological networks. Under local conditions (e. g. in case of migration corridors for endangered species) the aims should be specified. Specific aims should contain the preservation and improvement of habitats of endangered species in the focus of connectivity, in and between protected and priority areas. There are the existing potentials for quick efforts of implementation.

- Indeed the problem is more complex regarding that landscape is composed by interactive systems within a given ecological potential, which is itself more or less modified (disturbed) by human transformation. More important than priority aims (species and areas) is a tool for analysing the existing ecological potential for connectivity.
- However, it is not clear if lack of connectivity is currently a problem. Connectivity has become fashionable and currently there is an interest in connecting elements that may not require connections; this may also have negative consequences. Good planning, after a proper analysis of fragmentation effects, is required.
- All aims have to be considered together. It is not useful isolate specific aims, especially the concentration only on protected areas.
- Selected species are needed regarding protection (high need), monitoring and also PR (communication).

1.4. Achievements of a mid-term connectivity project: visions of the experts

11. Your personal vision: what would be the greatest success of the connectivity project at its supposed end after 5 years?

All answers to question 11 see Appendix 3.

This question should give some indication on priorities in view of a following main project. The expressed visions can be pointed out along four axes:

a. Establish and improve Alp-wide databases for applying in cartography, conceptual work and monitoring:

To develop, at alp-wide scale (-> at the catchment, subcatchment scale) a spatially explicitand comparative GIS data-base with relevant data concerning ecological networks as a working tool (minimum 1:100 000) for planning, modelling, monitoring etc. in areas of main interest (e.g. protected areas with extension zones). Such data should focus on key environmental pressures (present and future), on selected biota (e.g. fish, amphibians, mammals, birds, some insect groups), but also a catalogue of localised projects.

Applications of such databases could be: To develop maps, which can help to build understanding about the rational of the continuum, specially in light of the climate change, or an ecological risk map for the Alps that identifies areas that are at high future risk but play important roles (similar to the "red" zones for natural disasters). To come up with common baselines for main connectivity axes (and first examples how to preserve/improve/restore connectivity along such axes and with clear recommendations on how to set priorities in increasing connectivity among the various core areas.

b. Identify main problem areas:

- the most important problems (and information of the responsible managing authorities),
- the main lacks of knowledge needed and development of a pan-alpine scientific project on the functional aspects of connectivity, both aquatic and terrestrial,
- human-induced ecological barriers (e.g. highways, settlements) for the entire alpine arc and several projects to overcome these barriers are launched/ started or already done.

c. Focus on main concerns (not complete):

A clear vision for

- the rivers an the restoration of links between watercourses, wetland and lakes;
- the large carnivores and the installation of quiet protected large areas for ungulates and big carnivores and the connection of isolated populations, especially of ungulates and big carnivores;
- how to deal with the intensification in the farmland in the Alps (e.g. by changing the system of subsidies in a way to improve habitat quality for endangered farmland species);
- improving connectivity of open habitats and permeability of open habitats for forest or ecotone species;
- migrant birds and migrant routes ("footpath"- and feeding areas) and ecological networks for endangered amphibians.

d. Build up awareness of public, stakeholders and decision- & policy-makers

Awareness will be improved

- by realising projects in regional/national contexts, which are based on participatory processes (e.g. advisory board, stakeholder platform for discussions) and successfully supported by locals (policy, economy, population);
- by integrating ecological connectivity topics in national policies and implementations strategies (e.g. national strategies for conservation biodiversity) and by harmonizing the implementation possibilities in the authorities of the various countries in the Alps;
- by arguing with concrete data and facts (on rapid changes in the Alps), and using (interactive) visualisation tools (examples are in use!) and maps for presenting the need for ecological networks.

The Continuum Project will be known

- by the dissemination of proposed measures to persons engaged in nature conservation and protection areas management
- by triggering a few demonstration projects that will apply the proposed approaches, and to develop a clear strategy on how to assess the success of the "connectivity projects", resp. by implementing of appropriate measures to establish ecological corridors in pilot areas, and proof of their (re-gained) functionality (i.e. gene flow!), in particular where formerly connected species occurrences had been interrupted owing to fragmentation and/or (human-induced) barriers
- by supporting stakholders in applying the most suitable methods.

However, the Continuum Project may act as moderator between different groups of interest and pushes the process of implementation. Communication and the involvement of local stakeholders and practitioners is one of the most important actions, which should be undertaken in this context. Further the ECONNECT-Project (www.econnect.org) may act as project manager/coordinator and initiator for the harmonisation of monitoring methods, elaboration of common standards, facilitator of the exchange between stakeholders, and communicator of methods of "good practise". At all three levels, the question of the coordination seems to be important. Not to be neglected are the legal and organisational differences within and between theAalpine countries.

2. Theories and approaches used to design and implement ecological networks in the Alps

2.1. Biodiversity vision for the Alps (WWF)

Source: WWF (2006): A biodiversity Vision for the Alps. Proceedings of the work underatken to define a biodiversity vision for the Alps. Technical Report. WWF European Alpine Programme, Milano (unpublished).

Goals

Representation of natural communities within conservation landscapes / protected areas networks; Maintenance/restoration of viable populations; Maintenance/restoration of ecological and evolutionary processes; Conservation of blocks of natural habitats

Methodology

Methodology for the identification of connection areas: In the development of the biodiversity vision for the Alps, high biodiversity areas and connection areas were areas to focus on and they were identified purely on their biological values. A workshop with biodiversity experts (scientists) and observers (who work on policy and implementation issues) was the key event of the process. Their task was to identify priority areas for a taxon or a habitat type, corridors among the priority areas and preliminary long-term goals for the priority areas themselves.

The identification of main potential areas was coordinated with the ALPARC initiative (Chapter 2.2.). While the ALPARC approach identified corridors at a more precise scale (based mainly on land use and habitats), WWF defined "macro-corridors" or "main potential connection areas" at a rough, non-detailed scale and only approximately located (based mainly on species). Both existing (functional) and potential (no longer functioning but needed and possible to restore) connection areas were considered.

The connection areas have been identified according to experts' knowledge and experience (expert approach) and based on certain given criteria, through a workshop and through further consultations with experts. The intention was to capitalize on what already exists and to maximise synergies. Thus, it had to take into consideration other initiatives: National Ecological Networks, PEEN, NATURA 2000.

The geographic scope of analyses and mapping was the entire alpine range according to the boundaries defined by the Alpine Convention. 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. Three 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.

Results

Important areas for major taxon groups: vegetation/flora, large carnivores, large herbivores, medium and small mammals, birds, 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, Natura 2000 and Emerald sites, Important Birds Areas, Ramsar sites, remote areas, developed areas; Distribution of urbanization hotspots, domestic animal breeds;

Representation analysis by bio-geographic subdivision and by natural potential vegetation; Map of external connection areas: incomplete; e.g. river corridors and several others were not considered; Map of internal connection areas: incomplete; criteria for their identification were hard to define and then to apply, limited number of experts

The work undertaken to identify potential connection areas was a first test of how to proceed and therefore methodology and results should be validated and reviewed by other experts.

2.2. Cross-border ecological network of protected areas (ALPARC)

Source: Netzwerk Alpiner Schutzgebiete (2004): Grenzübergreifender ökologischer Verbund. Alpensignale 3, Innsbruck (German, French, Italian and Slovenian)

Goals

Overview of the current connectivity situation for protected areas across the whole of the Alps; Presentation of the strategies / measures / regulations adopted by Alpine countries and the EU which contribute towards implementing the networking of protected areas, establishing ecological corridors, and ensuring species migration at the national and cross-border level.

Methodology

Methodology for the identification of connection areas: The study focuses on transboundary protected areas as the starting point for a successful networking beyond administrative borders and large-scale protected areas (mainly > 1000 ha or groupings of protected areas, each of which covers a surface area of at least 100 ha).

Results

Recommendations were drawn up for wide-area strategies across the Alps to complement or usefully connect protected areas and for expedient regional links, which make sense by virtue of their geographic vicinity and ecological significance. The implementation possibilities were examined using indicators. In concrete terms the following products were created: Cartographic material of potentially suitable connecting axes between protected areas (model regions only) (1:100'000); Catalogue of indicators enabling a comparison of individual areas as well as a comparison over time. These indicators are then used to assess the progress made with the implementation of connectivity measures; Proposals for measures to improve the connectivity of habitats in the model regions (in the fields of agriculture, forestry, tourism, regional planning, transport); Basis for potential expansion areas in the model regions

2.3. Pan-European Ecological Network PEEN

Source: COUNCIL OF EUROPE (2007): The Pan-European Ecological Network: taking stock. Nature and Environment Nr. 146, Strasbourg

Goal

The Pan-European Ecological Network PEEN is the first objective of the Pan-European Biological and Landscape Diversity Strategy. It is a coherent assemblage of areas representing the natural and semi-natural landscape elements that need to be conserved or managed in order to ensure the favourable conservation status of the ecosystems, habitats, species and landscapes of European importance across their traditional range. The components of the Network serve three functions, namely: To provide the optimum achievable quantity and quality of environmental space (core areas);

To ensure appropriate interconnectivity between the core areas (corridors); To protect core areas and corridors from potentially damaging external influences (buffer zones). PEEN takes into consideration other programmes and initiatives, especially NATURA 2000, Emerald Network, UNESCO Biosphere reserves.

Methodology

Methodology for the identification of connection areas: The project has focused on habitats and species with an explicit European status. The planning scale of the project is such that ecological corridors can only be migration or dispersal corridors. Foraging corridors function on a lower scale and are not included. In this project corridors are included that function on a European scale and that have been analysed on species requirements as well as on system characteristics.

Results

An indicative map (1:5'000'000), showing core areas of international importance and so-called search areas (-> area enlargement or connection via corridors is considered an effective contribution to a robust ecological network).

2.4. Swiss National Ecological Network (REN)

Source: Bundesamt für Umwelt (2004): Nationales ökologisches Netzwerk REN. Schriftenreihe Umwelt Nr. 373, Bern (German and French)

Goals

Setting up a national ecological network (REN) is one of the main objectives of the Swiss Landscape Concept and of the Landscape 2020 model of the Federal Office for the Environment (FOEN). The REN is Switzerland's contribution to the three pillars of the strategy for the conservation of biological and landscape diversity at the European level: the NATURA 2000 network, the Emerald Network, and the Pan-European Ecological Network or PEEN (Chapter 2.3.). It follows the same overriding objectives as the PEEN (recording and presenting the various functions of the landscape) and is designed to contribute towards the protection and restoration of habitats to ensure genetic exchange; the linkage of important habitats and their connection through ecological corridors; reducing the fragmentation of ecosystems; the linkage of ecological compensation areas in agriculture; the improvement of the quality and diversity of agriculture.

Methodology

Methodology for the identification of connection areas: The guidelines described in the PEEN have been incorporated into the REN. However the ecosystem approach adopted for the REN differs from the PEEN due to the specific national characteristics (e.g. geographic extension, parcelling, etc.), the methodology used for obtaining information, the procedure used for interpreting the functions of the designated ecological network and the use of additional basic concepts. The REN is founded on the following basic concepts: continuum, core area, expansion area, development area, ecological corridors and the potentiality of landscapes. REN draws great attention to measures for overcoming obstacles. The implementation of the REN is based on overlaying the results of various complementary methods which taken individually do not allow any conclusive statements.

Results

The REN survey maps (1:500`000 and 1:100000) show the degree of networking among the specific networks and the fragmentation of ecosystems in Switzerland. REN working maps (1:25000) which at the regional level can serve as a basis for more detailed maps.

2.5. Comparing the 4 approaches regarding goals, methodologies and data

The elements of the 4 approaches that should preferably be combined are listed below, subdivided into the sections goals, methodology, and data. The approach at the beginning of each paragraph indicate the approach from which the text element comes.

2.5.1. Goals

WWF

Representation of natural communities; maintenance/restoration of viable populations; maintenance/restoration of ecological and evolutionary processes; conservation of blocks of natural habitats

PEEN

The components of the Network serve three functions, namely: to provide the optimum achievable quantity and quality of environmental space (core areas); to ensure appropriate interconnectivity between the core areas (corridors); to protect core areas and corridors from potentially damaging external influences (buffer zones).

REN

REN is designed to contribute towards:

- the protection and restoration of habitats to ensure genetic exchange;
- the linkage of important habitats and their connection through ecological corridors;
- reducing the fragmentation of ecosystems;
- the linkage of ecological compensation areas in agriculture;
- the improvement of the quality and diversity of agriculture.

2.5.2. Methodology for the identification of connection areas

WWF

The geographic scope of analyses and mapping was the entire alpine range according to the boundaries defined by the Alpine Convention. 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.

In the development of the biodiversity vision for the Alps, high biodiversity areas and connection areas were areas to focus on and they were identified purely on their biological values (first step).

Three 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. Assumptions and decisions made for the identification of the connection areas p.75

ALPARC

Selection of indicators to assess the analysed surface areas with regard to their suitability as a potential element and to specify how the network area should be fragmented (establishment of corridors, implementation of measures).

PEEN

Prior planning scale (less detailed) of the project is such that ecological corridors are only be migration or dispersal corridors. Foraging corridors function on a lower scale. On this scale corridors are included that function on a European scale:

- migration corridors for birds
- dispersal corridors for large mammals (terrestrial corridors for the most demanding forest species)
- migration/reproduction/dispersal corridors for fish and water related systems, dispersal corridors for wetlands (including bogs, mires, fens, peat cuttings).

All three should be analysed on species requirements as well as on system characteristics.

ALPARC

In-depth examination using model regions (larger, more detailed scale). These regions were analysed using the selected indicators and, with the help of suitable measures, can contribute towards an ecological network.

REN

As REN it should be founded on the following basic concepts: continuum, core area, expansion area, development area, ecological corridor (determination criteria p. 26-28). As in REN a great deal of importance should be attached in principle to obstacles.

As in REN the implementation should be based on overlaying the results of various complementary methods which taken individually do not allow any conclusive statements:

- Use of detailed statistical data on land use so the land can be divided up into ecologically similar areas.
- Grouping of individual species into guilds to complement the collated data on the distribution of habitats or guilds used.
- Compilation of potential maps (as a basis for further complementary field work).
- Systematic search for landscape elements which influence the networking situation of the fauna either favourably (e.g. hedges, embankments along motorways) or unfavourably (obstacles such as roads, walls, etc.).
- Involvement of the relevant regional departments and ecology specialists to carry out terrain clarifications.
- Gathering additional regional data.
- Systematic mapping of the structures of specific networks.
- Functional test of the specific networks mapped in order to differentiate areas with a satisfactory networking situation from those with a deficit in this respect (particularly in model areas).

2.5.3. Data

PEEN

Based upon the following key data sets an analysis has been made to assess where core areas are, where corridors should be formed or reinforced and where area enlargement could maintain target species:

- habitat map showing existing natural areas.

- selected species with high demands on area size and critical distances between habitats; those species and related demands which are habitat-specific.
- classification of (core) areas based upon insights in the probability of containing a certain percentage of all species including the most demanding in three classes:
  - very large areas (> 5 times the critical size): long term survival of all populations quite probable;
  - large areas (1-5 times the critical size): when isolated this area may suffer some loss of species: connection or area enlargement is recommended;
  - areas with a suboptimal size: a percentage between 70 – 100 % of species can maintain viable populations; the most demanding species can only be maintained or restored by enlargement and/or connections with comparable habitats by corridors; critical size area and selected thresholds are based on expert judgement based on literature sources (Tab 12 p.60).
- Definition of critical distances to bridge gaps, taking large animals and birds as key organisms, (resulting in distances of 50 –100 km ?);
- Location of major rivers as important natural corridors
- The distribution of internationally designated and acknowledged areas as already acknowledged elements of the network; MAB, Ramsar, World Heritage Convention (p.38/39).

Data base for large (more detailed) scale similar to REN.

ALPARC

For model regions also interviews suitable.

2.6. Other approaches for developing and implementing ecological networks

Question 4 : Do you know other approaches, which are appropriate to develop and implement ecological networks in the Alps? Which ones (please add a short description or a citation of literature)?

Full answers to question 4 see Appendix 3.

The experts mentioned the following, additional approaches (presented here only in short terms):

- Austria: Wildökologische Raumplanung für Schalenwildarten im Alpenraum. Reimoser, F., 1996: In: Sauteria, Salzburg, Bd. 8, 207-220.
- Austria: Catchment approach in Vorarlberg (yet in elaboration)
- Austria/Carpathians: Der Alpen-Karpaten-Korridor (WWF Austria; http://www.wwf.at/de/menu80/)
- Austria: Wildökologische Korridore Österreich (BOKU model; http://ivfl.boku.ac.at/upload/)
- Austria: RVS 04.03.12 Wildschutz (September 2007), vom Österreichischen Bundesministerium BMVIT; enthält rechtsverbindliche Richtlinien für Wildtierpassagen (WTP) an Verkehrswegen (http://www.fsv.at/)
- EU: Natura 2000, Smaragd
- EU: IBA (Important Bird Areas) build a network of stepstones for birds; Natura 2000/Emerald: Network for threatened animals, plants and habitats

- Methods applied in France:
  - a) „Trame verte et bleue“
  - b) „Réseaux écologiques dans les Parc naturels régionaux“
  - c) Réseau écologique Isère (REDI) et réseau écologique Rhône-Alpes
  - b) and c) are based on PEEN or Swiss REN
- General / Finland : There are tools or softwares that deal with this type of conservation planning accounting for biodiversity,connectivity, and socio-economic constraints (e.g. zonation: www.helsinki.fi/consplan).
- For rivers: Methods developped by Muhar et al. (1998) and Dynesius & Nilsson (1994)

3. Comparing 4 proposed approaches regarding their application in the Alps

3.1. Identification of areas with a high need for actions

Question 5 : One of the main goals of this connectivity project will be identifying areas with a high need for connectivity. How far the presented methods are appropriate for identifying such areas?

Full answers to question 5 see Appendix 3.

None of the discussed four approaches was developed in view of analysing the need for connectivity. The four approaches focus on potential connectivity in general (REN), defining corridors (WWF, PEEN) or connections areas between selected core (protected) areas (WWF, ALPARC, PEEN). All 4 approaches have some limiting factors in analysing the needs for connectivity, as: not enough available data, only based on species (WWF, PEEN), not specific to the Alps (PEEN, REN), too precise (REN), linear elements missing.

Regarding the use of the proposed methods the answers show a clear preference for PEEN and REN, arguing that these methods follow a hierarchy and can be adapted to areas, where minimum data is available. Anyhow, these methods have to be adapted to analyse connectivity needs.

On the other hand, WWF and ALPARC are seen by a minority as more pragmatic (-> corridors, protected areas) and adapted better to alpine space. It is suggested a combination of both, WWF (functional/species) and ALPARC (structural /habitats).

None of the 4 approaches integrates linear connectivity along rivers sufficiently. For analysing connectivity needs in river systems specific approaches are proposed (Muhar, Nilsson).

Approaches	suitable	suitable to only a limited extent	Hardly/not suitable
Biodiversity visions network / functional connectivity (**WWF**)	Pan-alpine, specific to the Alps (N=2)	Only species, only in combination with ALPARC approach, no hierarchy, not systematic **(N=5)**	Only corridors (N=1)
Cross-border ecological networks / structural connectivity (**ALPARC**)	optimum level for measures (N=1)	Pragmatic, only for existing PA, mainly corridors **(N=4)**	Too regional, oriented on neighboured PA, tools **(N=3)**
Pan-European ecological network **PEEN** / European perspective	European level, for catchments, for identifying core areas **(N=4)**	Only species (of European Importance), data need!, focus on corridors **(N=5)**	Not Alp specific (N=1)
Swiss ecological network **REN** / national perspective	Enlarge to the Alps, data need, spatial analysis possible, use a lower resolution than in CH **(N=7)**	limited continuum (data until 2100 m asl,)data need (to be very precise), linear elements missing, focus on corridors **(N=5)**	Not Alp specific (N=1)
General remarks	For rivers use Nilsson or Muhar	Available data is limiting factor Success-indicators?	PEEN and REN not developed specifically

For Alps combine WWF & ALPARC Combine all 4 approaches	Methods only looking for corridors No analysis of needs.	for the Alps

3.2. Application in different scales

Question 6: Another goal of this connectivity project will be to work on different scales: Which of the 4 approaches can be used for working on which pan-alpine, regional or local networks?

Full answers to question 6 see Appendix 3 of full WPA-report on http://www.alpine-ecological-network.org

	Pan-alpine ecological networks including surrounding regions (>1:500'000)	**Regional ecological networks (1:100'000 – 1: 500'000)**	**Local ecological networks (< 1:100'000)**
Biodiversity visions network / functional connectivity (developed by WWF)	++ (n=7)	++ (n=6)	+ (n=2)
Cross-border ecological networks / structural connectivity (developed by ALPARC)	++ (n=7)	++ (n=7)	+ (n=3)
Pan-European ecological network PEEN / European perspective	+++ (n=12)	+ (n=2)	(n=0)
Swiss ecological network REN / national perspective	+ (n=2)	+++ (n=10)	+++ (n=13)

The WWF method can be used for working on a pan-alpine and regional scale. The priority areas are at larger scale than the protected areas – they can contain several protected areas. The ALPARC method is also applicable on the pan-alpine scale, but with description of measures for improving connectivity at regional or even local ecological networks.

The PEEN-method is applicable for coarse scales above 1:500'000 and allows for a provisional overview that visualizes the reality and the complexity of the problem.

For the work on local ecological networks the REN-Method is the most appropriate method. It combines a high spatial resolution (maps at 1: 25 000) with local expert knowledge. The detailed maps of the REN can be used as baseline data for improving connectivity also at the regional level. Thus a progressive approach from local to general as used in the REN-method is preferable for establishing a coherent ecological network.

Often a combination of elements of different methods is useful, e.g. on the pan-alpine scale the ALPARC method can be combined with elements of WWF-method (corridors).

3.3. Data need (existing and new)

Question 7: The connectivity project will use mainly existing data (inventories, cartography, species data, population models, etc.) and expert information. Please compare the application of the 4 approaches regarding data need, availability of needed data, cross-boundary consistence and costs.

Full answers to question 7 see Appendix 3.

	Data need	**Availability of data**	**Consistency of data**	**Data costs**
Biodiversity visions network / functional connectivity (developed by WWF)	Medium-**High** High (n=4) Medium (n=3) Low (n=1)	**Medium**-Good Good (n=3) Medium (n=4) Bad (n=1)	1) Good (n=4) Medium (n=1) Bad (n=3)	1) High (n=3) Medium (n=1) Low (n=5)
Cross-border ecological networks / structural connectivity (developed by ALPARC)	**Low**-Medium High (n=1) Medium (n=3) Low (n=5)	**Good** Good (n=6) Medium (n=1) Bad (n=1)	**Good** Good (n=7) Medium (n=1) Bad (n=0)	**Low** High (n=1) Medium (n=0) Low (n=8)
Pan-European ecological network PEEN / European perspective	**Medium** High (n=3) Medium (n=3) Low (n=3)	**Medium** Good (n=2) Medium (n=4) Bad (n=2)	**Bad** - Medium Good (n=2) Medium (n=1) Bad (n=5)	Low-**Medium** High (n=1) Medium (n=5) Low (n=3)
Swiss ecological network REN / national perspective	**High** High (n=6) Medium (n=2) Low (n=1)	**Good** Good (n=5) medium (n=2) bad (n=2)	2) Good (n=4) Medium (n=0) Bad (n=4)	Medium-**High** High (n=5) Medium (n=2) Low (n=1)

1) The WWF-approach relies strongly on expert opinions, and might therefore be less quantitative or transparent.

2) The data consistency of REN is good for Switzerland but is not consistent across Europe/other countries. Maps that had been produced for the EC are consistent, but only for EC countries (e.g. CORINNE map not consistent for Switzerland). Data on biota (e.g. on aquatic and semiterrestrial organisms) are very unevenly distributed across the Alps.

All methods require the mobilisation of existing data and the collection of new data. The approaches WWF and ALPARC are those methods that can cope best with only existing data. For methods PEEN and REN the collection of new data is compulsory. To achieve better results, data efforts should be combined.

REN is a very data demanding approach, as it is a local approach requiring information at fine resolution. If existing data is used costs can be kept low. There may be problems of data availability for some European regions/nations.

3.4. Introduced / mentioned measures

Question 8: The connectivity project aims as well to propose and implement measures to improve or preserve connectivity. Which measures for implementation mentioned in the four approaches or deriving from them are most suitable for improving ecological connectivity on pan-alpine, regional and local level?

Full answers to question 8 see Appendix 3.

The four methods are not very specific about measures and their implementation; WWF method provides a rather broad summary, ALPARC method gives general reommendations on how to implement the approach (by existing protected areas). PEEN method gives a rough guideline to argue for regional or local planning and implementation. REN method contains a rather long list with specific situations and hardly examples for concrete measures. The measures mentioned by the experts can be found under the answers to question 8 in Appendix 3. These suggestions will be treated in a further step in Work package B of the Continuum Project.

3.5. How far do the 4 approaches fit with proposed aims

Question 9: Regarding the most important aims which can be reached by improving ecological connectivity mentioned by you in question 3: How far the proposed 4 approaches are fitting with these aims?

Full answers to question 9 see Appendix 3.

General aims

	WWF	ALPARC	PEEN	REN
Improve/preserve connectivity for (endangered) species or (isolated) populations	Some important species groups are not included **Fit** (n=3) Partly fit (n=1) Not fit (n=1)	Mainly concentrated on habitats, but includes some ideas of connectivity for species (ibex) Fit (n=1) **Partly fit** (n=2) Not fit (n=1)	Concentrated on species with European importance - many species with regional importance may not be included **Fit** (n=2) **Partly fit** (n=2) Not fit (n=1)	Approach makes important efforts to create guilds for ecotypes, but restricts the guilds mainly to insects **fit** (n=5) Partly fit (n=1) not fit (n=0)
Improve/preserve habitat diversity and connectivity between habitats	Evaluation of habitats tries to equally distribute the protected zones within the different biogeo-graphic regions; connection areas allow to set priorities at the pan-alpine and national scale	Clearly concentrated on habitats but based mainly on protected areas. These include the important habitats for endangered spe-cies only for some biomes (e.g. for wetlands, but prob-ably not for farmland and forests	Only takes into account major habitats an may be too coarse for the Alpine scale	Combines identification of core areas, "potential areas", and connecting corridors

	Fit (n=3) Partly fit (n=2) **Not fit** (n=3)	**Fit** (n=4) Partly fit (n=2) Not fit (n=1)	Fit (n=1) **Partly fit** (n=4) Not fit (n=2)	**Fit** (n=8) Partly fit (n=0) Not fit (n=0)
Improve both, habitat connectivity and connectivity for specific species or populations	Includes both, a species/ population approach and a habitat approach. **Fit** (n=4) Partly fit (n=2) Not fit (n=2)	Species and populations are only slightly touched. **Fit** (n=3) Partly fit (n=2) Not fit (n=1)	Connectivity is reduced to species level Fit (n=2) Partly fit (n=2) **Not fit** (n=3)	Some missing elements mainly in the assessment of the guilds **Fit** (n=7) Partly fit (n=1) Not fit (n=0)

Further general aims mentioned and the methods that fits best:

- Environmental dynamics: WWF, ALPARC and PEEN partly fit, REN does not fit
- Prevent "common" biodiversity erosion through global climatic changes: ALPARC and REN partly fit, WWF and PEEN do not fit;
- Value of the protected areas in terms of "productive capacity": all methods partly fit
- Improve/preserve connectivity for protected areas along artificial frontiers: ALPARC
- Creation of supra-national ecological networks beyond only connectivity: PEEN
- Creation of national ecological networks beyond only connectivity: REN as a part of PEEN

Specific aims

	A (WWF)	**B (ALPARC)**	**C (PEEN)**	**D (REN)**
Identify and overcome important ecological barriers (terrestrial and aquatic)	Approach is aiming at viable populations. The corridors are looked at at a "macro"-scale which is too rough for overcoming ecological barriers, and only considers traffic elements; could easily be improved if altitudinal distribution is analyzed with respect to topographical barriers fit (n=2) **partly fit** (n=5) not fit (n=2)	Identifies connections and barriers in trans-border networks or national assemblages of protected areas, but connection areas are on a scale that is still too large. Only traffic elements are considers; could easily be improved if altitudinal distribution is analyzed with respect to topographical barriers fit (n=4) **partly fit** (n=5) not fit (n=0)	Approach mainly aims at increasing the connectivity of certain zones and doesn't include the evaluation of barriers. The result is a set of so-called search-areas where connection via corridors is needed. Scale is too rough fit (n=1) **partly fit** (n=4) **not fit** (n=4)	Topographical barriers are not considered, no complete information on the permeability of potential barriers (e.g. highways), thus on the present quality of corridors **fit** (n=8) partly fit (n=2) not fit (n=0)
Focus on connectivity in and between protected areas and priority conservation areas	The protected areas and PCA are used to find important corridors for connecting the selected priority areas **fit** (n=3) partly fit (n=1)	Study aims at increasing the connectivity between existing protected areas **fit** (n=5) partly fit (n=2)	Aims in particular at connecting areas with a particular interest at the European scale **fit** (n=3) partly fits (n=2)	The protection status of areas is not specifically considered **fit** (n=5) partly fit (n=1)

	A (WWF)	B (ALPARC)	C (PEEN)	D (REN)
	not fit (n=2)	not fit (n=0)	not fit (n=1)	not fit (n=1)
Focus on priority species (groups): which ones?	Approach does not focus on priority species, but takes them into account as one important factor among others. Fits for vegetation, large carnivores, large herbivores, medium and small mammals, birds, herpetofauna, terrestrial invertebrates fit (n=3) **partly fit** (n=4) not fit (n=0)	Priority species were not explicitly used to identify protected and connection areas Fits for vegetation, large carnivores (wolf, bear, lynx), large herbivores (e.g. red deer, chamois, ibex, wild boar), medium and small mammals, herpetofauna, terrestrial invertebrates, further specific fish and migratory birds **fit** (n=3) partly fit (n=2) **not fit** (n=3)	Identification of core areas was based on the distribution of priority species. Fits for large carnivores (wolf, bear, lynx), large herbivores (e.g. red deer, chamois, ibex, wild boar), further specific fish, migratory birds and butterflies **fit** (n=4) partly fit (n=3) not fit (n=1)	The continua in REN are based on dispersal abilities of indicator species (groups). Fits for large carnivores (wolf, bear, lynx), large herbivores (e.g. red deer, chamois, ibex, wild boar), further specific fish, migratory birds and other vertebrates and invertebrates, reptiles and amphibians **fit** (n=5) partly fit (n=1) not fit (n=2)
Improve connectivity for the survival of large carnivores	Report states that an approach focused on large carnivores could have a negative impact on the perception of the study by the public **fit** (n=4) partly fit (n=1) not fit (n=1)	Large carnivores not particularly mentioned fit (n=2) **partly fit** (n=3) not fit (n=2)	Large carnivores listed as species proposed for identification of PEEN fit (n=2) **partly fit** (n=3) not fit (n=2)	No particular schemes for improving the particulars needs of large carnivores **fit** (n=4) partly fit (n=1) not fit (n=2)

3.6. Combination of proposed approaches

Question 10a: Which elements of the four approaches are important and for what reasons?

Full answers to question 10a see Appendix 3.

General

Species based approaches are not convenient, mainly because of knowledge of heterogeneity, and as they exclude “common” biodiversity. Especially, local endemic species as indicators don’t need pan-alpine connectivity to persist. But: Species reinforced approaches (guilds in REN) could help, if only data were generally available !

It’s important to take into account all kind of semi-natural or natural habitats, not only pre-identified, well known or protected areas, these being too depending on national policies.

Whatever the method will be, it has to easily integrate every new produced data that could enrich the analyses. This is particularly important for developing countries (like France) where inventories are scarce, poor and partial (but improving...)

Selection of indicators: The indicators should show whether an analysed surface is appropriate for being a priority area. The indicators must be well discussed.

Europe has a certain responsibility for species that support Alpine biodiversity. Therefore the project should take these into account. Because if a species does not life in a protection area, it does not benefit from the protection measures applied in these areas.

Select taxon priority areas for each taxon: Logical next step following the preceding point.

Identify bio-geographical sub-regions: Alpine habitat is not uniform. In order to maintain the maximum number of alpine habitats, the project must try to focus on a good distribution of the protection areas over the bio-geographical sub-regions.

Potentials of landscapes for connectivity are important.

WWF

Division into ecoregions (WWF) seems important, especially to identify value of core areas

Experts consultations (WWF), local validation (REN) (especially political ones) have to be avoid, because of their subjectivity, and the impossibility to reiterate the process...

This approach reveals the areas where expert are interested in (location of rare species, endemics etc.); pan-alpine these areas are well known (see the study “Biodiversity Vision”; they do not need connection per se; the approach might be useful locally (e.g. a network for Appenzell; e.g. where are the best spots with species rich meadows and how to connect them).

There is a representative data-background for the identification of the main potential areas in discussion with the proposals of the method WWF. And so we have a combination of the biodiversity vision proposals with the connectivity corridors in the model regions of ALPARC.

ALPARC

Indicators, as described in ALPARC project, are a quite good method to normalize (or automate) landscape analysis and could be useful to study connectivity areas or corridors (rather than core areas)

ALPARC is the most pragmatic approach, based on availability of protected land or land which might be requirable, and on well known corridor demands for some flagship species;

Recording of the current inventory of protected areas: The implementation of measures is easiest done in protected areas (core and border areas).

For connectivity projects start with existing protected areas (status of protection has to be claryfied!).

Analysis of gaps in protected/conservation managed areas is important, as a solution to preserve/restore connectivity.

The data base and the indicators used in method A are the basic planning elements for the implementation of the connectivity project in the Alps.

PEEN

PEEN is theory driven and not demand related; provides the theoretical background, and how it can be applied to “white spots” for a first exploration.

Calculated “permeability” or “moving costs” seems to be hard to implement and probably more interesting at local level

PEEN is as an overall network and all other networks, core areas and corridors are just contributing to it, following an Alpine ecological network should link to PEEN and be a part of it.

Swiss REN

Continuums, as defined in Swiss Ecological Network are theoretically interesting, even if data are probably not sufficient in most cases to implement these analyses...

REN concentrates on particular habitats, providing a methodology for measuring connectivity (continuum approach); sound theoretical background.

Based on WWF and ALPARC, the REN-principals of continuum, core area, expansion area, development area and ecological corridor should be transferred to the whole Alpine region.

Question 10b : How far structural connectivity, functional connectivity or a combination of both are appropriate?

Full answers to question 10b see Appendix 3.

General

Most answers highlight that structural and functional connectivity have to be combined. As connectivity is dependent mainly from structural diversity and regarding available data, the basic analysis should focus on landscape/habitat structures (diversity, mosaique, etc.). Functional connectivity has to be considered in a second step and if possible based on structural data.

All answers highlight that the goals (connectivity for what and why?) and approaches dealing with connectivity are dependent from scale and differing from pan-alpine to national /regional and to local level. Some answers say that works should progress from pan-alpine to local level (top-down), while some say that local measures should be realised first and then be integrated into regional and finally pan-alpine measures (bottom-up).

In view of implementation, the bottom –up approach is more appropriate. For implementation systems of subsidies have to be changed towards improving habitats for biodiversity.

Pan-alpine

Structural data have to be used to combine protected areas and priority areas and to establish a harmonized map of core areas and to identify existing ecological barriers (man-made as well as natural barriers as rivers and topography).

Functional connectivity can hardly be considered on a pan-alpine scale because data are not covering the whole area. The pan-alpine dimension is necessary to know more on bio-geographic migration routes, which may be active again in future.

National/regional

REN is a general strategy on regional (national) level. As all countries have different data, REN shouId be developed for national contexts but harmonised for trans-national exchange.

Local

Functional connectivity should be considered mainly on local level (depending on data; new data needed).

4. Proposed procedure (toolbox) for establishing ecological networks regarding different types of areas and specific aims

The experts proposed a range of structured procedures from problem analysis and identification to implemen-tation of ecological networks (details see question 10).

All experts proposed to start with a problem analysis aiming at the identification of core areas (mainly in protected areas and specific habitats) and connectivity areas between such core areas and, as well, with the identification of the "biggest problems (barriers, etc.).

Some scientific experts emphasised, that for such an analysis the data-base (for present state) has to be improved (data quality, consistency) and completed (inventories, expert validation of existing GIS data, etc.). Geographic scale (pan-alpine to local) is a relevant factor problem analysis regarding available data.

Problem analysis should, if possible, follow the hierarchy from pan-alpine to local in a coherent way: start on a pan-alpine level ("big picture"; PEEN as a reference) and then scale down to regional / local level. At least, beginning on a regional level, problem analysis should identify connectivity areas of pan-alpine relevance.

All experts agree that before planning measures a selection of areas and demands has to be made in order to focus on effective measures in priority areas. For such a selection, one has to be clear about the aims. Most experts recommend following aims in both, the structural dimension (landscape, habitats) and the functional dimension (selection of species groups).

Based on the experts proposals, a general procedure has been proposed at the Workshop in Zurich (10 /11. 12.2007). The following procedure has been discussed and tested by the participants of the Workshop:

- Problem analysis and setting aim:
  - Identifying main problem fields in the area considered (pan-alpine, regional, local) and setting aims for solving the problem
  - (= crosscutting main types areas and general goals of ecological networks in Matrix 1)
- Define Focus activities:
  - Definition of Focus activities in main problem fields (Matrix 2)
- Select appropriate approaches:
  - Assess which of the methodologies (including data need) fits with the aims of a focus activity (Matrix 3)
- Prepare Implementation:
  - Develop procedures to start selected focus activities (Matrix 4)

The results of the Zurich Workshop concerning these 4 steps are summarised as follows. All results of the Workshop shown in the 4 matrices are examples and the matrices have not been filled in completely. Depending on regional specificities (fragmentation, data availability, etc.) other outcomes are possible.

4.1. Problem analysis and setting aims

The participants assessed in a general way regarding the Alps main areas

All participants had 5 points for first (red) and 5 points for second (blue) priority (max. 1 red and 1 blue per field). The result is shown in Matrix 1: Eight main problem fields have been selected, covering four main areas and four general goals.

Matrix 1: Crosscutting main areas and general goals of ecological networks:

Result of the participants assessment (Workshop 10./11.12.2007 in Zurich)

R: first priority; B: second priority; 1-15: Number of choices

Grey: Main problem fields

General goals **Main areas**	Improve/ preserve connectivity for species or populations	Improve/ preserve habitat diversity and conn-ectivity between habitats	Improve/pre-serve habitat connectivity and connec-tivity for species or populations	Identify and overcome important ecological barriers (terrestrial and aquatic)	Focus on connectivity in and between protected areas and PCAs	Focus on priority species (groups): which ones?	Improve connectivity for the survival of large carnivores
Areas with high biodiversity values (PCA, Natura 2000, etc.)	R: 3 B: 1	**R: 9** B: 5	**R: 8** B: 5	**R: 9** **B: 9**	**R: 9** B: 4	R: 2 B: 5	R: 4 B: 1
Riverine systems as connecitivity elements of the wider landscape	R: 4 B: 3	R: 6 B: 1	R: 2 B: 0	**R: 8** **B: 15**	R: 2 B: 0	R: 3 B: 0	R: 0 B: 0
Densely populated low altitude areas	R: 0 B: 5	R: 4 B: 5	R: 3 B: 3	R: 6 **B: 14**	R: 2 B: 0	R: 1 B: 4	R: 1 B: 1
Areas with high pressure through intensive agriculture, tourisme, energy infrastructures	R: 2 B: 3	R: 5 **B: 11**	R: 5 B: 5	R: 6 **B: 12**	R: 5 B: 0	R: 1 B: 5	R: 1 B: 2
Border areas of the existing protected areas	R: 1 B: 1	R: 0 B: 3	R: 3 B: 3	R: 1 B: 3	R: 2 B: 3	R: 1 B: 3	R: 2 B: 0
Areas linked to large scale European networks such as PEEN, Alpine-Carpathian network (key corridors), IBAs etc.	R: 2 B: 0	R: 3 B: 2	R: 4 B: 2	R: 4 B: 3	R: 3 B: 1	R: 1 B: 0	R: 2 B: 0
Large scale forest areas	R: 0 B: 0	R: 2 B: 0	R: 1 B: 4	R: 2 B: 3	R: 3 B: 3	R: 0 B: 0	R: 1 B: 0

4.2. Define Focus activities

In a second step, the participants worked out in 4 groups focus activities for the 8 main problem fields (grey fields of Matrix 1). A clear distinction was made between pan-alpine and regional/local focus activities, looking for the appropriate level for an activity. In total, 23 focus activities have been identified.

Matrix 2 (selection from Matrix 1; grey fields only):

Definition of 23 focus activities (pan-alpine / regional-local) for the 8 main problem fields: Overview; description see list below

General goals **Main areas**	Improve/ preserve habitat diversity and connectivity between habitats	Improve / preserve habitat connectivity and connectivity for species or populations	Identify and overcome important ecological barriers (terrestrial and aquatic)	Focus on connectivity in and between protected areas and PCAs
Areas with high biodiversity values (PCA, Natura 2000, etc.)	**A: Panalpine:** Activity 1: Management plans for habitats (transboundry) Activity 2: Natural disturbance regimes	**B: Panalpine** Activity 3: Habitats that are important for species of conservation interest Activity 4: Permeability between high biodiversity value areas	**C: Panalpine** Activity 5: Biogeographical analysis Activity 6: Mapping of large scale barriers **D: Regiona/Local** Activity 7: Functionality of connectivity areas for selected species	**E: Panalpine** Activity 8: Implement large scale transects Activity 9: Strengthen contractual nature protection measures Activity 10: Make sure that process goes on
Riverine systems as connectivity elements of the wider landscape			**F: Panalpine** Activity 11: Analysis/ evaluation of riverine systems / catchments: **G: Regiona/Local** Activity 12: Implementation of EU-water framework directive	
Densely populated low altitude areas			**H: Regiona/Local** Activity 13: Identify ecological barriers in valleys Activity 14: Spatial planning: Find agreements on barrier free “windows”	
High risk areas/areas with high pressure/ through intensive agriculture, tourism, energy infrastructures	**K: Regiona/Local** Activity 21: Improvement of low intensity farming Activity 22: Implement best practices Activity 23: Share experiences with other areas		**J: Regiona/Local** Activities 15-19: Identify ecological barriers Activity 20: Special measures for high altitude areas	

4.2.1. List of 23 identified Focus activities (corresponding to Matrix 2)

Areas with high biodiversity values (PCA, Natura 2000, etc.)

A: Panalpine: Improve/ preserve habitat diversity and connectivity between habitats

1. Identify sites with habitats that need intervention esp. in trans-boundary areas (habitats according to EU-directives and Bern Convention) and define and implement management plans for (trans-boundary) habitats.
2. Support and maintain large scale natural disturbance regimes for pioneer habitats (avalanches, floods, land slides etc.)

B: Panalpine: Improve / preserve habitat connectivity and connectivity for species or populations

3. Identification of habitats (actual and potential) that are important for priority species (e.g. umbrella species, habitat directive, red list species, etc.)
4. Verify the permeability between high biodiversity value areas for the identification of not sufficiently connected sites, taking account of climate change, Local scale interventions in low permeable sites improving the level of connectivity (e.g. ecological bridges)

C: Panalpine: Identify and overcome important ecological barriers (terrestrial and aquatic)

5. Biogeographical analysis
6. Mapping of large scale barriers between protected areas on habitat level (landscape analysis)

D: Local: Identify and overcome important ecological barriers (terrestrial and aquatic)

7. Functionality of connectivity areas for selected species

E: Panalpine: Focus on connectivity in and between protected areas and PCAs

8. Implement large scale transects, Use existing opportunities for N-S transects, Develop strategies for E-W transects. Work out connectivity variants, evaluate the potentials, Make feasibility studies (technical/economic feasibility)
9. Strengthen contractual nature protection measures especially outside protected areas
10. Long term: make sure that process goes on, Alp-wide coordination (ALPARC)

Riverine systems as connectivity elements of the wider landscape

F: Panalpine: Identify and overcome important ecological barriers (terr. and aquatic)

11. Analysis/evaluation of riverine systems / catchments: structures, complete existing data

G: Local Identify and overcome important ecological barriers (terrestrial and aquatic)

12. Structure analysis Implementation of EU- water framework directive

Densely populated low altitude areas

H: Local: Identify and overcome important ecological barriers (terrestrial and aquatic)

13. Identify ecological barriers:, Mapping (fences, noise walls, big settlements, infrastructures, large monocultures). Identify interfaces between migration ways and barriers, Take historical migration ways into account, Define indicator species for the migration ways

14. Influence on spatial planning and land use planning (on a community level 1:5000 to 1:25000): Find agreements on barrier free "windows", Legal framework on national level, Subventions to reduce economic concurrence by including socio-economic aspects, Sensitisation and environmental education

High risk areas / areas with high pressure/ through intensive agriculture, tourism, energy infrastructures

J: Local: Identify and overcome important ecological barriers (terrestrial and aquatic)

15. Identify ecological barriers:, Mapping (fences, noise walls, big settlements, infrastructures, large monocultures)
16. Identify interfaces between migration ways and barriers, Take historical migration ways into account, Define indicator species for the migration ways.
17. Influence on spatial planning and land use planning (on a community level 1:5000 to 1:25000)
18. Find agreements on barrier free "windows" on migration ways, legal framework on national level.
19. Subventions to reduce economic concurrence by including socio-economic aspects (socio-economic barriers), Sensitisation and environmental education.
20. Specific indicators and measures for higher altitude areas (not densely populated low altitude areas) for conflicts between habitats and e.g. tourism activities, energy structures, cable cars. Example for a sensitive species: black grouse

K: Local: Improve/ preserve habitat diversity and connectivity between habitats

21. Programs, e.g. improvement of low intensity farming, and incentives for set aside, hedge planting, etc.
22. Identify pilot areas to implement and improve best practices linked to agriculture, tourism and energy infrastructures
23. Share experiences with other areas

4.3. Select appropriate approaches

In a next step was proposed to assess the 4 approaches in order to know, which of the methodologies (including data need) fits with the aims of a focus activity (Matrix 2). Even if the assessment in Matrix 2 is not complete, the result is, that the assessed approaches do not cover all proposed focus activities. Consequently, the range of approaches has to be enlarged or new methods have to be developed.

Matrix 3: Approaches (or specific elements of approaches) to be applied in order to work on focus activities (A1 – K4; p = pan-alpine; r= regional):

Focus activities	A (WWF)	B (ALPARC)	C (PEEN)	D (REN)	Remarks
High biodiversity					
1 Intervention need		Best for management	complement ary		Natura 2000/Emerald
2 Disturbance regimes	Layer ecological processes				Habitalp (regional), Natural hazard maps; link to riverine areas processes F1
3 Protection need	ok		Ok (migra-tory birds)	Ok (guilds,	

				corridors)	
4 Permeability			Ok buffer areas, landscape corridors	Ok, most appropriate	
5 Biogeographical situation					Basic data for species (available/needed), basic for Activity 3 and 4, climate change
6 Identify		OK		OK layer (to be verified)	
7 Functionality	–	–	–	–	Link Activity 4. Hard work, not only connectivity
8 Transects		OK (areas between existing PA)	PEEN (birds)		C1 (needed barriers) F1, combination with Natura 2000 (Piemont/ Lombardy new), not species needs
9 Contractual measures	indrectly	Partly (indicator)	–	Partly in implementation	Important for implementation (in- and outside PA, Natura 2000, PCA)
10 Support/Coordination					
Riverine systems					
11 Analysis catchment					
12 Implement WFD					
Densely populated					
13 Identify barriers					
14 Measures					
High pressure/risk					
15 Identify barriers				X	REN and more detailed scales, e.g. 1:5'000 (property adequate, ÖQV - ecological compensation on farm land)
16 Identify interfaces	X			X	WWF species and taxa related, partially and/or indirectly in REN
17Influence on planning					None of the approaches, only notes and recommendations (mainly ALPARC)
18 Barrier free "windows					None of the approaches References: «RVS Wildschutz, österr. Bundesministerium für Verkehr, Innovation und Technologie». «UVEK-Richtlinie 2001: Sanierungskonzept des Schweizerischen Nationalstrassennetzes». Tools for implementation: «MAMS:

					Merkblatt für Amphibienschutz an Strassen; Bundesrichtlinie Deutschland». VSS-Normen zur Fauna (Schweiz).
19 Socio-economic aspects					None of the approaches, only notes and recommendations (mainly ALPARC and REN)
20 High altitude areas					No direct comments in the approaches, but close to WWF approach (priority species/groups and their habitat needs) and REN (up to 2'100 m altitude only).
21 Farming					None of the approaches, only notes and recommendations (mainly ALPARC and REN)
22 Best/good practices	X	X			
23 Share experience	X	X	X	X	All 4 approaches, but not systematically

4.4. Prepare Implementation

The last step tested at the workshop was developing procedures to start selected focus activities (Matrix 4). Each of the 4 groups selected 1-3 Focus activities and defined the procedure (see Matrix 4). The results for 4 focus activities (2, 6, 16, 18) are shown in Matrix 4 (1,2). With this result it will be possible to plan a detailed project.

Matrix 4 (1): Steps to follow for focus activities 16 and 18

	Focus activity 16: **Identify interfaces between migration ways and barriers**. Take historical migration ways into account, Define indicator species for the migration ways. WWF species and taxa related, partially and/or indirectly in REN	**Focus activity 18:** **Find agreements on barrier free "windows" on migration ways, legal framework on national level.** References: «RVS Wildschutz, österr. Bundesministerium für Verkehr, Innovation und Technologie». «UVEK-Richtlinie 2001: Sanierungskonzept des Schweizerischen Nationalstrassennetzes». Tools for implementation: «MAMS: Merkblatt für Amphibienschutz an Strassen; Bundesrichtlinie Deutschland». VSS-Normen zur Fauna (Schweiz). None of the approaches
Step 1	Define responsibilities: For step 2 and 3: Platform Ecological Networks of the Alpine Convention (Sonderfall CH?)	Define responsibilities: For step 2 and 3: Platform Ecological Networks of the Alpine Convention (Sonderfall CH?)
Step 2	Collection of existing methods, data, maps and legal tools (related to indicator species or groups/taxa) in the countries and show the gaps	Collection of existing methods, thresholds, tools and legal frameworks in the different countries
Step 3	Common recommendations for harmonized/adjusted guidelines and standards for migration ways and dispersal for the Alpine region.	Common recommendations for harmonized/adjusted guidelines and standards for the Alpine region
Step 4	Define responsibilities:	Define responsibilities:

	For step 5: national governments and ministries	For step 5: national governments and ministries
Step 5	Stepwise implementation into the national legal frameworks	Stepwise implementation into the national legal frameworks

Matrix 4 (2): Steps to follow for focus activities 2 and 6

step	**Focus Activity 6:** **Identify barriers**	**Focus Activity 2:** **Disturbance Regimes (sc.)**
Step 1	Required data (recent, aerial f., land cover, land use ..) for needed scale (max. 1: 100`000 ca.)	Typology of disturbance
Step 2	Collect available data, identify databases, use existing data-base (converse Geostat/Corine)	Pan-alpine communication
Step 3	Define what is a barrier on large scale	Choose case study sites
Step 4	(ev. + identify potential = high risk areas by regional experts or working subgroups)	Analysis of disturbed areas and of potential areas (related to human activities)
Step 5	Data analysis / define hierarchy of information / modelling (indicators)	Colonisation events & migration of pioneer species; indicator how dynamic a region is
Step 6	Map barriers between PA/PCA (/result)	
Step 7	Verification of mapping	
Step 8	Typology of barriers & areas (all) and define action need	
Step 9	Develop guidelines for measures (= sensibilisation/ information)	
Step 10	Up-date of data & information (follow-up)	

4.5. Conclusions

The assessment of the 4 approaches showed, that none of them will cover all aspects of connectivity. Each of the approaches is specific and oriented on certain outcomes. Swiss REN nevertheless seems to be the best practicable method on a regional level.

We conclude from the Workshop, that the proposed 4 steps are appropriate to develop connectivity projects on pan-alpine or region/local level. It is important that discussion starts regarding problem areas, action need and aims and selecting most effective focus activities. Discussion regarding appropriate methodologies will follow after the definition of focus activities.

If such a procedure is followed in all pilot regions, co-operations between neighbouring regions will be possible on the strategic level (problem areas, action need) and led to a common definition of focus activities.

Appendix 1

List of experts

(Q and underlined: filled in questionnaire; W: participated in the Workshop)

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Irene Künzle (W), Swiss Biodiversity Forum
Daniele Meregalli (W), WWF Italy
Dr. Guido Plassmann (W), TF ALPARC
Sergio Savoia (W), WWF Switzerland
Dr. Thomas Scheurer (W), ISCAR
Guido Trivellini (W), WWF Italy
Aurelia Ullrich (W), CIPRA International

Appendix 2

The Continuum Project

Evaluation of methods August/September 2007 & Workshop 11./12. October 2007:

Questionnaire for Experts

We kindly ask you for answering the following 10 questions (3 general, 7 oriented to existing approaches). Please indicate in some few words, on which background (scientific competences, practical experiences) your personal valuation is based:

.....

I	Questions concerning needs, problems and goals related to ecological connectivity in the Alps

The *connectivity project* wants to improve ecological connectivity in the Alps.

1. What are the three most important problems when improving ecological connectivity in the Alps?

2. The *connectivity project* wants to act in a pragmatical way and work with areas where there is a high need for connectivity and where measures for improving ecological connectivity are most efficient. On what types of areas should the project focus?

Please indicate and argue the degree of problem pressure (high, medium, low):
O Densely populated low altitude areas

O Border areas of the existing protected areas

O Areas with a high biodiversity values (Priority Conservation Areas PCA, Natura 2000, etc.)

O Riverine systems as connectivity elements of the wider landscape

O Large scale forest areas

O Areas with high pressure through intensive agriculture, tourism (ski, hiking and touring areas) and energy infrastructure (high wire cables)

O Areas linked to large scale European networks such as PEEN, Alpine-Carpathian network (key corridors), Important Bird Areas, etc.

O Other: .....

3. What are the most important aims which can be reached by improving ecological connectivity in the Alps?

Please set priorities and give reasons for

– General aims:
O improve/preserve connectivity for (endangered) species or (isolated) populations
O improve/preserve habitat diversity and connectivity between habitats
O improve both, habitat connectivity and connectivity for specific species or populations
O other general aims: ……

– Specific aims:
O identify and overcome important ecological barriers (terrestrial and aquatic)

O focus on connectivity in and between protected areas and priority conservation areas

O focus on priority species (groups): which ones?

O improve connectivity for the survival of large carnivores
O other specific aims: ……

II Questions concerning existing approaches, concepts and methods

4. The evaluation is focusing on 4 approaches to develop ecological networks:

A Biodiversity visions network / functional connectivity (developed by WWF)

B Cross-border ecological networks/structural connectivity (developed by ALPARC)

C Pan-European ecological network PEEN / European perspective

D Swiss ecological network REN / national perspective

Do you know other approaches, which are appropriate to develop and implement ecological networks in the Alps? Which ones (please add a short description or a citation of literature):

E ……

F ……

Please answer the following questions for each of the 4 approaches (or comparing them):

5. One of the main goals of this *connectivity project* will be identifying areas with a high need for connectivity. How far the presented methods are appropriate for identifying such areas ?

6 Another goal of this *connectivity project* will be to work on different scales: Which of the 4 approaches can be used for working on

1) panalpine ecological networks including surrounding regions (>1:500 000)

2) regional ecological networks (1: 100`000 – 500`000)

3) local ecological networks (< 1: 100 000)

7. The *connectivity project* will use mainly existing data (inventories, cartography, species data, population models, etc.) and expert information. Please compare the application of the 4 approaches regarding:
- data need (high, medium, low)
- availability of needed data (good, more or less, bad)
- data consistence comparing different sources/countries (good, bad)
- costs (low, medium, high)

8. The *connectivity project* aims as well to propose and implement measures to improve / preserve connectivity. Which measures for implementation mentioned in the four approaches or deriving from them are most suitable for improving ecological connectivity on panalpine, regional and local level?

9. Regarding the most important aims which can be reached by improving ecological connectivity mentioned by you in question 3: How far the proposed 4 approaches are fitting with these aims?

Please specify and justify: do fit /do partly fit /do not fit for all of the 4 approaches:

- General aims:
O improve/preserve connectivity for (endangered) species or (isolated) populations
O improve/preserve habitat diversity and connectivity between habitats
O improve both, habitat connectivity and connectivity for specific species or populations
O other general aims: ……..…..

– Specific aims:
O identify and overcome important ecological barriers (terrestrial and aquatic)

O focus on connectivity in and between protected areas and priority conservation areas

O focus on priority species (groups): which ones?

O improve connectivity for the survival of large carnivores
O other specific aims: ……...

10. The *connectivity project* aims to combine different approaches in order to fulfil various goals. Please make concrete suggestions for a combined approach by answering the following questions (1-2 pages):
- Which elements of the four approaches are important and for what reasons?
- In which way elements of these approaches should be combined ? Especially: How far structural connectivity, functional connectivity or a combination of both are appropriate?
- What would be the concrete steps for implementing an ecological continuum with the help of the (combinations) of the presented approaches?

11. Your personal vision: what would be the greatest success of the *connectivity project* at its supposed end after 5 years?

9.8.2007/TS, IK, AU, YK, GP

Appendix 3

Full answers of **experts** to the questionnaire (ordered by question 1-10)

We kindly ask you for answering the following 10 questions (3 general, 7 oriented to existing approaches). Please indicate in some few words, on which background (scientific competences, practical experiences) your personal valuation is based:

Bernard BAL : I'm responsible for the databases (fauna, flora, habitats) at ASTERS (an NGO managing Nature Reserves and other sites in Haute-Savoie). I've been involved in several transnational programs aiming to describe or manage specific territories (protected areas, border zones…)
I mainly look at biodiversity and connectivity through habitats and habitat linked species (flora, invertebrates, short range vertebrates)

Georg GRABHERR: Univ. Prof. (Conservation Biology, Ecology). Involvment in conservation practice as advisor, expert (EC DGXI – FFH directive; WWF Austria; Austrian county governments, e.g. Vorarlberg; MAB-National Committee Austria etc.)

Fritz REIMOSER, Research Institute of Wildlife Ecology, Vienna Veterinary University, Department for ecology, wildlife management, and conservation. Focus of experience: wild ungulates and woodland grouse, their interactions with vegetation, habitat, and man; Wildlife Ecological Spatial Planning; principles, criteria, and indicators for sustainable use of wild living resources (IUCN – ESUSG).

Guy BERTHOUD: Consultant (Office ECONAT in Yverdon, Switrzerland). Elaboration of REN (Switerland, Departemnet Isère in France).

Michael SCHAAD: MSc in Biology, Projects in Species Protection (Hoopoe, Bearded Vulture), Conservation officer at BirdLife Switzerland, literature studies

Bernd STÖCKLEIN: My personal evaluation is based on scientific competence. I am professor in the department of landscape architecture, University of applied sciences Weihenstephan. My profession is Zoology and ecology of animals.

Friedrich VÖLK: Seit 2001 zuständig für Wildtiere und Jagd in der Unternehmensleitung der Österreichischen Bundesforste AG (Strategien, Controlling, Expertise, siehe unter http://www.bundesforste.at/index.php?id=52). Zuvor 15 Jahre in der österr. Wildforschung tätig (1986 – 2001), davon je die Hälfte am Forschungsinstitut für Wildtierkunde und Ökologie der Veterinärmedizinischen Universität Wien sowie am Institut für Wildbiologie und Jagdwirtschaft der Universität für Bodenkultur Wien.
1997-2001 wurde im Auftrag des Verkehrsministeriums die Durchlässigkeit des Österreichischen Autobahn- und Schnellstraßennetzes für Wildwechsel analysiert und daraus eine Empfehlung zur Errichtung von Wildtierpassagen abgeleitet. Seither Kooperation mit themenrelevanten Institutionen im Rahmen einer „Strategischen Partnerschaft Lebensraumvernetzung“ (Hauptziele: raum-planerische Verankerung überregional bedeutsamer Wildtierkorridore; Errichtung der geforderten Grünbrücken am bestehenden Autobahnnetz; Aktueller Fokus: Erhaltung bzw. Wiederherstellung des Alpen-Karpaten-Korridors).

Roland GRAF: Main expertise in bird ecology and conservation, especially forest grouse species (Graf, Suter & Hess, 2001; Suter, Graf & Hess, 2002). Habitat analyses at various spatial scales, GIS and remote sensing; spatial modelling and statistics (Graf, 2005; Graf et al., 2007a; Graf et al., 2006; Graf et al., 2005) Modelling dispersal with individual-based approaches (Graf et al., 2007b)

Michael FASEL: Our evaluation is based on practical experiences and, since this year, also on a big project called: Concept of developing nature- and landscape-protection together with agriculture in Liechtenstein (Entwicklungskonzept Natur und Landwirtschaft). This concept contains all the research on nature of the last 25 years and analysies of measures to be taken for all kind of nature- and landscape-protection. Some measures concern agriculutral areas, this is why the

agricultural development is part of the analysies. The same way is taken for the Natur-protection inside forests (Concept: Nature-protection in forests).

Klement TOCKNER: Personally, I am a river-floodplain ecologist working on aquatic and riparian biodiversity and ecosystem processes in Alpine rivers. In addition, I am heavily involved in developping the scientific basis, and of success evaluation indicators for restoration projects (e.g. Rhone-Thur project). I am running the research programme on the Tagliamento River in NE Italy, a reference ecosystem of Alpine importance. Finally, I did extensive research on the Val Roseg floodplain-catchment but also on large rivers such as the Danube. At present I am working on a European catchment data base (a book entitled Rivers of Europe will be published next year, Elsevier Publ).

Felix GUGERLI: plant population biology, with particular emphasis on alpine plants, molecular-genetic (descriptive) methods, historical/current gene flow, biodiversity conservation

Peter SKOBERNE: Experience and knowledge of processes regarding ecological networks on Pan-European level (participating in the Bern Convention working groups, PEBLDS, CBD, Natura 2000) and national level (protected areas, Natura 2000), working professionally in nature conservation since 1978.

Antonio RIGHETTI: - CO-Projektleitung nationales ökologisches Netzwerk Schweiz (REN)

- Mitarbeit an Wildtierkorridorbericht Schweiz

- Verantwortlich für Umsetzung REN und Sanierungskonzept Wildtierkorridore Schweiz

Sylvie VANPEENE: Je suis docteur en écologie et ma thèse a concerné la typologie d'écotones dans des prairies de fauche en déprise dans les Alpes.

J'ai continué ensuite à travailler en écologie du paysage sur des questions relatives au bocage, aux corridors biologiques. J'ai travaillé ensuite sur l'application en France de Natura 2000 à différents niveaux (de l'action très locale en tant qu'opérateur d'un site et par des enquêtes au niveau national)

Thomas SPIEGELBERGER, MSc PhD, works on the conservation on biodiversity for more than seven years and has in particular insights in different aspects of mountain grassland biodiversity. He has participated in several projects on the effect of land use changes on vegetation and has developed a sound knowledge in construction and exploiting long-term observational data sets. Recently he has started to work on the impact of climate change on the dynamics of mountain grassland vegetation. He is particularly interested in long-term observations and vegetation dynamics including invasive species and undertakes research in plant-soil interactions. He has freshly become the first laureate of the environmental research prize of the University of Fribourg for his achievements in the conservation of mountain grassland diversity. At the present he is coordinating a regional assessment on the temporal evolution of an invasive native plant species and undertakes research on the sensibility of mountain habitats to the invasion by exotic plants.

Henri JAFFEUX: …?

Mar CABEZA : I have a research background, particularly on the development of decision making (optimization) tools for the identification of protected areas, taking into account biodiversity values, connectivity and economic costs. Although my research is mostly methodological/conceptual, we do implement our methods at a variety of scales. However, I am not too familiar with the system in question here, the Alps, and therefore, my comments should be taken more from the point of view of an ideal (methodological) approach than a practical approach.

References : Cabeza, M. and Moilanen, A. (2001). Design of reserve networks and the persistence of biodiversity. TREE, 16: 242-247

Cabeza, M. and Moilanen, A. (2003). Site-selection algorithms and habitat loss. Cons Biol, 17: 1402-1413.

Margules CR, Pressey RL. 2000. Systematic conservation planning. Nature. 405: 243-53.

I Questions concerning needs, problems and goals related to ecological connectivity in the Alps

1. The connectivity project wants to improve ecological connectivity in the Alps. What are the three most important problems when improving ecological connectivity in the Alps?

BAL: - Heterogeneity of knowledge (fauna, flora, habitats), evaluation tools, methods, references

- Heterogeneity of biogeographic subregions and species pools origins

- Lack of theoretical knowledge concerning practical effects of connectivity on habitats or species conservation

GRABHERR: - missing clear goals (improving connectivity for what and why)

- heterogeneous data background

- no appropriate land available

REIMOSER: - To involve the ecological connectivity into an integrated ecological spatial planning system across national borders (integration of political and administrative sections, stakeholders, scales, etc.).

- To avoid long barriers as traffic roads (particularly with fences, noise protection), settlements, disturbance by tourism; further large mono cultures in agriculture and forestry.

- To manage the danger of easier distribution of diseases and "pests" along ecological corridors (needs preventive management – human dimension, etc.)

SCHAAD: A) implementation

B) communication and collaboration between actors

C) different scales

STÖCKLEIN: - There is no clear briefing for the implementation of ecological network of the appropriate ministeries to the appropriate local authorities in the different countries.

What sould the status of ecological corridors? An expansion of the priority and conservation areas or a conservation status of the corridors without special orders like the Natura 2000-areas?

It could be beter for the implementation, when there is a short way like banishment of natura 2000-habitats.

- The data source for concrete planning: aerial view are with different references of the pictures (for instance Germany-Austria).

- There are different competences of the local authorities in the corridors and different data-sources of surveying and mapping for habitats and focal species for different taxa.

VÖLK: - Das Hauptproblem ist im Alpenraum die Konzentration von Besiedlung und Verbauung **in den alpinen Haupttälern**. Dort herrscht aussergewöhnlicher „Flächenhunger" und es verbleiben zwischen den **mittlerweile beinahe durchgehenden Siedlungsbändern und Hauptverkehrsachsen** kaum mehr barrierefreie Grünlandzonen, die auch von grösseren oder scheueren terrestrischen Säugetieren für ihre Wanderbewegungen genutzt werden können.

- Eine wesentliche Schwierigkeit bei der Lebensraumvernetzung ergibt sich aus dem **unzureichenden Problembewusstsein** (leider auch von Entscheidungsträgern / Politikern) bezüglich komplexer wildökologischer Zusammenhänge und langfristiger (schleichender) Landschaftsveränderungen und Biodiversitätsverluste.

- In Österreich wirkt die **Raumplanungs-Kompetenz der Gemeinden** = **Kommunen** Problem verschärfend, weil sie im Regelfall kleinräumiges Denken, Planen und Handeln in den Vordergrund stellen, wobei überregionalen ökologischen Erfordernissen nur widerwillig Rechnung getragen wird. Den „übergeordneten" Raumplanungsbehörden in den Bundesländern mangelt es zum Teil an rechtlichen Durchgriffsmöglichkeiten, teilweise auch am nötigen Willen, sich für überregionale ökologische Erfordernisse - gegen tw. mächtige wirtschaftliche Interessen - entsprechend schlagkräftig durchzusetzen.

GRAF: For that the corridors and connectivity areas are used by animals, there must be healthy populations (sources) from where dispersing animals come. I believe that our main problem is that habitat quality is still decreasing at a large scale. This is especially true for farmland areas in the Alps. Intensification caused a large scale decline of many species inhabiting nutrient-poor open land (birds, grasshoppers, butterflies, reptiles). Without reproduction in source populations no dispersal will occur even though we install nice corridors or connection areas. The presently protected areas (AlpArc) are probably efficient for limiting settlement growth and tourism in alpine areas. However, reserves in the Alps mostly cover areas at high altitudes. These are important habitats that are already well preserved and mostly not endangered. Instead, the big alpine valleys are rarely part of the reserves; and if they are, their development does not differ substantially form similar, not protected areas in their neighbourhood. Growing settlements in the big alpine valleys (e.g. Engadin, Switzerland) are a big problem because this development will enhance the barrier effect of the valleys for different taxa (large mammals, carnivors). This development is unfavourable for ecological reasons and for touristic reasons (aesthetics).

BERTHOUD: A. prendre conscience et faire connaître que l'entité géographique de l'arc alpin est encore un vaste ensemble de continuums d'habitats naturels diversifiés encore relativement intacts et bien organisés en réseaux écologiques cohérents. La connectivité écologique y est imposée essentiellement par l'orographie naturelle. Les activités et les constructions humaines viennent interférer le plus souvent les meilleurs points de croissement des corridors. Un inventaire des points de conflit à protéger ou assainir peut être rapidement organisé à l'échelle de l'arc alpin afin de sauver ou rétablir les meilleurs corridors (critères et modèles d'enquêtes à établir).

B. Les étages collinéen et submontagnard sont souvent des espaces clés pour la biodiversité. Le développement exponentiel de l'urbanisation secondaire a pour conséquence une fragmentation très importante de cet espace vital sans possibilité de conserver des corridors horizontaux de connexion suffisants. Le réchauffement climatique entraine un décalage altitudinal non négligeable de plusieurs centaines de mètres qui peut profiter à certaines espèces pour autant que ces nouveaux espaces restent accessibles et non construits. Des nouvelles règles pour définir des zones non constructibles dans l'aménagement du territoire sont à imaginer à partir d'un principe de non aménagement qui serait à tester dans une vision de réseau écologique local

C. Le même problème se pose avec l'élévation de la limite supérieure de la forêt qui pourrait localement s'élever de 3-400 m au profit du développement de zone de transition favorables à la faune et à la flore si les pressions de l'élevage et du tourisme hivernal libèrent ses espaces

FASEL: In Liechtenstein: 1. Intensive land-use in densely populated, built-up areas together with a dens net of traffic roads.

2. Touristic and sportive activities in the alpine areas.

3. Highways

TOCKNER: I will primarily focus on catchments and river corridors as the key units and because this is my expertise.

1. Hydropower generation: Loss of longitudinal connectivity: habitat fragmentation due to dam construction and change in the flow regime

2. Land reclamation, flood protection: Loss of lateral connectivity, primarily through channel regulation, floodplain modification

3. Clogging, river bed incision, lack of sediment transport: Loss of vertical connectivity, primarily through the channel modification and flow regulation (clogging, intense biofilm development, lack of sediment transport, vertical incision of river channel, hydrological decoupling from hillslope). Restoring the sediment regime is an important issue (also identified by the EU-WFD; see large demonstration projects in France to enhance sediment delivery to the system, e.g. along the Drome)

GUGERLI:- Political will

- Available resources (land, money, data, humans)

- Courage/local agreement to allow for (natural) dynamics

RIGHETTI: Inhaltlich/sachlich sehe ich das Hauptproblem in den dicht besiedelten Talgebieten: einerseits aufgrund der vielerorts eingeschränkten Biodiversität (u. a. intensive menschliche Nutzung, Siedlungsdruck) und vor allem der Vielzahl von Barrieren (insbesondere bzgl. lineare Verkehrsträger).

Damit wäre auch bereits der schwierigste Konflikt genannt: Der menschliche Druck und damit die sozio-ökonomischen Zwänge werden die notwendige Umsetzung von Entschneidungskonzepte massiv erschweren.

VANPEENE : 1- l'artificialisation des milieux de vallées (cours d'eau, ripisylves, prairies humides …) et l'intensification agricole dans les vallées

2- la périurbanisation des versants et des massifs montagneux à proximité des centres urbains

3- la banalisation des milieux et l'expansion d'espèces invasives ou rudérales banales au détriment de milieux spécifiques

SPIEGELBERGER : Who will set the standards for good/acceptable connectivity and which standards? This includes the questions which approach should be chosen and whether this approach should be species or habitat orientated? Will these standards be accepted by the scientific community? And by practitioners? And by the stakeholders? Otherwise, the project will have important barriers to climb before it could be realised.

How will the process of implementation be organised? One model region, several model regions, complete application of the programme to the whole alpine region?

Acceptation of the public (includes technical possibilities, financial and aesthetical aspects).

JAFFEUX : - Fragmentation du massif et obstacles à la continuité écologique : conséquences négatives pour le maintien ou la restauration du bon état de conservation des écosystèmes et des espèces

- Les effets attendus du changement climatique sur la biodiversité : nécessité de préserver et rétablir les continuités écologiques pour permettre aux écosytèmes et aux espèces de s'adapter aux nouvelles conditions écologiques ou d'en trouver de meilleures

- La connectivité écologique inter espace protégés

CABEZA : One of the most important problems is to find out where is connectivity needed, and how improving it would affect biodiversity persistence prospects. Related to this problem is the harmonization of different initiatives, and the aggregation of data. Another problem is a practical one, which relates to the topography of the area, and the distribution of urbanized areas

2. The connectivity project wants to act in a pragmatical way and work with areas where there is a high need for connectivity and where measures for improving ecological connectivity are most efficient. On what types of areas should the project focus?

GRABHERR: - areas which improve or/and connect already existing protected areas; case by case decisions recommended (see alparc approach "Netzwerk alpiner Schutzgebiete")

Please indicate and argue the degree of problem pressure (high, medium, low):

GRABHERR: Not clear to me what is ment here !

O Densely populated low altitude areas :

BAL: high, these areas concentrate a great part of the problems encountered and are the most changing. Effects are permanents (all year long) and difficult to reverse

GRABHERR: Are – in most cases - lost areas. Improving connectivity can only be exceptionally successful; needs to much effort.

REIMOSER: High._Are often long continuous total barriers along valleys; particularly on smaller (less detailed) scale important.

SCHAAD: Densely populated low altitude areas are important when regarding corridors but I don't think they should be focussed on as areas that should be connected themselves.

VÖLK: high, (see I/1 and I/2)

FASEL: 5

SKOBERNE: medium

STÖCKLEIN: Low degree of problem pressure: Densely populated low altitude areas

GRAF: high problem pressure

SPIEGELBERGER: Medium, because often low social acceptance for such projects and at the same time often very high costs to install/maintain zones of connectivity. However, there is a very high need for connectivity in those areas.

O Border areas of the existing protected areas :

BAL: medium, these areas are frequently less modified than distant areas

GRABHERR: Implementing puffer zones and corridors which connect protected areas are probably the most promising activity (for migrating animals in particular)

REIMOSER: High. Studies on functioning of "membranes" (borders, buffer zones of protected areas, etc.) for connectivity, particularly on larger (more detailed) scale (eg. WESP – mentioned below).

X **SCHAAD**: Border areas are an important link to core areas (often large, long border) and ideal for improving connectivity. Problem pressure is medium.

FASEL:4

X **TOCKNER**

SKOBERNE: high

STÖCKLEIN: High degree of problem pressure

GRAF: medium problem pressure

SPIEGELBERGER: Medium. Depending on the distance between borders of existing protected areas, these zones can often easily be connected without huge investments in time and money. Moreover, border zones often already act as connectivity areas for several species and habitats.

O Areas with a high biodiversity values (Priority Conservation Areas PCA, Natura 2000, etc.)

BAL: high, as they work as core areas and connectivity areas

GRABHERR: Nature should be protected everywhere, and should focus on maintenance of the regional natural treasures; WWF's PCA approach (see "Biodiversity Vision") – though interesting - produced a map mainly of expert interests, and not of hot spots of conservation demands of which the need for improving connectivity might be a part of.

REIMOSER: Medium. Most of them are already identified.

X **SCHAAD**: PCA and others must be linked together. Problem pressure is medium.

FASEL: 1

X **TOCKNER**

X **GUGERLI**: conserve source areas

X **SKOBERNE**: low

STÖCKLEIN: High degree of problem pressure

GRAF: high problem pressure

SPIEGELBERGER: High. In these areas, data long-term monitoring led to good data availability, social acceptance for measurements increasing or maintaining biodiversity is often high and biodiversity is worth to be conserved. Awareness towards such projects is often good and some projects or attempts were already undertaken to increase connectivity. A alpine-wide project could probably boost these initiatives.

X **JAFFEUX**

O Riverine systems as connectivity elements of the wider landscape

BAL: high, because of their efficiency and the feasibility of the measures

GRABHERR: Improving the connectivity of rivers is one of the most urgent problems in the Alps (e.g. the break down of the Bodensee-trout); when looking to the wider landscape this only works if the immediate surroundings of the river are considered (riversides should be in a natural state;

riverside landscape seminatural or natural: e.g. most river inventories ignore the river landscape, and concentrate on the immediate wtare course only)

REIMOSER: medium Mostly a correlation to densely populated low altitude areas (see above) exists.

X **SCHAAD**: Riverine systems (especially if land strips on both sides are included) play an important role and should be focussed on. Problem pressure is high.

VÖLK: high

FASEL:2

X **TOCKNER**: Rivers serve as key corridors for organsims (aquatic and TERRESTRIAL), matter (water, sediment, nutrients, organic matter), and energy (stream power). There are two key priorities (1) to enlarge existing free-flowing sections, and (2) to focus on key "ecological nodes" (e.g. tributary confluences, backwater-main channel intersections, alluvial zones) for enhancing connectivity. River-floodplain corridors can be considered as keystone ecosystems for maintaining local and regional diversity and ecosystem processes.

X **SKOBERNE**: high

STÖCKLEIN: Medium degree of problem pressure: Riverine systems as connectivity elements of the wider landscape

GRAF: low problem pressure

SPIEGELBERGER: Medium. Already existing linear features (this means, there is no debate about where to create a connectivity zones, as rivers already exist) which often have already good/satisfying connectivity. An amelioration of the existing situation can often easily be done.

O Large scale forest areas

BAL: low, they are supposed to be functional

GRABHERR: Disruption of the forest continua on valley slopes (e.g. by touristic infrastructures) cause regionally the break down of capercaillie populations and creates barriers for other wildlife; this is one of the true important issues related to connectivity.

REIMOSER: Low. Large or large scale (i.e. small) forests?? Large forest areas are not the most important landscape types to improve connectivity; in addition, forest areas are increasing. Exception: large mono culture forests.

FASEL:5

SKOBERNE: low (in case of improving)/high (in case of preventing fragmentation)

STÖCKLEIN: Medium degree of problem pressure

GRAF: medium problem pressure

SPIEGELBERGER: Low. Large scale forest areas are per se already good connected as they are “large scaled”.

O Areas with high pressure through intensive agriculture, tourism (ski, hiking and touring areas) and energy infrastructure (high wire cables)

BAL: Agriculture : medium, alpine agricultural landscapes preserve elements of connectivity, due to natural constraints. Tourism, Energy : low, impacts are seasonal and generally reversible, and permeability quite high…

GRABHERR: This is a problem everywhere; even local activities might be useful; not only as corridors (e.g. expeding seminatural structures in intensive agricultural land from 2% up to 4% might be a success; however, implementing in an Alps wide strategy is impossible; this must be included into agroenvironmental subsidies systems)

REIMOSER: low Are not very important if enough corridors are available in between. However, large mono cultures are a problem.

X **SCHAAD**: Tourism pressure and high wire cables are a big problem for birds in the alpine area. It should be discussed whether the project should focus on theses areas or whether it's enough to consider these problems in potential corridors.

VÖLK: medium. Anmerkung: Flächen mit intensiver Landwirtschaft können durch die Wiederherstellung von Gehölz-Leitstrukturen und Trittsteinbiotopen wieder aufgewertet und

„durchlässig“ gemacht werden. Eine partielle „Barrierewirkung“ solcher Gebiete ist also reversibel (geringerer Zeitdruck)

FASEL:3

SKOBERNE: high

GRAF: high problem pressure

SPIEGELBERGER: High. Those areas often suffer from the intensive land-use and already small connectivity projects may substantially increase the inter-linkage between zones of high biological interest. However, social acceptance for such projects may be low, time needed to manage such project long and costs may be high.

O Areas linked to large scale European networks such as PEEN, Alpine-Carpathian network (key corridors), Important Bird Areas, etc.

BAL: low, as they don't necessarily contribute to "alpine" diversity, but European or general biodiversity, concerning large scale species or habitats

GRABHERR: Though important, not easy to realise.

REIMOSER: high Small scale view (overview and connection on large areas) primarily important.

X **SCHAAD**: Existing networks should be involved to use synergies.

FASEL:6

SKOBERNE: high

STÖCKLEIN: High degree of problem pressure

GRAF: medium problem pressure

SPIEGELBERGER: Medium. Most of the reflexions needed at the start of the project have already been undertaken. Much data is available, often already in the right format. These areas should of course be included, but no special efforts are necessary as those areas are already inscribed in other networks.

X **JAFFEUX**

O Other: ……

TOCKNER: other: Future regime shifts as a consequence of average change in temperature and flow and an increase in flow/temperature extremes (e.g. how to enhance ecosystem resilience, e.g. by providing thermal refugia for many Alpine species during hot summers?

STÖCKLEIN: Other: Areas with endangered species by the climate change and e. g. species of Birds Directive, Habitats Directive, the Red List of the IUCN and the Red Lists in the different countries

Comments:

VÖLK: Jene derzeit noch unverbauten Grünlandflächen (Wälder, Gebüsche, Weiden, Wiesen, Äcker), die als Verbindungskorridore zwischen grösseren Rückzugs-gebieten für Wildtiere und/oder zwischen Schutzgebieten von wesentlicher Bedeutung sind („Schlüssel-Korridore“), müssen mit höchster zeitlicher Dring-lichkeit für die Zukunft raumplanerisch abgesichert werden. Je stärker in einer Region die wirtschaftliche Dynamik und somit der Bauland-Hunger ist, desto wichtiger ist eine rasche Absicherung solcher Grünlandflächen, bevor diese für die Landschaftsvernetzung irreversibel verloren sind (sehr hoher Zeitdruck!).

GRAF: I would focus on areas with high biodiversity values. Again, I would stress the argument of preserving or establishing strong source populations (see above). Also, presently protected areas must not necessarily contain the important source populations; e.g. farmland birds, insects. As mentioned before, protected areas in the Alps mostly cover areas at high altitudes that are less endangered than the lower altitudes and big alpine valleys.

BERTHOUD: En termes de connectivité paysagère et de réseau écologique, ill n’y a pas de priorité à définir mais que des **opportunités régionales ou locales** à saisir en fonction des besoins et des appuis à trouver dans des projets en développement.

Dans l’analyse d’un réseau écologique, comme dans toute approche écosystémique, il faut éviter de simplifier et de sélectionner certains habitats importants ou certaines espèces prioritaires. On

considère au contraire la biodiversité gloBALe, l'ensemble des habitats naturels et transformés, ainsi que la complexité des connexions principales ou diffuses.

Contrairement à la définition des zones prioritaires pour la conservation de la biodiversité qui sélectionne la qualité et la capacité d'accueil des habitats, l'identification des connexions des habitats (donc du réseau écologique) passe par une analyse fine des structures et du maillage de la matrice paysagère avec un grain de lecture du paysage compris entre 10 et 100m de côté. L'échelle de cartographie la plus pratique sur le terrain est celle du 1 :25'000[e]

GUGERLI: other: ecotones, transition areas, i.e. regions with (steep) environmental gradients (e.g. forested/non-forested; suBALpine/alpine; wet/dry) to include rich habitat diversity, as complementary areas to stable, large-scale habitat types (e.g. large forested areas) that promote (umbrella) species requiring large home ranges or allow for (seasonal) dispersal

SKOBERNE: Not only improving, it is important to take car of existing corridors, as well !!!I would prefer to have a scanning phase to identify corridors and barriers and then focus on main problems that are coming out of this survey. It is difficult to say that densely populated low attitude areas have low priorities, but they can in some cases trigger fragmentation.

I see PEEN as an overall network and all other networks, core areas and corridors are just contributing to it. I can not see PEEN as something different, e.g. that alpine network should link to PEEN. Alpine network IS part of the PEEN.

RIGHETTI: Wie bei 2 ist auch diesbezüglich keine Kochbuch ähnliche Anleitung möglich. Grundsätzlich ist auf Stufe Konzept der pragmatische Ansatz wichtig, dazu gehört auch jener bereits laufender, etablierter und mehr oder weniger akzeptierter Ansätze zu folgen. In diesem Sinne sollte meiner Ansicht nach das PEEN eine – wenn nicht die zentrale – Leitlinie im vorliegenden Projekt sein: Einerseits um all das vorhandene Wissen und die entsprechenden Erfahrungen zu nutzen, den Elan des fahrenden Zuges und Synergien zu nutzen und vor allem bei der Umsetzung mit gemeinsamen Zielen, stark und einig aufzutreten. Damit wird auch die Gefahr kleiner, gegeneinander ausgespielt zu werden.

Bei der Arbeit auf Detailebene, welche den Rahmen dieses Projektes sprengt, ist dann auf der Basis der Gegebenheiten vor Ort (Gesetzgebung allgemein, Synergiemöglichkeiten mit laufenden Projekten und Konzepten, „die Gunst der Stunde") der zielführenste Weg zu suchen.

Dies alles im Bewusstsein, dass Gebiete mit hohem menschlichen Druck (intensive Landwirtschaft, Skigebiete ...) bei geringsten Erfolgschancen am meisten Einsatz verlangen werden. Umgekehrt aber auch im Bewusstsein, dass ausserhalb der Talgebiete vielerorts eine hohe Naturnähe herrscht – sowohl bezüglich Qualität des Lebensraumes als auch bezüglich der Vernetzung.

VANPEENE :Il est difficile pour la plupart des enjeux de répondre à la fois à un souci d'être pragmatique et efficace et de répondre à des besoins importants en connectivité. C'est souvent dans les endroits où la connexion serait la plus nécessaire à établir que les conditions d'usage des sols et d'acceptation sociale seront les plus difficiles.

Type de zone	Nécessité de connexion	Efficacité/facilité
Densely populated low altitude areas	Forte	Faible et difficile
Border areas of the existing protected areas	Moyenne	Forte et relativement facile
Areas with a high biodiversity values	Forte	Moyenne
Riverine systems	Forte	Forte
Large scale forest areas	Moyenne	Forte
Areas with high pressure	Forte	Forte et difficile

Areas linked to large scale European networks	Faible	Faible

CABEZA : This is a difficult question. The answer will depend on the concrete objectives of the project, and these are not clear yet. Of course one wants to concentrate on all areas mentioned here. But if one has to chose, one needs to specify the objective: To safeguard all species in the Alps? To connect all habitat types to a similar degree? To protect large carnivores? To protect highly threatened species (Red Listed) or species in the Habitats Directive? And to what extent? The choice of areas to focus on should be a natural result of the choice of objective (see the literature on systematic conservation planning, e.g. Margules and Pressey 2000; Cabeza and Moilanen 2001). Additionally, while some areas may require protection of current habitat in order to keep present critical connectivity, one will also need to identify areas that require restoration to improve the current fragmented situation, for particular habitats or species. All the elements listed here may thus be important in different ways. How to prioritize should be decided with a proper quantitative analysis, and not beforehand.

However, densely populated low altitude areas are obviously the ones with larger pressure, higher fragmentation, and more difficult to restore or connect. Similarly, areas of high use, such as agriculture or tourism also present pressures and restrictions.

3. What are the most important aims which can be reached by improving ecological connectivity in the Alps?

Please set priorities and give reasons for

– General aims:

O improve / preserve connectivity for (endangered) species or (isolated) populations

FASEL: third

STÖCKLEIN: High priority

SPIEGELBERGER: Low. Would be better than nothing, but preserving the connectivity would more or less just keep the status quo. However, many conservationists would prefer a “habitat approach” over a “species (flagship) approach” (cf. above).

O improve / preserve habitat diversity and connectivity between habitats

BAL: this aim seems to be the main one to pursue: as it is the most difficult to obtain, one assumes that effects will concern most of the species, even if not the most endangered ones…

FASEL: most important

X **GUGERLI**: diverse habitat types offer niches for a large set of species, while corridors in-between provide areas for dispersal (-> range shifts!)

STÖCKLEIN: Medium priority

X **GRAF**: The most important reason for species extinction or population decline is habitat loss. The negative impact of fragmentation on populations is in most cases accompanied with habitat loss. In real life, there are only very few examples that show population extinction or decline as a result of pure fragmentation processes. Therefore, I argue that the ecological continuum project should focus strongly on the quality of habitats. And the most sensitive habitats in the Alps (e.g. nutrient-poor, extensively used meadows, dry meadows) are often not covered with protected areas.

SPIEGELBERGER: Medium. Preserving, or even better improving habitat diversity includes the protection of endangered species and of (today) common species living in these habitats. It’s a more complete approach and should be preferred of the pure species approach.

O improve both, habitat connectivity and connectivity for specific species or populations

X **GRABHERR**

X **REIMOSER**: Both always interconnected; habitats have priority before present populations.

X **SCHAAD**. Habitat connectivity is especially needed for plants, fungi and smaller animals, whereas larger animals and birds need a connectivity for specific species or populations (e.g. stepping-stones, corridors)

X **VÖLK**: Most important.

FASEL: second

X **TOCKNER**

X **STÖCKLEIN**: high priority

X **SKOBERNE**

X **RIGHETTI**: Grundsätzlich sollte die Lebensraumvernetzung bzw. die Vernetzung der verschiedenen Landschaftselemente im Zentrum sein. Dies garantiert meiner Ansicht nach einen „generellen Ansatz". Wird das Konzept auf einzelne Arten aufgebaut, besteht die Gefahr, dass gewisse Gebiete „durchfallen". Der Einzelarten-Ansatz sollte jedoch gezielt und allenfalls bezogen auf Schwerpunktsgebiete angewendet werden, aber immer Teil des ganzheitlicheren Lebensraum-/Landschaftsaspektes sein.

X **VANPEENE** : Raisons : Pour quelques espèces clé isolées, il est nécessaire de travailler au niveau des populations pour identifier finement leurs besoins en connexion entre habitats nécessaires pour réaliser leur cycle de vie.

- Pour la majorité de la biodiversité « ordinaire » l'approche par habitat paraît la plus pertinente. Elle permet de rétablir la connectivité pour plusieurs groupes d'espèces et comme elle prend en compte l'usage du sol, elle peut mieux être expliquée aux acteurs locaux.

SPIEGELBERGER: High. This is the most difficult as most complex approach. However, it would be the most appropriated as it includes both, the species and the habitat approach.

X **JAFFEUX**

CABEZA : Obviously one can improve both habitat connectivity at a general level, and connectivity for focal species. While I believe that connectivity is species-specific and therefore habitat connectivity per se is not something to always favor, often we do not have information for all species and therefore we have to rely on habitat connectivity as a surrogate. However, it is not clear to me if lack of connectivity is currently a problem. Connectivity has become fashionable and currently there is an interest in connecting elements that may not require connections; this may also have negative consequences. Good planning, after a proper analysis of fragmentation effects, is required

O other general aims

BAL: prevent "common" biodiversity erosion through gloBAL climatic changes .....

STÖCKLEIN: connectivity of large area habitats (e.g. forest) and line-like habitats (e.g. freshwater); medium priority.

FASEL: Information of the public and authorities.

TOCKNER: increase ecosystem resilience (e.g. recolonization potential after major disturbance events), maintain biodiversity at both local and regional scales

Increasing the degree of connectivity between contrasting ecosystems (e.g. land-water, high Alpine and lowlands; hillslope-alluvium; etc.). The link between the contrasting systems is very crucial, e.g. for less productive systems the link to highly productive systems is very important.

GUGERLI: other general aims: Allow for environmental dynamics within conservation/connectivity areas (-> ecological and/or evolutionary processes)

Comments:

STÖCKLEIN: The general aims incorporate the priority aims for designing an ecological network. Under local conditions (e. g. in case of migration corridors for endangered species) the aims should be specified.

BERTHOUD: En fait, le problème est plus complexe. Le paysage, les habitats et les espèces sont dans un système complexe totalement interactif qui fonctionne en fonction du potentiel écologique

offert par l'espace géographique concerné (l'arc alpin avec toutes ses particularités orographiques et écologiques) et que l'homme a plus ou moins transformé à son profit. Par conséquent il faut retenir que le réseau écologique des Alpes préexiste et fonctionne mais est souvent perturbé, voire partiellement détruit, par les aménagements humains.

Il s'agit donc en premier lieu de disposer d'un outil d'analyse permettant de connaître le potentiel écologique existant, la capacité d'accueil et le fonctionnement de l'infrastructure naturelle avec ses dynamiques possibles. La biodiversité locale ou régionale ainsi que les priorités de connexion vont résulter de l'histoire des sites et de l'utilisation de ce potentiel écologique.

TOCKNER: Increasing connectivity may also facilitate the exchange of nonnative species.

– Specific aims:

O identify and overcome important ecological barriers (terrestrial and aquatic) :

BAL: of course, as it is the main problem !

REIMOSER: First: Both always interconnected; habitats have priority before present populations.

X **SCHAAD**. With the overcoming of ecological barriers many problems can probably be solved. It seems that e.g. large carnivores can travel far distances through areas that are under high pressure (population). The real problems seem to be the total ecological barriers. If need be, there could be a focus on priority taxa groups. I consider this as a methodological aspect.

VÖLK: important. und anthropogener Barrieren sowie deren Summenwirkung

FASEL:most important

X **TOCKNER**

X **GUGERLI**: particularly important regarding needs of measures (see also below)

STÖCKLEIN: High priority

SPIEGELBERGER: Medium, but this point is in my opinion a sub-aspect of the following aim. The question of ecological barriers must in any case be implemented in the reflexions of the connectivity in and between protected areas.

O focus on connectivity in and between protected areas and priority conservation areas :

BAL: it could be a good aim, if only we were sure that protected and priority conservation areas are well defined (obviously not in France, where political issues are dominant when identifying these areas)

REIMOSER: The focus only on already existing conservation areas will be not enough.

X **SCHAAD**.

FASEL:third.

X **TOCKNER**

X **GUGERLI**: corridors should be flanked by potential source areas (as at least priority conservation areas are assumed to be)

X **STÖCKLEIN**: High priority

X **VANPEENE**

SPIEGELBERGER: High, because good data availability, high social acceptance, good monitoring possibilities. Protected areas have a high biological interest (that's why they are protected) and linking them in an appropriate way would clearly improve their quality. Best approach!

O focus on priority species (groups): which ones?

X **GRABHERR**: Mainly aquatic; e.g. Bodensee-Seeforelle

REIMOSER: Second focus on priority species (groups, umbrella species). Large carnivores (wolf, bear, lynx), large herbivores (e.g. red deer, chamois, ibex, wild boar), further specific fish and migratory birds.

VÖLK: important. Indikatorarten, für Grossräumige Vernetzung z.B. die Grossraum-Tierarten Bär, Luchs, Rothirsch

FASEL:second. Butterflies, Birds, amphibians, reptiles, fish. Vegetation on dry meadows.

X **TOCKNER**

STÖCKLEIN: High priority. Birds, Amphibians, Reptiles, Butterflies, Fishes

SPIEGELBERGER: Low. As I argued before, this would be the easiest solution, but not the best one. I would try to aim higher and focus on the connectivity of habitats. Only if this would not be achievable (what I doubt), return to the concept of priority species.

O improve connectivity for the survival of large carnivores

X **GRABHERR**

REIMOSER: Third_O improve connectivity for the survival of species mentioned above (large carnivores)

FASEL:fourth

STÖCKLEIN: High priority

VANPEENE : absolument pas, ces espèces, et en particulier le loup, ont démontré leur capacité à recoloniser les espaces même séparés par des infrastructures. De plus leur acceptabilité sociale en France est très négative, argumenter un projet de rétablissement de la connectivité sur les grands carnivores le rendrait difficile à implémenter au niveau local

SPIEGELBERGER : Low, see above. Moreover, the social acceptance of such a project would be in some European regions quite low. That's why project A (WWF) has chosen not to use the species approach exclusively.

O other specific aims: .....

FASEL:5. Promotion for extensive exploitation in agricultural areas.

TOCKNER: priority species might be long-distance migrating species, e.g. salmon, Hucho hucho

SKOBERNE: identify existing corridors and man made barriers. ecological network concept should be broad enough taking into account existing areas where nature can move and man made structures which are hindering possible movement. In first cases the activities are focused to conservation principles in the second one to the restoration measures. We mustn't forget that our aim are ecosystems and not only particular species. If we are looking one group we can easily fall into the trap when a corridor for one species becomes a barrier for another.

VANPEENE : augmenter la connectivité des paysages ordinaires c'est-à-dire de la matrice agricole des vallées et des versants

Comments:

STÖCKLEIN: The specific aims should contain the preserve and improve habitats of endangered species in the focus of connectivity in and between protected and priority areas. There are the existing potentials for a quick effort of implementation.

GRAF: To keep the level of complexity at a reasonable level, we will have to focus on priority species (groups; by the way: "focussing on priority species" is more a strategy than an aim). Criteria for selecting the species are:

- requirements of species to habitat quality and spatial distribution (species with high demands that may serve as umbrella species)

- species of conservation concern

- species, for which the region has a special responsibility (endemic species, hosting a high proportion of European or World population)

There are already many attempts to select species of special concern. The European Continuum Project should rely on this work. E.g. in birds with the lists of priority species (Keller & Bollmann, 2004) or species for which a region has a high responsibility (endemic species). Identify and overcome important ecological barriers are also important aims.

BERTHOUD: Le choix des espèces prioritaires est utile pour le monitorage du réseau écologique

identifié (valeur d'indicateur de qualité, de vitalité ou de résilience du système « Réseau écologique alpin ») mais un choix d'espèces plus communes, représentatives du fonctionnement des écosystèmes montagnards, est plus approprié pour améliorer rapidement la définition du modèle de réseau écologique à mettre en place.

TOCKNER: see comment in question 2

RIGHETTI: Keines der oben erwähnten Punkte darf einzeln betrachtet werden, es sind alle grundsätzlich von Bedeutung.

Als gefährlich – würde es als „Umsetzungs-Glatteis" bezeichnen – ist der Schutzgebietsansatz. Einerseits gibt es da die Klippe der Gesetzgebungen, Verankerung, aktuellen Schutzziele …. der Gebiete oder „landspezifische Empfindlichkeiten" gegen verordneten Gebietsschutz. All dies verunmöglicht aus meiner Erfahrung ein einheitliches Vorgehen a priori. Andererseits können je nach Tiergruppe auch nicht geschützte Gebiete von zentraler Bedeutung sein.

Bei der oben aufgeworfenen Frage der Zielarten sollten sowohl wissenschaftliche Aspekte einbezogen werden – Arten mit grossem Schutzwert, wie auch „Verkaufsargumente" – Arten, die zwar nicht unbedingt selten sind, sich aber als „PR-Leitarten" eignen.

CABEZA : I find interesting to focus on fragmentation problems within and between protected areas. This is not only a matter of scale but also of system dynamics (i.e. land-use change within and between protected areas differs)

Also, one needs to focus on particular species. Good habitat connectivity is preferred, and one should avoid fragmenting the landscape further. However, when it comes to restoring or improving connectivity I would not do it for a particular habitat if I wouldn't know it is necessary, for the species depending on it. Obviously, the choice is clear if one has to chose what to protect, a very connected or a very fragmented landscape, without knowing anything about the habitat and the species. But the answer is not that simple when one has to set priorities, and the persistence of many species is at play. I would focus on particular species that are a) protected by legislation, b) representative of the Alps, and c) threatened by habitat loss and fragmentation at a particular scale. Some of these species would have connectivity needs at a PanEuropean scale, others at the scale of the Alps, some at the National level, others within smaller protected areas

II Questions concerning existing approaches, concepts and methods

4. The evaluation is focusing on 4 approaches to develop ecological networks:

- **A Biodiversity visions network / functional connectivity (developed by WWF)**
- **B Cross-border ecological networks / structural connectivity (developed by ALPARC)**
- **C Pan-European ecological network PEEN / European perspective**
- **D Swiss ecological network REN / national perspective**

Do you know other approaches, which are appropriate to develop and implement ecological networks in the Alps? Which ones (please add a short description or a citation of literature):

GRABHERR: Catchment approach in Vorarlberg (yet in elaboration)

REIMOSER: E: Wildlife Ecological Spatial Planning (WESP). Realised in some Austrian provinces (embodied in the hunting laws). Planning process includes GIS-based investigations by experts, participation of stakeholders, development of monitoring system, evaluation procedure for implementation.

Reimoser, F., 1996: Wildökologische Raumplanung für Schalenwildarten im Alpenraum. In: Sauteria, Salzburg, Bd. 8, 207-220.
Reimoser, F., 1999: Wildlife Ecological Spatial Planning (WESP): An instrument for integrating wildlife into comprehensive land management. In: C. Thomaidis and N. Kypridemos (eds.) Agriculture forestry – game, interating wildlife in land management. Proceedings of the

International Union of Game Biologists, XXIVth congress (1999), Thessaloniki, Greece, 176-185.
Reimoser, F., 2001: Wildökologische Raumplanung für Schalenwildarten im Alpenraum. In: Führer, E. and U. Nopp. (eds.). Ursachen, Vorbeugung und Sanierung von Wildschäden. Facultas Universitätsverlag, Wien, pp. 176-184
Reimoser, F., Spörk, J., Duscher, A., Agreiter, A., 2005: Evaluierung der Wild – Umwelt – Situation im Bundesland Vorarlberg unter besonderer Berücksichtigung der Auswirkungen des Vorarlberger Jagdgesetzes auf Wald und Wild (Vergleich 1988 – 2003). Endbericht, Vorarlberger Landesregierung, Bregenz, 373 S. (download unter http://www.vorarlberg.at/pdf/evaluierungdesjagdgesetze.pdf)

F: Der Alpen-Karpaten-Korridor (WWF Austria; http://www.wwf.at/de/menu80/)

G: Wildökologische Korridore Österreich (BOKU model; http://ivfl.boku.ac.at/upload/)

H: RVS 04.03.12 Wildschutz (September 2007), vom Österreichischen Bundesministerium BMVIT; enthält rechtsverbindliche Richtlinien für Wildtierpassagen (WTP) an Verkehrswegen (http://www.fsv.at/)

SCHAAD: IBA (Important Bird Areas) build a network of stepstones for birds; Natura 2000/Emerald: Network for threatened animals, plants and habitats

STÖCKLEIN: There is no other approach, which is appropriate to develop and implement ecological network in the Alps. The transboundary cooperation between National Park Berchtesgaden and Land Salzburg in the zone of the ALPARC pilot area number 2 is a "forerunner" for the implementing ecological network in a wider area (see minutes of meetinng platform Ecological Network in Munich, March 29, 2007).

GRAF: Smaragd, Natura 2000

BERTHOUD: Les méthodes appliquées en France (Réseaux écologiques dans les PNR, réseau écologique Isère (REDI) et réseau écologique rhône-alpin, sont toutes dérivées du PEEN ou du REN Suisse.

TOCKNER: I do not specifically know additional once adhoc, but I believe that organisations such as the IUCN or the TNC (e.g. Panamerican network) have developed similar approaches

SKOBERNE: What about Natura 2000? (I don't believe that metodologicaly Natura 2000 can contribute, but we have to take it into account)

RIGHETTI: Auf dieser Stufe nicht. Grundsätzlich möchte ich auf die Bemerkungen unter 3 verweisen, also das PEEN als Leitschnur zu verwenden. Hierbei stellt sich lediglich die Frage, ob sich der verwendete Massstab wirklich eignet. Aus der Erfahrung und – wo diese fehlt – aus dem Bauch heraus, scheint mir dieser etwas zu grob zu sein. Wenn dies mit einfachen Mitteln reduzieren liesse – etwa auf 1:1'000'000 – wäre dies sehr nützlich. Ein feinerer Massstab seinerseits würde das „Handling" der Karten zu sehr strapazieren.

Bei den obigen Aussagen basiere ich mich weniger auf das zugestellte Dokument, das von 2002 datiert, als vielmehr das letzte Produkt zum PEEN von 2006 bzw. 2007.

VANPEENE : application locale du principe du REN Suisse à l'échelle d'un département : REDI réseau écologique départemental de l'Isère

JAFFEUX : Commentaire : il est important, quelque soit les approches adoptées ou combinées que le réseau comporte des zones nodales, des corridors biologiques, des zones tampon et des zones de restauration bien identifiées, justifiées et concertées avec toutes les parties prenantes.

CABEZA : There are tools or softwares that deal with this type of conservation planning accounting for biodiversity,connectivity, and socio-economic constraits (e.g. Zonation: www.helsinki.fi/consplan). These tools require quantitative objectives. They can deal with species or habitat data, and they can generate a hierarchy of priorities.

The project Intrabiodiv (www.Intrabiodiv.eu) may be of relevance. Intrabiodiv assessed the species and genetic diversity of plants in the Alps and Carpathians. They also assessed protected areas and identified gaps in the current network

Please answer the following questions for each of the 4 approaches (or comparing them):

5. One of the main goals of this connectivity project will be identifying areas with a high need for connectivity. How far the presented methods are appropriate for identifying such areas ?

BAL: A: inappropriate species approach, put the emphasis on some specific aims, probably unreachable, and forgot the greater part of "common" biodiversity…
B: inappropriate, as protected areas are not "for sure" the best ones for biodiversity conservation
C: same as "A"
D: probably the best approach, but quite impossible to generalize to the Alps…

GRABHERR: REN is certainly most appropriate but depends on a adequate data source (the one used for REN is certainly unique for the Alps; thus, the REN approach can only be applied in regions where data sources are available which come close to the REN data base) Also the ALPARC approach is useful in its pragmatic way; however only regional problems could be solved.

REIMOSER: Combination of the 4 methods and addition of parts of other approaches probably will be most efficient.

SCHAAD: ALPARC: To start with an inventory of existing protected areas seems very reasonable. The inventory on existing measures was perhaps conducted too early in the project but gives a good base for future projects. Choosing indicators for the analysis of the existing connectivity helps detecting deficits. These indicators are to be analysed and well discussed.I'm not sure how important it is for implementation, that the focus is set on transboundary areas.
WWF: The identification of biogeographic subregions is another approach than starting with existing protected areas. It assumes that Taxa are not exclusively dependend on the existence of a protected area. The existing networks are taken into comparison only later in the gap analysis. This looks rather like the testing of a method than beeing aimed at implementation. Nevertheless the identification of focal species for different taxa, key habitats and ecological processes can be a good approach and should be considered. Further criterias like priority status, evaluation of habitat representation and ranking of areas are good tools to reduce the number of areas and should be discussed.
PEEN: The pure species approach can be interesting but depends heavily on data availability which may not be given. It can be taken into account. The involvement of actors into the process is useful because they know best, which measures could be taken!
REN: By choosing this approach, there would be one existing continuum in the alps which would cover a big part of the alps. The alps should therefor be divided into different continua (could be discussed). The produced maps are an ideal background for the different actors. This is necessary but need not be absolutely done in this project.

STÖCKLEIN: The method A (ALPARC) is the method focusing habitats and species in the wide-area across the common habitat Alps. There is a method for the structural and functional connectivity for a ecological network.
The cartografic scale is a good basis for designing corridors, the proposals for measures are planning basis for the implementation of the functional ecological network. We have a catalogue of indicators for the longe-range monitoring in the corridors not only in the Natura 2000-areas.

The aspects of species especially in the focus of method B (WWF) are regarded and coordinated with the ALPARC-method A . The ALPARC-method is for the implementation in a more detailed scale as the proposals of method B.
I agree, that the method C (PEEN) contains several deficiences because the lack of detailed European wide information on species distribution and trends.
The method C (REN) is a very high precision method based on a fully data source not in every country available. So it is a aim for the method A, for the implementation of ecological network in the Alps to achieve so a perfect work-level.

GRAF: A: Very course approach that is probably very useful at the pan-alpine scale. The identification of priority and connection areas is not only based on presently protected areas, which is an advantage in my view.
B: Focus on already existing protected areas. These areas mostly cover high altitudes. Habitats at high altitudes are naturally fragmented. Thus, of relatively low importance for identifying areas

with a high need for connectivity. However, good discussion on measures, detailed description of examples and for improving connectivity

C: Appropriate at the international scale; provides some links from eastern Europe to the alpine ecological network.

D: Very appropriate at different scales (see below)

BERTHOUD : Les secteurs peuvent être isolés par une forte distance pour atteindre des secteurs homologues ou par une fragmentation de l'espace liée aux activités humaines. Les possibilités de connexion sont toujours en fonction de la distance à parcourir et des obstacles à franchir. La cartographie détaillées des milieux favorables formant des continuums ou la présence d'habitats refuge pouvant favoriser l'aménagement d'un corridor, ainsi que l'identification précise de la nature des obstacles existant seront déterminants pour définir le potentiel de connectivité. La méthode du REN permet cette analyse. La distance d'application dépend des coefficients de résistance (frottement) rencontré dans le paysage à traverser et de la capacité de déplacement de l'organisme étudié. Le REN a testé les possibilités de traverser le plateau suisse (50-100 km) pour des grands ongulés et pour les carnivores (lynx et loup).

FASEL:Concerning only Liechtenstein the REN is the best approach.

TOCKNER: All 4 approaches use suitable methods and approaches to identify areas of high priority and potential. They all rely on available data bases (and often the same data bases). However, as emphasied for example in the PEEN document, major data deficits exist at the European as well as the Alpine scale. Personally, I know how difficult it is to develop a data base at the catchment scale, which must be the key ecological and management unit, because data are often available only at the country or county level, and the quality of data is unsufficient and unequall distributed (e.g. species distribution, species traits, long-term records, population size, ecosystem processes, etc..
Even data such as discharge or water temperature are often not available or accessible. I believe that beside the development of this connectivity programme, major efforts must be put into filling the data gap. I think that there is a great opportunity to benefit from combining the various monitoring programmes such as the Biodiversity monitoring, the water quality monitoring, etc.

Further, it remains key to assess the ecological quality of a proposed corridor. There has been a major debate on how low-quality corridors may serve as "sinks" for populations and communities.

An additional key problem that is common for all four approaches is that connectivity as a functional approach contrasts to the data that are collected and are primarily structural data (land-use maps, species distribution maps). The challenge is to "translate" the structural data into functional data (e.g. via species traits, indirect indicators of processes)

WWF: The specific elements for identifying corridors (see page 53) are fine and suitable. What is missing a bit is a nested selection procedure that ranks the elements according their hierachical position (i.e. importance, scale). The environmental filter approach (e.g. Tonn et al., Poff et al.) would provide a suitable approach. Or to develop an objective hierarchy as it is commonly used in decision making processes.

One aspect that need to be included too is the predicted change in flow, temperature, land-use, etc., in order to develop scenarios for future development. Such an approach may help to identify areas that still maintain connectivity but are under pressure (high risk areas). E.g. the Tagliamento still serves as a major corridor linking the Mediterranean and the Alpine biomes but there are many small impacts that threatens this function in a cummulative way.

REN: This is a good approach that combines environmental data with data on "Zeigerarten" (priority species). What is missing (or I did not find it in these documents) is the ragmentation of river corridors. This is a general problem of applying grid based data (e.g. land use) on linear features (e.g. rivers).

Another aspect that probably needs to be more considered is the connection between the Alps and areas outside the Alps. If we consider the Rhine, the Po, the Rhone, The Tagliamento or some of other Italian or Slovenian Rivers then it is clear that the conditions in the downstream sections have major influences on the sections in the Alpine belt, and vica versa (but this is considered in the PEEN approach).

Another key challenge is to assess the success of a connectivity project. One has always to keep in mind that connectivity means a function (in contrast to connectedness as a "structural" indicator), therefore one needs functional approaches to assess the degree of connectivity. Which indicators (biotic, functional, socioeconomic) are applied to test if the "connectivity" approach has been

successful? Is, for example, Lachs 2000 a good example of success evaluation? I have some major doubts!

For rivers, the approach by Christer Nilsson et al. (Science, 2005) could be applied. They have used 2 criteria (% free flowing sections and flow regulation) to identify three categories of river fragmentation. This approach could be applied for smaller catchments as well! It would be necessary to have such a map for all Alpine catchments >500 km2 (see similar approach in Austria by Muhar et al.)

GUGERLI: A: Only marginally, since the approach chosen focuses on identifying suitable areas for implementing corridors, rather than searching for areas in great need of connecting elements/areas

B: More or less adequate: purely expert approach:

- with limited validation

- focus on existing/potential corridors, not necessarily on areas with great need of connection

C: areas of need are rather superficially identified, using an arbitrary dispersal distance to set buffers around core areas

D: Only marginally, since the approach chosen focuses on identifying suitable areas for implementing corridors, rather than searching for areas in great need of connecting elements/areas

General remark: The approaches chosen predominantly rely on rather coarse methods to identify corridors, but rather focus on the core areas of biodiversity (protected or priority areas) and simply try to find connections between those. In addition, it is important to distinguish between areas that should serve as corridors and those that require measures so that they become functional (i.e. remove existing barriers to dispersal within corridors identified).

SKOBERNE: All 4 are relevant, but you have to pick bits of each. A overall habitat type map and DMR could be of great help as you can see the structure of the area and then model with particular species/groups. Unfortunatelly I'm not familiar enough with ALPARC work.

VANPEENE : A - Biodiversity visions network : cette approche n'est pas basée a priori sur une cartographie des zones d'intérêt pour la biodiversité mais elle peut inclure une localisation des zones prioritaires de conservation et des zones de connexion.

Cette identification des zones prioritaires a lieu par analyse d'experts taxons par taxons puis par superposition des cartes pour obtenir les zones concernées par le plus de taxons. Ces zones sont donc les plus susceptibles de bénéficier d'une création de connexions. La hiérarchisation identifie les zones prioritaires en termes de niveau de menace et d'urgence de l'action.

B - Cross-border ecological networks : cette approche n'identifie pas de zones importantes à connecter mais fait d'emblée le choix de s'intéresser aux espaces protégés de plus de 1000 ha. Elle identifie de manière détaillée les outils de gestion de l'espace et les politiques publiques susceptibles d'améliorer les connexions que les zones à connecter.

C - Pan-European ecological network PEEN : il se place uniquement à l'échelle des déplacements de dispersion et de migration. Les zones centrales identifiées sont à priori déjà constituées des zones contenant des populations dont la viabilité est assurée et uniquement pour des espèces d'importance européenne. Ce ne sont donc pas forcément des zones qui ont le plus besoin de connexion.

D - Swiss ecological network REN : il n'identifie pas vraiment les zones à besoin de connectivité mais il identifie les réseaux possibles quelque soit le type de zones à relier.

SPIEGELBERGER: Out of the four approaches, C (very large scale) and D (applies the principals of C and explicitly excludes the Alps) don't implement the particularities of the Alps which are too important to be neglected in the construction of an alpine wide ecological network. A and B are focused on the Alps and have developed methodologies adapted to the Alps (e.g. takes into account the altitude).

For identifying appropriate areas, A, C, and D use similar methods: based on existing data on species and habitat distribution, they tried to identify in a first step important areas which are then – in a second step – connected with each other. B uses another approach and extracts from an existing database of major protected areas in the Alps their 29 main protected areas. When comparing the priority conservation areas of B with those of A (they working with the same geographical limits), the result is similar, even if there is some divergence in a small number of regions (cf. WWF Fig. 25). However, concerning a way to identify priority zones in the Alps with their specific context, I prefer method A (WWF) over method B (ALPARC) for different reason.

Being based on the existing protected areas, even if honourable efforts are made to preserve and make evolve the biodiversity of these areas, comprises the potentiality that zones are included that hardly match the requested minimal habitat and species diversity. On the other hand, overlaying selected taxa and habitats maps allows representing the present diversity. This, however, means that species/habitats maps must be up to date and should have been produced using the same monitoring approaches in each mapping unit. That's exactly where I see a major problem. Moreover, the method used by WWF does – voluntarily - not include some important species groups or habitats. It would therefore be favourable to enlarge the existing taxa and habitat maps to other groups and habitats. I think in particular of insects and of lower plants, but also of particular habitats like mires, calcareous grasslands, or glacier foreland. Very important concerning a similar topic is in my view step 5 of the WWF approach (Evaluation of candidate areas). However, I'm very critical about the non-ranking of threats in step 6. In my opinion, berry and mushroom picking has not the same impact in the long run as urbanization!

JAFFEUX : Les approches C et D sont celles qui répondent le mieux à la question

CABEZA : While reading the 4 background documents I had the feeling that most of them are looking for areas to be connected without really assessing the need for connectivity. For example, some focal species are used in the WWF approach, to identify corridors, or areas that can be connected. Nonetheless, there is no proper investigation of whether these connections are needed, or how many of them; there is no prioritization across different types of connections or connection needs across species or habitats (although the summary mentions that connection areas would be identified based on ecological need, feasibility and political acceptance, the process cannot be evaluated from the report). Another problem is that instead of looking at the current landscape, its fragmentation and its needs for connection, this approach first identifies 'high biodiversity areas' and tries to connect these afterwards. This problem is similar in the ALPARC approach, although this approach explicitly analyses the situation of protected areas (of a minimum size, and especial attention on transfrontier areas)), and looks at many statistics of the protected areas (called indicators) that other approaches do not look at, and that may be of relevance. However, from the point of view of (species-specific) connectivity needs, this approach is too heuristic (considering mostly connectedness of habitat or landscape elements (protected areas)

Although the question here is which are the areas with a high need of connectivity, this can be understood in two ways: which are the areas that together represent a large amount of biodiversity of the Alps, and for which it is critical to preserve their connectivity (i.e. these areas will loose biodiversity if connectivity is lost), or which are the areas with species of conservation interest being most threaten currently because a lack of connectivity. Perhaps the approaches that go more into these directions are the PEEN and REN, because explicitly quantify connectivity needs (but see further comments below).

Within PEEN objectives I find very appropriate that "different species have been chosen for major habitat types(…). The critical distances for species have resulted in habitat-specific critical area sizes. The data have been used to define whether existing natural areas are too small or too isolated to carry viable populations and where reinforcement of ecological networks by corridors or area enlargement is desired" However I still have my reservations on how this has been done in practice, as there are several phases for the identification of core areas. PEEN uses rather transparent criteria for the choice of target species (e.g. species of European importance), and in principle, a good approach to identify core areas (considering together designated+acknowledged+areas fulfilling size criterion). I have my concerns (also expressed in p58) that species richness has been the criteria used, and that a connectivity criterion has not been used in this phase together with the size criterion (see also below, question 10)

The Swiss REN identifies nodal areas based on inventories of biotopes and assesses the connectifity of ecosystems, identifying areas with high potential for improving connections where needed. Although I also have my concerns on how connectivity is computed (with coefficients of resistence) I believe it is the most objective and quantitative approaches when comes to the assessment and improvement of connectivity of the network. The REN connectivity approach presents a computational problem for larger scales, however this could be solved by working at lower resolution.

6 Another goal of this connectivity project will be to work on different scales: Which of the 4 approaches can be used for working on

1) panalpine ecological networks including surrounding regions (>1:500 000) :

BAL: C

GRABHERR: No real need for an panalpine network (what species or habitats of conservation interest need this ?; the bearded vulture is probably the only one); "panalpine network" sounds good, and might be derived from ecological theory, but does it match reality: the alpine areas are isolated per se and shouldn't be connected (see the limitation of D to areas below 2100m); river continua are restricted to ergional catchments; so do forests; migration of the large carnivores is mainly in south-north direction, so do birds.

REIMOSER: Elements of C combined with elements of B, A, and D

SCHAAD: ALPARC, WWF and PEEN

STÖCKLEIN: Method A (ALPARC, Übernahme corridors from WWF), C (PEEN), D (REN)

SKOBERNE: PEEN

RIGHETTI: klar PEEN (siehe Punkt 4)

VANPEENE: A - Biodiversity visions network, C - Pan-European ecological network PEEN

2) regional ecological networks (1: 100`000 – 500`000) :

BAL: C, D

GRABHERR: B, A, D

REIMOSER: Elements of B combined with elements of D, A, and C

SCHAAD: ALPARC, WWF, REN

STÖCKLEIN: Method A (ALPARC), B (WWF)

RIGHETTI: Bemerkung: Kann hier natürlich nicht ganz objektiv sein! – Trotzdem und trotz aller durchgemachten Schwierigkeiten würde ich hier den REN-Ansatz wählen.

VANPEENE :A - Biodiversity visions network

B - Cross-border ecological networks

D - Swiss ecological network REN

3) local ecological networks (< 1: 100 000) :

BAL: D

GRABHERR: A and D where data and/or experts available

REIMOSER: Elements of D combined with elements of B, A, and C

SCHAAD: REN

STÖCKLEIN: Method A (ALPARC), D (REN)

GRAF: A: pan-alpine, coarse scale of 1:500'000; Priority areas and connection areas; the priority areas are at larger scale than protected areas – they can contain several protected areas.

B: pan-alpine scale, but with description of measures for improving connectivity at regional or local ecological networks. Additionally, detailed description of 8 example areas. For these areas information on regional ecological networks. Description of trans-border or large national assemblage of protected areas (with detailed description of important connections and barriers

C: international scale for eastern European countries; identification of core areas and corridors and proposed identification of restoration and buffer zones

D: The results of the REN for Switzerland can be integrated/ connected to the pan-alpine ecological networks. The detailed maps of the REN can be used as baseline data for improving connectivity at the regional level (cantonal level) and also at the local level. The provisional maps with a resolution of 1 ha (with the continua) have been validated by cantonal agencies and experts. The validation of the continua included field visits.

BERTHOUD: Une approche progressive du local au général (méthode REN) est préférable pour

établir un réseau écologique cohérent. Ainsi une cartographie même sommaire des continuums et des corridors à l'échelle du 1 :25'000 (éventuellement au 1 :50'000), situant notamment les espaces protégés au titre de zones nodales pour la biodiversité, fournit une information fiable et relativement complète, utilisable pour les échelles régionales et pan-alpins.

- Une approche directe par le niveau pan-alpin est utile pour obtenir une vue d'ensemble provisoire qui prévisualise la réalité et la complexité du problème.

- L'identification des besoins et des priorités des interconnexions viendra uniquement d'une analyse à partir des niveaux local et régional.

FASEL:no information about that.

TOCKNER: The PEEN is primarily at a large scale, the other approaches can be applied at all three scales. It very much depends on the "grain size" of data availability (in particular of the biota) and the questions asked (connectivity for what?). Again a hierarchical or nested approach would be necessary to develop and apply!!.

GUGERLI:
A: (regional –) panalpine (only protected areas >1000ha considered)

B: (regional -) panalpine

C: panalpine (at best!)

D: (regional –) local (working scale: 1:25'000; synthesis map: 1:100'000)

SKOBERNE: REN

RIGHETTI: Diesbezüglich macht keine der vorgestellten Arbeiten detaillierte Angaben. Im REN kann allerdings nachgelesen werden, wie es in der Schweiz im Rahmen des ökologischen Ausgleichs bzw. der Umsetzung der Ökoqualitätsverordnung abläuft. Sei es hier oder bei den ebenfalls laufenden Projekten im Rahmen der Umsetzung von Entschneidungsprojekten im Zusammenhang mit Wildtierkorridoren liegt der Massstab im Bereich von 1:10'000 oder gar 1:5'000.

VANPEENE: B - Cross-border ecological networks

D - Swiss ecological network REN

SPIEGELBERGER: For the work on local ecological networks D is the most appropriate method. It combines a high spatial resolution (maps at 1: 25 000) with local expert knowledge (verification by the cantons). For working on regional ecological networks, D seems to be the most appropriate, while for the pan-alpine scale, A and B seems equivalent. C is above the wanted scale.

JAFFEUX : C'est l'approche C qui est la mieux adaptée pour travailler à ces différentes échelles

CABEZA : I do not find the scale a big issue, it will mostly depend on the data availability.

a. <1:500 000 PEEN, WWF, ALPARC
b. 1:100 00 – 500 000 REN, PEEN (depending on species distribution maps)
c. <1:100 000 REN

7. The connectivity project will use mainly existing data (inventories, cartography, species data, population models, etc.) and expert information. Please compare the application of the 4 approaches regarding:

- data need (high, medium, low)

BAL: A medium, B medium, C low, D high

GRABHERR: A low; B low; C low; D high

SCHAAD: ALPARC: high, WWF: high, PEEN: high, REN: medium

TOCKNER: This is partly difficult to compare because very different scales have been considered (from CH to Europe) and the data quality at the CH level is much better and more consistent than at the European scale. From high to low:

GUGERLI: A: high, B: medium, C: medium, D: high

STÖCKLEIN: high: Method C (PEEN); medium: Method B (WWF); low: Method A (ALPARC), D (REN)

- availability of needed data (good, more or less, bad)

BAL: A more or less, B good, C good, D bad

GRABHERR: A good; B good; C bad; D good

SCHAAD: ALPARC: bad (but done now!), WWF: good, PEEN: more or less, REN: good

GUGERLI: A: medium, B: medium, C: medium, D: high

TOCKNER: REN: good but not available for the entire Alps;

STÖCKLEIN: good: Method A (ALPARC), D (REN); more or less: Method B (WWF); bad: Method C (PEEN)

- data consistence comparing different sources/countries (good, bad)

BAL: A bad, B good ?, C good, D bad

GRABHERR: A,B good(as being based on expert knowledge); C,D bad

SCHAAD: ALPARC: good, WWF: good, PEEN: bad, REN: good

TOCKNER: REN: good for CH but not consistent across Europe/country. Again, maps that had been produced for the EC are consistent, but only for EC countries (e.g. Corinne map not for CH). Data on biota (e.g. on aquatic and semiterrestrial organisms are very unevenly distributed across the Alps

GUGERLI: A: medium, B: medium – low (depending on experts available), C: medium – high, D: high

STÖCKLEIN: good: Method A (ALPARC), B (WWF), D (REN); bad: Method C (PEEN)

- costs (low, medium, high)

BAL: A medium, B low, C low, D high

GRABHERR: A,B,C – low, D – high

SCHAAD:, ALPARC: high, WWF: low, PEEN: medium, REN: medium

TOCKNER: Depends on general availability, and if these available data are free available. REN: low costs for many data. If you would like to have these data quality for the entire Alps than it would require major costs to get these data.

GUGERLI: A high, B: low (if data provided), C: medium, D: high

STÖCKLEIN: low: Method A (ALPARC), B (WWF), D (REN), high: Method C (PEEN)

REIMOSER:

A ALPARC

- data need (high, **medium**, low)
- availability of needed data (**good**, more or less, bad)
- data consistence comparing different sources/countries (**good**, bad)
- costs (**low**, medium, high)

B WWF

- data need (high, **medium**, low)
- availability of needed data (**good**, more or less, bad)
- data consistence comparing different sources/countries (**good**, bad)
- costs (**low**, medium, high)

C PEEN

- data need (high, **medium,** low)
- availability of needed data (**good**, more or less, bad)
- data consistence comparing different sources/countries (**good**, bad)
- costs (low, **medium**, high)

D REN

- data need (**high**, medium, low) - availability of needed data (good, **more or less**, bad)
- data consistence comparing different sources/countries (good, **bad**)
- costs (low, medium, **high**)

GRAF: A: Relatively low cost (no field work); based on existing data and knowledge

B: Low data need and costs at the pan-alpine scale (data on protected areas easily available). However, the description of trans-border and national assemblages of protected areas probably needed much effort. The same may be true for the eight examples of local networks of protected areas.
C: Relatively low data need and costs (maybe, except species distribution data)

D: Extensive data need: national databases on land-use categories, vector-based data and several inventories on vertebrate and invertebrate species (CSCF), birds (important bird areas), reptiles and amphibians (Karch). These data may not all be available for the other countries of central Europe. Validation of the continua required expensive field work.

BERTHOUD : L'établissement d'un réseau écologique fait appel certes aux habitats de valeur patrimoniale généralement connus et localisés, mais a besoin surtout de situer les habitats secondaires, souvent anthropogènes formant une grande partie de la matrice paysagère, qui constituent l'essentiel des continuums et des corridors. Une cartographie fine n'est pas nécessaire mais demande cependant une lecture correcte du paysage. Cette interprétation ne peut se faire que pas une vision du terrain par un cartographe expérimenté. Un manuel de terrain et une formation de quelques jours pour acquérir une méthode standard est donc nécessaire. Le REN a utilisé cette procédure.

Le besoin des données de qualité et la consistance variable des données resteront inévitablement une réalité des résultats obtenus par une première cartographie. La cohérence s'améliore par la suite avec la publication des cartes de synthèse qui mettront en évidence les lacunes et les incohérences.

FASEL:not enough information about that.

SKOBERNE: Difficult to compare as the scales of projects are so different. A common basic cartography would already be a big success.

RIGHETTI: Ehrlich gesagt, hatte ich nicht genügend Zeit, die verschiedenen Arbeiten "à fond" auf diese Fragen hin durchzugehen.

Aus der Erfahrung des REN soviel: Grundsätzlich sind genügend Daten vorhanden, meistens sind diese auch verfügbar. Diese Kosten halten sich auch im Rahmen, solange man auf den vorhandenen Daten baut. Werden jedoch Feldarbeiten nötig ändert sich das Bild.

Bezogen auf die Qualität der Daten gab es bereits innerhalb der Schweiz grosse Unterschiede, dies nicht nur zwischen Mittelland und Alpenraum, sondern auch innerhalb von Kantonen im gleichen Naturraum.

VANPEENE:

	Data need	availability	consistence	costs
A – Biodiv. visions network	forte	mauvaise	mauvaise	élevé
B - Cross-border ecological netwks	faible	bonne	bonne	faible
C - PEEN	moyenne	plus ou moins	mauvaise	moyen
D - REN	moyenne	plus ou moins	bonne	moyen

SPIEGELBERGER:

	A (WWF)	B (ALPARC)	C (PEEN)	D (REN)
data need	high	low	high	high
availability	more or less	good	more or less	bad
consistence	bad	good	bad	bad
costs	high	low	medium	high

JAFFEUX : Toutes les méthodes demandent plus ou moins la mobilisation de données existantes et la collectes de données nouvelles. Les approches A et B sont celles qui peuvent le plus s'accommoder des seules données existantes. Pour C et D, il faut obligatoirement passer par une phase de collecte de nouvelles données.

CABEZA : If one compares the data used in the different approaches one realizes that data efforts should be combined to achieve better results. Sounds that REN is the more data demanding approach, as it is a local approach requiring information at fine resolution, and there may be problems of data availability for some regions/nations. The other approaches are similar in data demands and availability, and all of them would benefit from exchanging data. Perhaps the WWF approach is the less data demanding, but it relies strongly on expert opinions, and it is therefore less quantitative or transparent (at least from what I could assess with the report provided). I do not have the expertise to comment on costs or consistency among countries.

8. The connectivity project aims as well to propose and implement measures to improve / preserve connectivity. Which measures for implementation mentioned in the four approaches or deriving from them are most suitable for improving ecological connectivity on panalpine, regional and local level?

BAL: ?

GRABHERR: Panalpine – useless exercise; at least useful as a vision

Regional – B ALPARC approach;

Local – D - REN approach; A – if experts available

SCHAAD: panalpine:

Measures concerning: communication and collaboration between actors (specific measures, science), CAP (common agricultural policy), land use regulation, traffic and common management of protection areas

regional: Measures concerning: ecological agriculture, near-natural forestry, traffic, water management, public relations, tourism, inventories, extension of existing protection areas, extension of borders of protection areas, definition of migration corridors and better protection of core areas,

local: Measures concerning: Overcoming of ecological barriers, corridors, networking and tourism

STÖCKLEIN: The connectivity projekt.....Which measures ....?

- panalpine level: measures of Method A (ALPARC), B (WWF), C (PEEN)
- regional level: Method A (ALPARC), D (REN)
- local level: Method D (REN)

GRAF: Panalpine:

- Coordination and planning at pan-alpine and regional level; actions at local level

- Regional: - Identify important ecological barriers that can be overcome by building “green bridges” over highways.
- Local: - Improve the effect of subsidies for ecological compensation areas in farmland/agriculture. Optimize the quality and the location of ecological compensation areas. Where food production is not possible in a profitable way, subsidies should further habitat quality for farmland biodiversity.

General remarks: - Connectivity can hardly been reached without source populations that produce dispersing individuals. Therefore, as a main focus, we should improve the quality of habitats. See local measures.

- Follow the principle of adaptive management: the effect/ success of measures has to be assessed in order to permanently adapt and optimise the measures.

BERTHOUD : Les mesures de connectivité dépendent entièrement d’un travail de cartographie systématique à envisager pour obtenir une vue d’ensemble des potentialités existant sur le terrain et des opportunités d’aménagement et de protection des corridors identifiés au cours de l’analyse.

- Les potentialités dépendent strictement d’un travail de cartographie fait par des équipes indépendantes.
- Les choix de priorités et d’opportunité dépendent de la validation et de l’implication des autorités administratives consultées au cours de la démarche du projet.

La procédure suivante est proposée :

Niveau pan-alpin :

- Mettre en place le modèle cartographique du réseau provisoire à partir de la définition des éléments structurant de réseaux écologiques (selon modèle REN : zones nodales, zones d’extension, continuums, corridors).

- Réunir les données cartographiques communes standards à utiliser au minimum : Cartes nationales digitalisées, imagerie satellite, inventaires des sites protégés connus, fichiers des habitats prioritaires NATURA/CORINE.
- Choisir une procédure de validation pour les équipes régionales : étapes de travail, fiches descriptives d’identification sur photos aériennes et sur le terrain.

- Proposer des guildes d’espèces indicatrices des fonctionnalités de réseaux écologiques adaptées aux zones altitudinales et biogéographiques du massif alpin. Ces guildes de référence peuvent être complétées aux niveaux local et régional si nécessaire.

- Répartir les données de base et les consignes de travail dans les groupes régionaux.

- Collecter les informations cartographiques des réseaux écologiques régionaux après validation par les équipes régionales.

- Faire le traitement de synthèse et fixer les priorités retenues après analyse des propositions locales et régionales.

Niveau régional :

- Faire une analyse critique des données fournies par la direction de projet en fixant des priorités et en complétant les instructions reçues (traduction).

- Contacter les autorités administratives ayant à charge l’aménagement du territoire et la planification environnementale pour expliquer et coordonner la démarche (au cas où des projets similaires sont en cours (cas Suisse, France, Italie, notamment). Dans ce cas on utilisera, dans la mesure du possible, les informations des projets en cours pour appliquer la procédure adoptée au niveau pan-alpin.

- Former des groupes de travail locaux pour appliquer les procédures proposées par la direction du projet. Prévoir notamment des exemples de cartographie à faire en commun sur le terrain avec une correction instantanée par un responsable méthodologique.

- Distribuer les secteurs à analyser par des équipes locales.

- Collecter et vérifier la cohérence des informations obtenues au niveau local.

Niveau local :

- Etablir un programme de vérification sur le terrain avec une mise à disposition du matériel cartographique et des fiches de relevés (commentaires de justification avec schémas et photos, pour des cas particuliers ou des points de conflit identifiés).

- Organisation des équipes locales et répartition des tâches.

- Contrôle de l'avancement et de la qualité du travail par un responsable reconnu par le niveau régional.
- Collecte et enregistrement des données obtenues avant transmission.
- Bilan des opérations locales avec propositions d'applications (listes et priorités d'interventions)

FASEL:not enough information about that.

TOCKNER: ALPARC: very general reommendations on how to implement the approach. The approach is primarily based on area and extent of existing protected areas. The same with the PEEN approach: at present is a very rough pilote study focusing on structural aspects. REN very ambigious. WWF: I wonder how the maps have been created? Some maps (e.g. priority areas for freshwaters) are questionable.

GUGERLI: A: no specific measures are recommended, but a rather broad summary is provided

B: no specific measures are recommended

C: no specific measures are recommended, since it can only be seen as a rough guideline to argue for regional or local planning and implementation

D: a rather long list is given with specific situation in which REN may be a useful knowledge basis (rather than concrete measures)

SKOBERNE: Not knowing details enough to answer.

RIGHETTI: Auch hierzu eine grundsätzlich Anmerkung: Soweit ich es beurteilen kann, bestehen mindestens zwischen der Schweiz und den übrigen Ländern etliche Unterschiede: sei es in der Rechtsgrundlage, der Anwendung dieses Rechts, den Abläufen zwischen Entscheiden und deren Umsetzung (im Sinne etwa von Zentralismus und Föderalismus) – um nur einige zu nennen.

Wie es in den übrigen Ländern aussieht, können Sie besser beurteilen. Aus meiner (nicht riesigen internationalen) Erfahrung aus betrachtet, sind auch hier innerhalb der einzelnen Länder und natürlich auch untereinander doch gewisse Fallstricke und Schwierigkeiten vorhanden …

Inhaltlich soviel: Mir scheint es wichtig, zwar aufbauend auf den mehr oder weniger vorhanden Vernetzungsachsen und ihrer Sicherung, das Potenzial der Landschaft einzubeziehen: sei es bezüglich der Vernetzung, sei es bezüglich von Vorranggebieten – unabhängig, ob sie geschützt sind oder nicht.

Ein weiteres Stichwort ist das „Nutzen von Synergien": etwa bezogen auf den Hochwasserschutz, in dem man den Fliessgewässern mehr Raum zur Verfügung stellt und damit die entsprechenden Vernetzungsachsen stärkt oder bei Strukturänderungen in der Landwirtschaft durch ein Anreizsystem der Ökologie mehr Gewicht verleiht.

VANPEENE :

on panalpine level

Recherche du meilleur outil (réserve de biosphère) pour la mise en réseau des espaces protégés (Cross-border ecological networks).

Utiliser les zones Natura 2000 comme éléments de liaison entre les espaces protégés (Cross-border ecological networks).

Remettre en état les paysages des vallées (Cross-border ecological networks).

Communiquer vers les états et les utilisateurs en utilisant des cartes comme outils de médiation (PEEN, Biodiversity visions network)

Une étude préliminaire des opportunités et des menaces avant de proposer l'établissement d'un réseau (PEEN, Biodiversity visions network)

Importance de soutenir et préserver les espèces endémiques des Alpes (PEEN) mais aussi de préserver des zones où beaucoup de taxons sont présents (Biodiversity visions network)

Aires de restauration de la nature pour élargir ou connecter les zones protégées en recréant des écosystèmes autorégulés (PEEN)

Unifier la création de cartes d'habitats compatibles et les réaliser ou les réactualiser sur tout le territoire de l'Europe (PEEN)

La carte indicative avec son guide qui permet entre autre de résumer les données de manière compréhensible pour les acteurs publics et d'identifier les zones de conflit entre plusieurs types de planification (PEEN)

Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité à long terme (de l'ordre du siècle) (PEEN)

Hiérarchisation par degré d'urgence ou d'opportunité (Biodiversity visions network)

on regional level

Inciter les états voisins à créer des frontières communes longues entre leurs espaces protégés et inciter les équipes à travailler ensemble (Cross-border ecological networks).

Recherche du meilleur outil (réserve de biosphère) et de la synergie de tous les instruments de politique publique pour améliorer la connectivité entre zones protégés par une zone tampon qui soit géré et utilisé de manière compatible avec la préservation des espèces (Cross-border ecological networks, PEEN, biodiversity visions network).

Augmenter la durée des contrats de mesures agrienvironnementales et/ou avoir une politique d'achat de ces espaces pour leur assurer une vraie durabilité (Cross-border ecological networks).

Remettre en état les paysages des vallées (Cross-border ecological networks).

Impliquer plus les espaces protégés dans les planifications d'aménagement du territoire au delà de leur zone centrale (Cross-border ecological networks).

Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité à long terme (de l'ordre du siècle) (PEEN)

Hiérarchisation par degré d'urgence ou d'opportunité (Biodiversity visions network)

on local level

Utilisation comme base de travail de l'usage actuel du sol (REN et Cross-border ecological networks)

L'identification des points de conflits ou obstacles anthropiques à résoudre (accidents entre faune et véhicules ou écrasements constatés) est une bonne base de démarrage d'actions locales et de sensibilisation des élus et acteurs locaux (REN)

Le découpage de l'espace en secteurs écologiques isolés par des obstacles infranchissables (REN et Cross-border ecological networks mais là en excluant les zones à problèmes trop difficiles à résoudre)

La validation locale par les acteurs au niveau canton ou département et la production d'un document « cadre » qui doit être complété par des analyses locales (REN)

Communiquer selon un plan de diffusion adapté localement (REN).

Remettre en état les paysages des vallées (Cross-border ecological networks).

Augmenter la durée des contrats de mesures agrienvironnementales et/ou avoir une politique d'achat de ces espaces pour leur assurer une vraie durabilité (Cross-border ecological networks).

Impliquer plus les espaces protégés dans les planifications d'aménagement du territoire au delà de leur zone centrale (Cross-border ecological networks).

La connexion des petites zones protégées (Cross-border ecological networks).

Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité (PEEN)

SPIEGELBERGER: I am not sure, whether measures of implementation should already be engaged. At the current state, the definition of the important continuum zones is not yet done in a sufficient way (lack of certain taxons/habitats, cf. above).

A second point is that the Ecological Continuum project (ECP) can only propose, but the implementation has in my opinion to be done by the local/regional/national authorities and/or stakeholders. However, the ECP may act as moderator between different groups of interest and pushes the process of implementation. Communication and the involvement of local stakeholders and practitioners, more or less mentioned in all reports, is one of the most important actions which should be undertaken in this context. Indeed, I'm conscious that this is not a concrete action, but

an inevitable preparing action which shouldn't be in any case neglected. Taking a concrete example, I can hardly imagine that the ECP will have the funding sources to pay for the tunnels/bridges to increase the connectivity between the Chartreuse and Vercors Regional Parks.

Further ECP may act as coordinator and initiator for the harmonisation of monitoring methods, elaboration of common standards, facilitator of the exchange between stakeholders, and communicator of methods of "good practise". I clearly see the role of the ECP more as a project manager which pushes stakeholders to undertake actions to maintain or increase the connectivity of some areas.

At all three levels, the question of the coordination seems important. That means, that continuums zones must be planned by an independent expert body (WWF?, ALPARC?, scientific community?), but at the same time well esteemed by the national/regional authorities. The ECP may be the right platform where scientific/field experts and stakeholders meet and discuss about the way how and where to implement ecological continuum zones.

JAFFEUX : Identifier les corridors écologiques transfrontaliers

Localiser les principaux points noirs qui font obstacle à la continuité écologique transalpine

Interconnecter les espaces protégés alpins là où cela est pertinent écologiquement

CABEZA : I must admit that it has been hard to identify approaches that deal with improving connectivity.

I emphasise that two issues are confused across the approaches: the need to preserve critical current connectivity, and the need to restore connectivity. For instance, WWF concentrates on identifying important biodiversity areas, and then identifies large scale corridors, without assessing whether these are areas that have pristine habitat that will have to be protected, or whether these are areas that have to be restored. PEEN identifies needs for area enlargement or connectedness at a pan(European)/Alpine scale, REN identifies potential areas to improve connectivity at a national level with a quantitative and defensible approach that could be extended to larger scales if data were available

Summary of all concrete measures mentioned by experts:

Measures on panalpine level

- communication and collaboration between actors (specific measures, science), CAP (common agricultural policy), land use regulation, traffic and common management of protection areas
- Coordination and planning at pan-alpine and regional level; actions at local level
- Mettre en place le modèle cartographique du réseau provisoire à partir de la définition des éléments structurant de réseaux écologiques (selon modèle REN : zones nodales, zones d'extension, continuums, corridors).
- Réunir les données cartographiques communes standards à utiliser au minimum : Cartes nationales digitalisées, imagerie satellite, inventaires des sites protégés connus, fichiers des habitats prioritaires NATURA/CORINE.
- Choisir une procédure de validation pour les équipes régionales : étapes de travail, fiches descriptives d'identification sur photos aériennes et sur le terrain.
- Proposer des guildes d'espèces indicatrices des fonctionnalités de réseaux écologiques adaptées aux zones altitudinales et biogéographiques du massif alpin. Ces guildes de référence peuvent être complétées aux niveaux local et régional si nécessaire.
- Répartir les données de base et les consignes de travail dans les groupes régionaux.
- Collecter les informations cartographiques des réseaux écologiques régionaux après validation par les équipes régionales.
- Faire le traitement de synthèse et fixer les priorités retenues après analyse des propositions locales et régionales.
- Recherche du meilleur outil (réserve de biosphère) pour la mise en réseau des espaces protégés (Cross-border ecological networks).

- Utiliser les zones Natura 2000 comme éléments de liaison entre les espaces protégés (Cross-border ecological networks).
- Remettre en état les paysages des vallées (Cross-border ecological networks).
- Communiquer vers les états et les utilisateurs en utilisant des cartes comme outils de médiation (PEEN, Biodiversity visions network)
- Une étude préliminaire des opportunités et des menaces avant de proposer l'établissement d'un réseau (PEEN, Biodiversity visions network)
- Importance de soutenir et préserver les espèces endémiques des Alpes (PEEN) mais aussi de préserver des zones où beaucoup de taxons sont présents (Biodiversity visions network)
- Aires de restauration de la nature pour élargir ou connecter les zones protégées en recréant des écosystèmes autorégulés (PEEN)
- Unifier la création de cartes d'habitats compatibles et les réaliser ou les réactualiser sur tout le territoire de l'Europe (PEEN)
- La carte indicative avec son guide qui permet entre autre de résumer les données de manière compréhensible pour les acteurs publics et d'identifier les zones de conflit entre plusieurs types de planification (PEEN)
- Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité à long terme (de l'ordre du siècle) (PEEN)
- Hiérarchisation par degré d'urgence ou d'opportunité (Biodiversity visions network)
- Identifier les corridors écologiques transfrontaliers
- Localiser les principaux points noirs qui font obstacle à la continuité écologique transalpine
- Interconnecter les espaces protégés alpins là où cela est pertinent écologiquement

Measures on regional level

- Measures concerning: ecological agriculture, near-natural forestry, traffic, water management, public relations, tourism, inventories, extension of existing protection areas, extension of borders of protection areas, definition of migration corridors and better protection of core areas,
- Identify important ecological barriers that can be overcome by building "green bridges" over highways.
- Faire une analyse critique des données fournies par la direction de projet en fixant des priorités et en complétant les instructions reçues.
- Contacter les autorités administratives ayant à charge l'aménagement du territoire et la planification environnementale pour expliquer et coordonner la démarche (au cas où des projets similaires sont en cours (cas Suisse, France, Italie, notamment). Dans ce cas on utilisera, dans la mesure du possible, les informations des projets en cours pour appliquer la procédure adoptée au niveau pan-alpin.
- Former des groupes de travail locaux pour appliquer les procédures proposées par la direction du projet. Prévoir notamment des exemples de cartographie à faire en commun sur le terrain avec une correction instantanée par un responsable méthodologique.
- Distribuer les secteurs à analyser par des équipes locales.
- Collecter et vérifier la cohérence des informations obtenues au niveau local.
- Inciter les états voisins à créer des frontières communes longues entre leurs espaces protégés et inciter les équipes à travailler ensemble (Cross-border ecological networks).
- Recherche du meilleur outil (réserve de biosphère) et de la synergie de tous les instruments de politique publique pour améliorer la connectivité entre zones protégés par une zone tampon qui soit géré et utilisé de manière compatible avec la préservation des espèces (Cross-border ecological networks, PEEN, biodiversity visions network).
- Augmenter la durée des contrats de mesures agrienvironnementales et/ou avoir une politique d'achat de ces espaces pour leur assurer une vraie durabilité (Cross-border ecological networks).
- Remettre en état les paysages des vallées (Cross-border ecological networks).

- Impliquer plus les espaces protégés dans les planifications d'aménagement du territoire au delà de leur zone centrale (Cross-border ecological networks).
- Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité à long terme (de l'ordre du siècle) (PEEN)
- Hiérarchisation par degré d'urgence ou d'opportunité (Biodiversity visions network)

Measures on local level

- Measures concerning: Overcoming of ecological barriers, corridors, networking and tourism
- Improve the effect of subsidies for ecological compensation areas in farmland/agriculture. Optimize the quality and the location of ecological compensation areas. Where food production is not possible in a profitable way, subsidies should further habitat quality for farmland biodiversity.
- Etablir un programme de vérification sur le terrain avec une mise à disposition du matériel cartographique et des fiches de relevés (commentaires de justification avec schémas et photos, pour des cas particuliers ou des points de conflit identifiés).
- Organisation des équipes locales et répartition des tâches.
- Contrôle de l'avancement et de la qualité du travail par un responsable reconnu par le niveau régional.
- Collecte et enregistrement des données obtenues avant transmission.
- Bilan des opérations locales avec propositions d'applications (listes et priorités d'interventions)
- Utilisation comme base de travail de l'usage actuel du sol (REN et Cross-border ecological networks)
- L'identification des points de conflits ou obstacles anthropiques à résoudre (accidents entre faune et véhicules ou écrasements constatés) est une bonne base de démarrage d'actions locales et de sensibilisation des élus et acteurs locaux (REN)
- Le découpage de l'espace en secteurs écologiques isolés par des obstacles infranchissables (REN et Cross-border ecological networks mais là en excluant les zones à problèmes trop difficiles à résoudre)
- La validation locale par les acteurs au niveau canton ou département et la production d'un document « cadre » qui doit être complété par des analyses locales (REN)
- Communiquer selon un plan de diffusion adapté localement (REN).
- Remettre en état les paysages des vallées (Cross-border ecological networks).
- Augmenter la durée des contrats de mesures agrienvironnementales et/ou avoir une politique d'achat de ces espaces pour leur assurer une vraie durabilité (Cross-border ecological networks).
- Impliquer plus les espaces protégés dans les planifications d'aménagement du territoire au delà de leur zone centrale (Cross-border ecological networks).
- La connexion des petites zones protégées (Cross-border ecological networks).
- Gestion adaptative où dans chaque corridor les actions de gestion menées sont suivies comme des expérimentations afin de pouvoir évaluer leur efficacité (PEEN)

9. Regarding the most important aims which can be reached by improving ecological connectivity mentioned by you in question 3: How far the proposed 4 approaches are fitting with these aims?

Please specify and justify: do fit / do partly fit / do not fit for all of the 4 approaches:

JAFFEUX : Les approches C et D sont celles qui répondent le mieux à la réponse faite à la question 1 car ces deux approches construisent des réseaux écologiques complets avec les quatre éléments constitutifs de tout réseau écologique : z. nodales, corridors, tampon et restauration. L'approche PEEN apporte la dimension du local au supra national

L'approche du WWFest trop dirigée vers les seules espèces alpines emblématiques et celle d'ALPARC trop exclusivement orientée vers les questions transfrontalières et interespaces protégés.

CABEZA : PEEN fits well with identifying connectivity needs for particular species if one focuses on core areas rich in numbers of species of interest. REN offers a context to assess fragmentation of habitats at a finer resolution; it also allows looking at the potential of the landscape, not only the current situation. REN's approach can assess connectivity within and between areas. PEEN has clear (rather objective) choices for focal species (given data availability constraints). Both PEEN and REN fit with the aims identified. The ALPARC and WWF approaches are perhaps more practical. While they may use biodiversity data, expert opinion, and may or may not include current protected areas, in my view they do not deal with properly with connectivity

- General aims:

O improve / preserve connectivity for (endangered) species or (isolated) populations

O improve / preserve habitat diversity and connectivity between habitats

BAL: A do not fit, B do partly fit, C do not fit, D do fit

X **GUGERLI**: A: fits (improvement of conservation status within connectivity areas should increase diversity and thus favor connectedness)

B: fits (improvement of conservation status in connectivity areas increases diversity and favors connectivity)

C: partly fits (too coarse for the Alpine scale)

D: fits (combines identification of core areas, "potential areas", and connecting corridors)

O improve both, habitat connectivity and connectivity for specific species or populations

X **GRABHERR**: A – do partly fit; B – do partly fit; C- do not fit; D – do fit

X **REIMOSER**: Both always interconnected; habitats have priority before present populations. Fits for all 4 approaches.

X **SCHAAD**: ALPARC: Does partly fit. By focussing on the protection areas, the habitat connectivity and the connectivity for species or populations is not given. The protection areas may nevertheless include these habitats or species.

WWF: Does fit. The chosen approach points to the aims.

PEEN: Does partly fit. Connectivity is reduced to species level.

REN: Does fit. Continuum (habitat) and corridors (species) are the products of this method

X **VANPEENE**

O other general aims:

X **BAL**: prevent "common" biodiversity erosion through gloBAL climatic changes : A do not fit, B do partly fit, C do not fit, D do partly fit……

X **GUGERLI**: environmental dynamics. A partly fits (depending on the nature and the management of the connectivity areas)

B: partly fits (it is appreciated that processes should be supported, though they are hard to predict – suggestion to include steep gradients, e.g. elevation, or instable habitat types, e.g. river banks given natural dynamics)

C: partly fits (dynamics is mentioned as relevant, and it's likely to occur in the large-scale corridors defined)

D: does not fit (dynamics not considered in evaluation)

RIGHETTI: Ich habe auch in diesem Punkt Mühe, den einen oder anderen Ansatz hervorzuheben. Vielmehr scheint es mir wichtig zu unterstreichen, dass grundsätzlich auch hier Pragmatismus im Vordergrund stehen soll (siehe Punkt 10). Im Weiteren finde ich es wichtig dem Potential einen hohen Stellenwert beizumessen (REN). Diese Betrachtung ist insbesondere in den Talgebieten notwendig.

SPIEGELBERGER:

	A (WWF)	B (ALPARC)	C (PEEN)	D (REN)
species and population	**do fit** (species and population are mentioned in step 2. However, some important species groups are not included, cf. above)	**do partly fit** (is mainly concentrated on habitats, but includes some ideas of connectivity for species (ibex)	**do partly fit** (is concentrated on species with European importance what implies that many species with regional importance may not be included)	**do partly fit** (the approach makes important efforts to create guilds for ecotypes, but restricts the guilds mainly to insects)
habitat	**do fit** (step 5. Moreover, the evaluation of the habitats tries to equally distribution the protected zones within the different biogeographic regions)	**do fit** (is clearly concentrated on habitats and is based on the inventory of the existing protected areas)	**do partly fit** (but only takes into account major habitats)	**do fit** (the main ecological habitats are included in the inventory and represented in a separate layer)
both	**do fit** (includes both, a species/population approach (step 2) and a habitat approach (step 5)	**do partly fit** as species and populations are only slightly touched.	**do partly fit** (cf. above)	**do partly fit** (as they are same missing elements mainly in the assessment of the guilds (see above), the approach is only partly fitted to improve both, habitat and species connectivity

JAFFEUX:

Approche A

X improve/preserve connectivity for (endangered) species or (isolated) populations

O improve/preserve habitat diversity and connectivity between habitats

O improve both, habitat connectivity and connectivity for specific species or populations

O other general aims: ……..…..

Approche B

O improve/preserve connectivity for (endangered) species or (isolated) populations
O improve/preserve habitat diversity and connectivity between habitats
O improve both, habitat connectivity and connectivity for specific species or populations
X other general aims: improve/preserve connectivity for espaces protégés situés près des frontières et corrige les défauts des limites d'origine de ces espaces protégés
……..…..

Approche C

X improve/preserve connectivity for (endangered) species or (isolated) populations
X improve/preserve habitat diversity and connectivity between habitats
X improve both, habitat connectivity and connectivity for specific species or populations
X other general aims. cette approche conduit à la réalisation de véritables réseaux écologiques intégrés et supra nationauxet et ne traite pas seulement de connectivité. C'est un système qui rend plus performant les espaces protégés en en faisant un véritable réseau solidaire.

Approche D

X improve/preserve connectivity for (endangered) species or (isolated) populations
X improve/preserve habitat diversity and connectivity between habitats
X improve both, habitat connectivity and connectivity for specific species or populations
X other general aims: cette approche conduit aussi à la réalisation de véritables réseaux écologiques mais au niveau national. Mais cette approche se combine bien avec l'approche C dont elle en est un élément constitutif.

– Specific aims:

O identify and overcome important ecological barriers (terrestrial and aquatic)

X **BAL**: A do partly fit, B do partly fit d, C do not fit, D do fit

X **REIMOSER**: Approach D (REN) fits best.

X **SCHAAD**: ALPARC: Does fit. The connection areas are on a scale that is still too large.

WWF: Does partly fit. The approach is aiming at viable populations, which is good. The corridors are looked at at a "macro"-scale which is too rough for overcoming ecological barriers.

PEEN: Does partly fit. The result is a set of so-called search-areas where connection via corridors is needed. This is on an scala, that is too rough.

REN: Does fit: Proposals for the overcoming of ecological barriers are shown on a fine scale.

X **GUGERLI**: A: partly fits (approach only considers traffic elements; could easily be improved if altitudinal distribution is analyzed with respect to topographical barriers)

B: partly fits (only considers traffic elements; could easily be improved if altitudinal distribution is analyzed with respect to topographical barriers)

C: does not fit (approach only sets buffers around core areas)

D: partly fits (topographical barriers not considered)

O focus on connectivity in and between protected areas and priority conservation areas

X **SCHAAD**: ALPARC: Does fit.

WWF: Does partly fit. The protected areas and PCA are used to find important corridors for connecting the selected Priority areas.

PEEN: Does partly fit. See WWF.

REN: Does not fit. The protected areas and PCA are considered only marginally.

X **GUGERLI**: A fits (exclusively aimed at connecting between protected areas)

B: fits (priority areas as the basis for identifying connection areas)

C: fits (core areas as basis for delimiting corridors)

D: partly fits (protection status of areas not specifically considered)

X **VANPEENE**

O focus on priority species (groups): which ones?

X **GRABHERR**: A – do partly fit; B – do partly fit; C – do partly fit; D – do fit

X **REIMOSER**: O focus on priority species (groups, umbrella species): which ones? Large carnivores (wolf, bear, lynx), large herbivores (e.g. red deer, chamois, ibex, wild boar), further specific fish and migratory birds. Approaches D, C, and B fit.

O improve connectivity for the survival of large carnivores

X **GRABHERR**: A- do fit; B – do partly fit, C – do partly fit; D – do fit

X **REIMOSER**: O improve connectivity for the survival of species mentioned above. Approaches D, C, and B fit.

O other specific aims: ……..

STÖCKLEIN:

9. Regarding the most important aims....Specifying und justifying the proposed approaches:

- general aims:

  improve /preserve connectivity for (endangered) species or (isolated) populations

  1. do fit: Method A (ALPARC), D (REN)
  2. do partly fit: Method B (WWF), C (PEEN)
  3. do not fit: -----

  improve/preserve habitat diversity and connectivity between habitats

  1. do fit: Method A (ALPARC), D (REN)
  2. do partly fit: Method B (WWF), C (PEEN)
  3. do not fit: ----

  improve both, habitat connectivity and connectivity for specific species or populations

  1. do fit: Method A (ALPARC), D (REN)
  2. do partly fit: Method B (WWF)
  3. do not fit: Method C (PEEN)
- other general aims: improve/preserve species and populations endangered by climate change
- specific aims:

  identify and overcome important ecological barriers (terrestrial and aquatic)

  1. do fit: Method A (ALPARC), D (REN)
  2. do partly fit: Method B (WWF), Method C (PEEN)
  3. do not fit: ------

  focus on connectivity in and between protected areas and priority conservation areas

  1. do fit: Method A (ALPARC), Method D (REN)
  2. do partly fit: Method C (PEEN), Method B (WWF)
  3. do not fit: ------

focus on priority species (groups)

1. do fit: Method A (ALPARC)/Method B (WWF): vegetation / flora, large carnivores, large herbivores, medium and small mammals, birds, herpetofauna, terrestrial invertebrates,
   Method D (REN): birds, other vertebrates and invertebrates, reptiles and amphibians,
2. do partly fit: Method C (PEEN): birds, butterflies
3. do not fit: ---------

improve connectivity for the survival of large carnivores

1. do fit: Method A (ALPARC), B (WWF), D (REN)
2. do partly fit: Method C (PEEN)
3. do not fit: ------

GRAF:

General aims	**A**	**B**	**C**	**D**
Improve/preserve habitat diversity, quality and connectivity	Does partly fit; priority conservation and connection areas allow us to set priorities at the pan-alpine and national scale	Does fit; however, this approach is based mainly on protected areas. These include the important habitats for endangered species only for some biomes (e.g. for wetlands, but probably not for farmland and forests)	Does partly fit; highlights areas of international importance	Does fit; the REN is a good basis for planning measures to improve/ preserve…
Specific aims	**A**	**B**	**C**	**D**
Identify and overcome important ecol. barriers	Does partly fit; Priority conservation and connection areas tell us, where large-scale connectivity is most important. However, the approach does not help to identify ecological barriers.	Does fit; identifies connections and barriers in trans-border networks or national assemblages of protected areas	Does partly fit at the international scale	Does partly fit; as I understood, the maps in the REN identify the important corridors but do not include complete information on the permeability of potential barriers (e.g. highways), thus on the present quality of corridors
Focus on priority species (groups)	Does partly fit; Important habitats and connection areas of priority species have been used.	Does not fit; priority species were not explicitly used to identify protected and connection areas	Does fit; identification of core areas was based on the distribution of priority species	Does fit; the continua in REN are based on dispersal abilities of indicator species (groups)

BERTHOUD:

Deux types complémentaires d'approches de la connectivité doivent être distingués :

A - Identifier un besoin de connexion à partir de facteurs internes (isolement partiel/total, surfaces suffisantes/insuffisantes, émigration, surproduction)

B - Identifier un potentiel de connexion à partir de facteurs externes (présence de continuité écologique, présence de zones d'extension/développement, corridor de connexion existant, corridor virtuel)

Approche WWF : Type A adapté en partie ; Type B adapté en partie
Approche PEEN : Type A adapté en partie; Type B n'est pas adapté
Approche ALPARC : Type A adapté ; Type B adapté en partie
Approche REN-CH : Type A adapté ; Type B adapté

Objectifs prioritaires pour la connectivité	Biodiversity vision WWF	Réseau ALPARC	Approche PEEN	Approche REN-CH
Objectifs généraux :				

Connectivité améliorée/préservée pour l'espèce (mise en danger) ou pour les populations (isolement)	Pas adapté Adapté en partie Pas adapté adapté			
Améliorer/préserver la diversité et la connectivité en les habitats	Pas adapté Adapté en partie		Pas adapté	Adapté
Améliorer la connectivité d'habitat et la connectivité pour l'espèce spécifique ou les populations.	Pas adapté Adapté en partie Pas adapté adapté			
Autres : valeur des zones réservoir en termes de capacité productive	Adapté en partie Adapté en partie Adapté en partie adapté en partie			
Objectifs spécifiques :				
Identifier et surmonter les barrières écologiques importantes (terrestre et aquatique)	Pas adapté adapté en partie pas adapté adapté			
Se concentrer sur la connectivité dans et entre les secteurs protégés et les secteurs prioritaires de conservation	pas adapté adapté en partie pas adapté adapté			
Se focaliser sur les espèces prioritaires (groupes) : lesquels ?	adapté en partie adapté adapté adapté en partie			
Améliorer la connectivité pour la survie de grandes carnivores	pas adapté adapté en partie pas adapté adapté en partie			
Autres : définition d'un flux déterminant pour la connectivité	pas adapté pas adapté pas adapté pas adapté			

FASEL:not enough information about that.

TOCKNER: This section is difficult to answer for me (partly also because I did not find enough time to carefully read through all four reports in detail)

1. the information provided in the four studies is often too general to assess its applicability

2. the focus is primarily on connectedness rather than on connectivity.

3. As stated in the PEEN report, the indicative maps are considered as a tool to identify core areas and potential corridors. This is true for all four reports. So the maps and the information included in these maps can be considered as important background information to develop now the connectivity project (identify data gaps, provide suggestions on how to fill these data gaps, define hypotheses, focus on a few aspects)

SKOBERNE: All four approaches can be used, but selectively and using brains!

RIGHETTI: Zwar formulieren internationale Vereinbarungen zum Artenschutz – wie etwa die Berner Konvention – allgemeine Rahmenbedingungen, die Umsetzung im Detail ist jedoch stark

unterschiedlich, so bestehen verschiedene Artenförderungsprojekte oder geniesst der offizielle Schutz einzelner Arten unterschiedliche Akzeptanz und Auslegung, wie dies vor allem bei grösseren Carnivoren immer wieder beobachtet werden kann. Auf diesem Hintergrund sollte im Sinne eines „state of the art report" die Situation der beteiligten Staaten zusammengestellt werden. Diese Zusammenstellung soll einerseits dazu dienen eine gemeinsame Basis zu finden und andererseits nachahmenswerte Beispiele zu liefern.

VANPEENE : augmenter la connectivité des paysages ordinaires c'est-à-dire de la matrice agricole des vallées et des versants

A - Biodiversity visions network :

general aim : do fit

2 specific aims : do fit

Cette approche se base sur la complémentarité de différentes échelles d'intervention et se veut un outil de sensibilisation pour les décideurs. Les cartes produites prennent en compte à la fois une base de l'utilisation du sol et de la présence des espèces (au travers d'une expertise). Les actions sont guidées par la réalité socioéconomique. Les enjeux et menaces sont hiérarchisés selon 3 critères (importance biologique, intégrité du paysage et menaces). Les zones de connexion sont identifiées par une combinaison d'approche par espèce et par habitat.

B - Cross-border ecological networks :

general aim : do not fit for all

2 specific aims : do partly fit

Cette approche est au départ basée sur les espaces protégés de grande taille et transfrontaliers, elle prend donc pleinement en compte les espaces protégés. Elle ne prend donc pas a priori en compte les « paysages ordinaires ». Par contre, dans son approche des outils (programme de soutien à l'agriculture extensive) elle peut les prendre en compte les paysages des vallées et des versants agricoles dans la constitution des réseaux.

Elle n'est que très peu axée sur la connexité des habitats et des populations, elle part du présupposé que si les espaces protégés sont connectés ce sera suffisant.

C - Pan-European ecological network PEEN :

general aim : do not fit for all

2 specific aims : do partly fit

Cette approche ne s'intéresse qu'à un très petit nombre d'espèces et de taxons qui ont des grandes distances de dispersion (grands mammifères, oiseaux principalement) d'intérêt européen, elle a donc une efficacité très limitée en terme d'espèces et les habitats sont absents de la méthode et de l'échelle utilisée.

Elle ne s'intéresse qu'à la connexion de très grandes aires où la viabilité de la population est durable. Elle ne prend que très peu en compte l'usage du sol dans les zones tampons et les corridors.

A - REN:

general aim : do fit

2 specific aims : do fit

L'approche par continuums écologiques de 5 grands types couvre une majorité d'espèces et d'habitats. Les milieux agricoles doivent être partie prenante du réseau en améliorant les microstructures existantes. Est un outil d'accompagnement pour l'évaluation stratégique de plans et de programmes. Elle peut être déclinée au niveau local comme cela a été fait en Isère par le REDI.

SPIEGELBERGER:

	A (WWF)	B (ALPARC)	C (PEEN)	D (REN)
barriers	**do fit** (while not explicitly mentioned, this aspect is included in the questions for the experts for determining the connections areas)	**do partly fit** (are not explicitly mentioned, but roads and railways are identified in the detailed maps)	**do not fit** (this approach mainly aims to increase the connectivity of certain zones and doesn't include the evaluation of barriers)	**do fit** (REN pays through it mathematical model of resistance particular attention to barriers)
connectivity	**do fit** (approach tries to connect important protection areas inside the Alps and even tries to connect them beyond the geographical limits of the Alps)	**do fit** (study is aims to increase the connectivity between existing protected areas)	**do fit** (PEEN aims in particular to connect areas with a particular interest at the European scale)	**do fit** (does not only focus on connectivity between already protected areas but includes all areas when they have a national, regional or cantonal importance and tries to connect them)
priority species	**do partly fit** (the approach does not focus on priority species, but takes them into account as one important factor among others)	**do not fit** (priority species are not mentioned)	**do fit** (species with an European importance)	**do not fit** (REN works with a theoretical species with a hypothetical travel distance of 100 m)
carnivores	**do partly fit** (as above, but the report states that an approach focused on large carnivores could have a negative impact on the perception of the study by the public)	**do not fit** (are not particularly mentioned)	**do fit** (large carnivores are listed as species proposed for identification of PEEN, Ann. 4)	**do not fit** (REN does not elaborate particular schemes for improving the particulars needs of large carnivores)

JAFFEUX: Approche A
O identify and overcome important ecological barriers (terrestrial and aquatic)

O focus on connectivity in and between protected areas and priority conservation areas

X focus on priority species (groups): which ones? Espèces alpines emblématiques (oiseaux et mammifères, principalement)

X improve connectivity for the survival of large carnivores (loup, ours, lynx)
O other specific aims: ……...

Approche B

X identify and overcome important ecological barriers (terrestrial and aquatic)

X focus on connectivity in and between protected areas and priority conservation areas

O focus on priority species (groups): which ones?

O improve connectivity for the survival of large carnivores
O other specific aims: ……...

Approche C

X identify and overcome important ecological barriers (terrestrial and aquatic)

X focus on connectivity in and between protected areas and priority conservation areas

O focus on priority species (groups): which ones?

O improve connectivity for the survival of large carnivores
X other specific aims: prend en compte toutes les échelles territoriales, de l'infra national au supra national……...

Approche D

X identify and overcome important ecological barriers (terrestrial and aquatic)

X focus on connectivity in and between protected areas and priority conservation areas

O focus on priority species (groups): which ones?

O improve connectivity for the survival of large carnivores
X other specific aims:prend en compte l'ensemble du territoire national

10. The connectivity project aims to combine different approaches in order to fulfil various goals. Please make concrete suggestions for a combined approach by answering the following questions (1-2 pages):

a. Which elements of the four approaches are important and for what reasons?

BAL: It's important to take into account all kind of semi-natural or natural habitats, not only pre-identified, well known or protected areas, these being too depending on national policies.

Division into ecoregions (WWF) seems important, especially to identify value of core areas

Continuums, as defined in Swiss Ecological Network are theoretically interesting, even if data are probably not sufficient in most cases to implement these analyses...

Species based approaches are not convenient, mainly because of knowledge heterogeneity, and as they exclude "common" biodiversity. Especially, local endemic species as indicators seems to me a "nonsense", as they generally don't need panalpine connectivity to persist, unlike alpine endemic species...
Species reinforced approaches (guilds in SEN) could help, if only data were generally available !

Calculated "permeability" or "moving costs" seems to be hard to implement and probably more interesting at local level

Indicators, as described in ALPARC project, are a quite good method to normalize (or automate) landscape analysis and could be useful to study connectivity areas or corridors (rather than core areas)
Experts consultations (WWF), local validation (SEN) (especially political ones) have to be avoid, because of their subjectivity, and the impossibility to reiterate the process...

Analysis of gaps in protected/conservation managed areas is important, as a solution to preserve/restore connectivity

Whatever the method, it has to easily integrate every new produced data that could enrich the analyses. This is particularly important for developing countries (like France) where inventories are scarce, poor and partial (but improving...)

GRABHERR: 1) A: PCA approach reveals the areas where expert are interested in (location of rare species, endemics etc.); panalpine these areas are well known (see the study "Biodiversity Vision"; they do not need connection per se; the approach might be useful locally (e.g. a network for Appenzell; e.g. where are the best spots with species rich meadows and how to connect them);

2) B: ALPARC is the most prammatic approach, based on availability of protected land or land which might be requirable, and on well known corridor demands for some flgaship species;

3) C: PAN is theory driven and not demand related; provides the theoretical background, and how it can be applied to “white spots” for a first exploration

4) REN concentrates on particular habitats, porviding a methodology for measuring connectivity (continuum approach); sound theoretical background

REIMOSER: The elements of the 4 approaches that should preferably be combined are listed below, subdivided into the sections goals, methodology, and data. The capitals A, B, C, and D at the beginning of each paragraph indicate the approach from which the text element comes.

1. Goals

B. Representation of **natural communities**; maintenance/restoration of **viable populations**; maintenance/restoration of ecological and evolutionary **processes**; conservation of **blocks of natural habitats**

C. The components of the **Network** serve **three functions**, namely: to provide the optimum achievable quantity and quality of environmental space (**core areas**); to ensure appropriate interconnectivity between the core areas (**corridors**); to protect core areas and corridors from potentially damaging external influences (**buffer zones**).

D. is designed to contribute towards:

the protection and restoration of habitats to ensure genetic exchange;

the **linkage of important habitats and their connection through ecological corridors**;

reducing the fragmentation of ecosystems;

the linkage of ecological compensation areas in agriculture;

the improvement of the quality and diversity of agriculture.

2. Methodology for the identification of connection areas

B. The geographic scope of analyses and mapping was the **entire alpine range according to the boundaries defined by the Alpine Convention**. 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.**

B. In the development of the biodiversity vision for the Alps, **high biodiversity areas** and **connection areas** were areas to focus on and they were **identified purely on their biological values (first step).**

B.Three 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**. Assumptions and decisions made for the identification of the connection areas p.75

A. Selection of indicators to assess the analysed surface areas with regard to their suitability as a potential element and to specify how the network area should be fragmented (**establishment of corridors**, implementation of measures). p. 34

C. Prior planning **scale (less detailed)** of the project is such that ecological corridors are only be migration or dispersal corridors. Foraging corridors function on a lower scale. On this scale corridors are included that function on a European scale:

- migration corridors for birds (p.64)
- dispersal corridors for large mammals (terrestrial corridors for the most demanding forest species) (p.65)
- migration/reproduction/dispersal corridors for fish and water related systems, dispersal corridors for wetlands (including bogs, mires, fens, peat cuttings) (p.66).

All three should be analysed on species requirements as well as on system characteristics.

A. In-depth examination using **model regions (larger, more detailed scale)**. These regions were analysed using the selected indicators and, with the help of suitable measures, can contribute towards an ecological network.

D. As REN it should be founded on the following basic concepts: continuum, core area, expansion area, development area, ecological corridor (determination criteria p. 26-28). As in REN a great deal of importance should be attached in principle to **obstacles**.

As in REN the implementation should be based on **overlaying the results of various** complementary methods which taken individually do not allow any conclusive statements:

- Use of detailed statistical **data on land use** so the land can be divided up into **ecologically similar areas**.
- **Grouping of individual species** into guilds to complement the collated data on the distribution of habitats (p. 39; guilds used, Appendix 1)
- **Compilation of potential maps** (as a basis for further complementary field work).
- Systematic search for landscape **elements which influence the networking** situation of the fauna either **favourably** (e.g. hedges, embankments along motorways) or **unfavourably** (obstacles such as roads, walls, etc.).
- Involvement of the relevant regional departments and ecology specialists to carry out terrain clarifications.
- Gathering additional regional data.
- Systematic mapping of the structures of specific networks.
- **Functional test** of the specific networks mapped in order to differentiate areas with a satisfactory networking situation from those with a deficit in this respect **(particularly in model areas)**.

3. Data

C. Based upon the following key data sets an analysis has been made to assess where **core areas** are, where **corridors** should be formed or reinforced and where area **enlargement** could maintain target species (Fig 6 p.40):

- habitat map showing existing natural areas.
- **selected species with high demands on area size and critical distances between habitats; those species and related demands which are habitat-specific.**
- **classification of (core) areas based upon insights in the probability of containing a certain percentage of all species including the most demanding in three classes:**
  - very large areas (> 5 times the critical size): long term survival of all populations quite probable;
  - large areas (1-5 times the critical size): when isolated this area may suffer some loss of species: connection or area enlargement is recommended;
  - areas with a suboptimal size: a percentage between 70 – 100 % of species can maintain viable populations; the most demanding species can only be maintained or restored by enlargement and/or connections with comparable habitats by corridors; critical size area and selected thresholds are based on expert judgement based on literature sources (Tab 12 p.60).
- **Definition of critical distances to bridge gaps, taking large animals and birds as key organisms,** (resulting in distances of 50 –100 km ?)**;**
- **Location of major rivers as important natural corridors**
- The distribution of internationally designated and acknowledged areas as already acknowledged elements of the network; MAB, Ramsar, World Heritage Convention (p.38/39).

D. Data base for large (more detailed) scale similar to REN.

A. For model regions also interviews suitable.

For the methodological approach, I would suggest to work with different precise methods on two different spatial scales.

1. The whole biological continuum of the Alps with connection to surrounding regions (not focusing only on existing conservation areas!)

Smaller scale (e.g. 1:5.000.000 – 1:1.000.000)

Wide ranging communities and species, e.g. large herbivores (ungulates etc.), large predators, migratory birds, fish

2. The model areas: certain regions and certain corridors within the biological continuum (with specific investigations and more detailed methods)

Permeability of borders between different zone types

Function of corridors

Larger (more detailed) scale (e.g. 1:500.000 – 1:25.000)

Also for small area communities and species, e.g. invertebrates, …..

The results and experiences of the model areas should serve for further projects to work more detailed on the whole Alps (all corridors) concerning development and monitoring of biological connectivity within the Alps and to neighbouring mountain regions.

SCHAAD: + Recording of the current inventory of protected areas: The implementation of measures is easiest done in protected areas (core and border areas). They should be taken into account. The approaches considering species and habitat in first place have shown that these protection areas do fit quite well to the developed areas.

+ Selection of indicators: The indicators should show whether an analysed surface is appropriate for being a priority area. The indicators must be well discussed.

+ Identify focal species for different taxa, key habitats and ecological processes: Europe has a certain responsibility for species that support Alpine biodiversity. Therefore the project should take these into account. Because if a species does not life in a protection area (s.above), it does not benefit from the protection measures applied in these areas.

+ Select Taxon priority areas for each taxon: Logical next step following the preceding point.

+ Selection of candidate priority areas: Logical next step following the preceding point.

+ Conduct a gap analysis for protected areas and candidate priority areas: See, whether these two sets of areas (protection areas and taxon priority areas) overlap. Define the definitive priority areas to work with.

+ Identify the biogeographical subregions: Alpine habitat is not uniform. In order to maintain the maximum number of alpine habitats, the project must try to focus on a good distribution of the protection areas over the biogeographical subregions.

+ Identify important corridors among priority areas: The priority areas must be connected.

BERTHOUD: Eléments déterminants :

- Localisation et caractérisation exhaustive des sites protégées (valeur acquise) : délimitation des zones nodales reconnues ;

- Localisation et caractérisation des habitats représentatifs du paysage (valeur patrimoniale transitoire) : délimitation de zones nodales potentielles à conserver ;

- Identification des habitats écologiquement proches du paysage (grille d'homologie) à partir de la mosaïque des habitats naturels et transformés : délimitation cartographique des zones d'extension et des continuums représentatifs.

- Identification des éléments structurels et flux de propagation existants ou probables: délimitation cartographique des corridors de connexion.

Ces 4 éléments sont totalement complémentaires et permettent d'obtenir un modèle spatiale de réseau écologique général.

TOCKNER: Again, I have to provide a more general comment on question 10 because of the reasons mentioned above.

1. Improve the data base (consistency, quality control) and provide a consistent overview of the present state (from a structural and a functional point of view). Indicative maps are a first major step and they should be developed at 2-3 spatial scales (nested/hierarchical approach). Development of interactive maps and visualization tools

2. Identification of risk areas

3. Use the catchment as the core ecological unit and focus on key corridors (e.g. riparian corridors) and key elements (e.g. large wood as a key connector along river corridors; islands as stepping stones along riparian corridors)

4. Apply/develop a reactive and a proactive approach

5. Move from a structural to a functional approach

GUGERLI: I generally support a combined approach using (i) GIS-based data compilation across a (ii) broad range of taxon groups (often rather loose coincidence of biodiversity hotspots!) and (iii) regional/local expert validation. This provides a maximum of (consistently assessed) data and ensures that generalizations necessary in data acquisition may be adjusted by specialized knowledge of the experts. In this way, B and D in my view have chosen a procedure that, in combination, should proof very useful for the purpose of the present project.

Certainly, a concluding evaluation of the feasibility is mandatory.

RIGHETTI: Ich würde klar auf bestehende Schutzgebiete aufbauen, wobei es deren Status zu klären gilt, damit grenzüberschreitend keine Missverständnisse entstehen. Gleichzeitig aber dürfen allgemein und im Speziellen im Alpenraum auch nicht geschützte Gebiete, welche jedoch einen ähnlichen ökologischen Wert besitzen, nicht vergessen werden. Diese sind meines Erachtens, auf der gleichen Ebene zu betrachten.

Schliesslich soll nochmals auf das Potential der Landschaft bzw. der Lebensräume hingewiesen werden. Dieser Punkt ist vor allem im Talgebiet wichtig,

JAFFEUX : L'approche A du WWFest intéressante pour aborder la question de la conservation à long terme des espèces animales caractéristiques des Alpes (principalement grands rapaces et grands carnivores)

L'approche B d'ALPARC est surtout intéressante pour optimiser et corriger les défauts d'origine des espaces protégés actuels (limites inadaptées, superficies insuffisantes, manque d'interconnexion entre espaces protégés voisins, spécifiquement fraontaliers) et mieux prendre en compte l'environnement périphérique de ces espaces

L'approche C du PEEN est la plus complète car elle a pour ambition de construire un réseau écologique paneuropéen par intégration des réseaux écologiques infranationaux, nationaux et supranationaux. dans un système gigogne se construisantdu bas vers le haut (bottom – up) et faisant appel aux éléments constitutifs des réseaux écologiques (z. nodales, tampon, restauration et corridors biologiques. Pragmatique, il s'adapte aux contextes juridiques existants dans les pays (par exemple, une zone nodale ne doit pas obligatoirement être désignée comme un espace protégé sous statut réglementaire). Cette approche est très intégratrice des systèmes d'aires protégées existants et les optimise par l'apport de la connectivité écologique. Voir le récent rapport produit par le cté d'experts PEEN du Conseil de l'Europe pour la conférence de Belgrade (8-11 octobre)

L'approche Nationale suisse est une déclinaison au niveau national des principes directeur du PEEN et identifie à l'échelle du 1:100000 les éléments constitutifs du réseau laissant le soin aux cantons de prendre les dispositions ad hoc pour qu'il produise tous ses effets sur la conservation des communautés animales et végétales et des écosystèmes.

b. In which way elements of these approaches should be combined ? Especially: How far structural connectivity, functional connectivity or a combination of both are appropriate?

BAL: As I'm quite sure that data needed to take into account functional connectivity are generally missing, it seems clear to me that the only way is to consider structural connectivity. Normalization and automation could be based on existing structural data, functional data coming later to improve local models

GRABHERR: The answer of these question depends on connectivity for what and why ? REN e.g. is a kind of general purpose strategy which aims at space planning, on improving local and regional networks by displaying gaps. It can only be applied where sufficient data are available. For general application a combination of the ALPARC approach (mainly the selection of sound regions with already protected areas) and a PCA-analysis might be the best (asking expert how they would rearranged the protected area system including corridores to optimise the contribution of the region for the overall maintenance of biodiversity.

SCHAAD: + The existing protection areas (inventory) should be combined with candidate priority areas (selection of areas by Taxon, key habitat and ecological processes) to find the priority areas to work with.

+ I strongly consider a combination of structural and functional connectivity, because (if i got it right!) different taxa profit of one or the other approach.

+ Connectivity areas should be looked at at a bigger scale to link the priority areas. The problem is: The larger the scala the less the implementation is promoted. The smaller the scale the better the implementation will be (more concrete) but it will cost much more to elaborate them.

GRAF: Pan-alpine scale: - In my view, the priority conservation areas from the Biodiversity vision and the AlpArc- network should be combined and harmonised in one map (as proposed in the Biodiversity vision report, p. 92). This map should also include the connection to the PEEN.

- In my view, a major effort is necessary to change the system of subsidies towards improving habitats for biodiversity (mainly in farmland, but also in forestry and tourism). Such an initiative may be more successful when launched by an international (pan-alpine) committee.

National scale: - At this scale, it probably makes sense for the countries to develop their national REN's independently (but with harmonised method, that allows us to identify the important trans-border connection), because data sources and availability may differ between countries.

- Identify existing ecological barriers, where connectivity would be important based on Biodiversity vision, AlpArc, and REN. This task not received enough attention by the evaluated approaches.

Local scale: - This is the scale, at which most actions should happen in the coming five years. In fact, there are many projects finished, running or planned that aim at improving structural and functional connectivity (e.g. LEK's). Ideally, these projects should now be spatially embedded into the national REN and the priority conservation and connection areas at the pan-alpine scale.

BERTHOUD: La connectivité dépend de la richesse structurale en éléments favorables aux divers groupes d'espèces propres aux continuums identifiés (mosaïque de milieux favorables, présence de structures linéaires, proximité d'habitats refuge).

Les déplacements entre habitats favorables peuvent porter sur de longues distances si la qualité écologique des écotones et des corridors est bonne pour le groupe d'espèces considéré.

GUGERLI: It would be highly desirable to include aspects of functional connectivity. However, as it is mentioned in C, such a proof requires either intensive observation or better molecular-genetic studies, and the effectiveness may in most cases only be shown in the long term. Accordingly, one is limited to involving only structural elements (not forgetting free migration routes for birds). Unfortunately, this is often restricted to linear elements, and in the case of rivers, it's forgotten that they not only serve as linear connection elements, but may likewise represent strict barriers to dispersal for many taxon groups. In this line, topographical roughness should also be incorporated when identifying potential barriers, particularly in the context of climate change-induced range shifts. Consequently, a further information base that has never been considered to my knowledge is biogeographic/phylogeographic information, i.e. historically functional migration pathways (postglacial re-colonization) that may in the future still function as routes for migration owing to climate change.

RIGHETTI: keine Zeit gehabt

- What would be the concrete steps for implementing an ecological continuum with the help of the (combinations) of the presented approaches?

BAL:

1. identification of continuous or patch patterned areas mainly containing natural or subnatural habitats, considered as potential core areas
2. as far as possible, identification of continuums (SEN like) into each of these areas
3. identification of main connectivity areas and corridors (for each of these continuums), as and where they are or should be (including no longer functioning but needed and possible to restore)
4. identification of gaps in protected/well-managed areas into connectivity areas, and man-made disruptions or breaks into corridors
5. Description of management policies to be implemented in order to keep/recover connectivity, and if the need arises, technical methods to cure the pain...
6. Parallel to 3, 4 and 5, organize continuums into a hierarchy of panalpine, regional, local levels, based on "classical" criteria (to be specified for each ecoregion for regional and local) like surface, habitats integrity, richness, number of endangered/protected species... This step will be helpful to define at which level the intervention is needed to solve the connectivity problems

7. Organize connectivity areas and corridors into the same hierarchy, based on the "value" of linked areas
8. Applause

GRABHERR:

1) Define the region of interest (ecological unit, political unit, PCA, cluster of protected areas);

2) Analyse the conservation demands under specific consideration of connectivity problem (e.g. why does a known corridor for large carnivores does not work);

3) Make a list where continuums should be approved, and explore the needs for implementing appropriate measures.

SCHAAD: To be considered as a suggestion only:

+ Inventory of existing protection areas
+ Selection of species, key habitats and ecological processes for priority areas
+ Define priority areas for the three elements
+ Overlay the four layers
+ Define definitive priority areas
+ Reduce number if necessary
+ Define areas of connectivity
+ Define connectivity areas on a scale 1:500'000-1:2'00'000 (?)
(+ Define corridors on a scale 1:100'000)
+ Communicate results
+ Implement

STÖCKLEIN: 10. The connectvity projekt aims ....:

- Which elements of the four approaches are important and for what reasons?

  The data base and the indicators used in method A are the basic planning elements for the implamentation of the connectivity project in the Alps.

  There is a respresentative data-background for the identification of the main potential areas in discussion with the proposals of the method B (WWF). And so we have a combination of the biodiversity vision proposals with the connectivity corridors in the model regions of ALPARC.

  So it is possible, the REN-principals of continuum, core area, expansion area, development

  Area and ecological corridor to transfer in the whole alpin region.
- In which way elements....How far structural connectivity, functional connectivity or a combination of both are appropriate?

  A combination of both factors is appropriate, because endangered species use for migration and partly used habitats functional connectivity with special structural and functional attributes.
- We should check the used indicators in method A and preprojects and then decide the catalogue of indicators, measures and tools for monitoring the functioning axes for ecological connectivity in the Alps have to install.

BERTHOUD: Voir aussi les étapes de procédure décrites au point 8.

Selon la méthode du REN il y a toujours différents continuums à considérer, les uns sont complémentaires et les autres sont antagonistes. Les marges des continuums (espaces proches des habitats primaires et secondaires utilisés pour de multiples fonctions, telles que le nourrissage, les contacts sociaux et les déplacements) constituent des espaces clés dont il faut identifier aussi précisément que possible les rôles et les espèces utilisatrices et le potentiel de dispersion de chaque espèce (ou guilde d'espèces). L'interprétation même sommaire de spécialistes est ici indispensable à moyen et long terme pour valider le modèle, car les facteurs combinés sont

nombreux et le recours aux méthodes propres au SIG (par buffer ou par calcul de dispersion) n'est pas toujours satisfaisant.

FASEL: not enough information about that.

GUGERLI:

A rough outline of a specific process to implement in test areas:

(1) determine corridor ranges (GIS-based data analyses)

(2) validate by regional/local experts

(3) identify specific features that should actually represent structural elements (and for which species/guilds)

(4) check for feasibility (politically, socially, economically)

(5) implement respective management

(6) monitor effectiveness of measures (current gene flow, colonization events)

... without claiming completeness...

Comment **SKOBERNE**: As I said before, I think we need first a view to the big picture, to try to understand how the Alpine continuum, which still exists, works and identify big remaining more or less pristine areas as well as connection areas (steping stones, corridors) and existing man-made barriers (more ambitious to scan big planned infrastructural projects, as well). Then we can scale down to make similar exercise on regional/national level.

The synthesis could be a common map highlighting 'best' areas and biggest problems. This could be a very good and convincing tool for further work and to get public/political attention.

Than we can overlap this map by existing networks (protected areas, Natura 2000...) and see the match. This can show what measure we need or can be used by existing instruments.

RIGHETTI: Aus der Erfahrung in der Schweiz würde ich den unter Punkt 8 beschriebenen Ansatz wählen.

VANPEENE: Les éléments importants de contexte communs à plusieurs approches sont la nécessité de tester et de construire l'acceptabilité sociale et la hiérarchisation en niveau de priorité des corridors à mettre en place.

Le point important est de se baser sur des structures existantes qu'il faut restaurer ou compléter mais pas créer de toutes pièces.

Il est fondamental d'avoir une réflexion sur les outils de politique publique (aide à l'agriculture extensive ; réflexion forte au niveau des aménagements : urbanisation, infrastructure de transport, tourisme ...) dans tous les espaces semi-naturels ou moyennement artificialisés pouvant servir de zone de dispersion de nombreuses espèces.

Les approches proposées par le REN et la biodiversity visions network me paraissent les plus adaptées. Le Cross-border ecological networks a une partie très intéressante sur toutes les politiques en dehors des espaces protégés mais sa thématique initiale est trop centrée sur les espaces protégés transfrontaliers.

L'échelle paneuropéenne du PEEN ne me paraît pas du tout opérationnelle.

Il est indispensable que la notion de continuum écologique puisse être adaptée au moins de l'échelle nationale ou régionale à l'échelle locale où elle pourra plus facilement être mise en oeuvre. Ensuite il faudrait être capable de fédérer selon une planification utile à l'échelle supérieure, les projets locaux pour que leur somme constitue un renforcement d'un réseau régional et non un saupoudrage uniquement local et disjoint.

La méthodologie me semble devoir partir de cartes d'usage du sol pour définir des continuums de grands milieux (approche REN) complétées quand elles existent avec des cartes d'habitats basées sur le même système de classification (lacune mise en avant par le PEEN).

La superposition des cartes de couverture végétale du sol avec des données sur l'artificialisation (carte topographique avec infrastructures, densité de population et luminosité de la nuit) paraît intéressante (cartes de référence jugées les plus pertinentes par les experts de la biodiversity visions network). Une attention particulière doit être portée à localiser les paysages construits par

l'activité humaine et maintenus en bon état de conservation par de l'agriculture extensive et du pâturage.

L'utilisation de bases de données sur la présence des espèces intervient ensuite pour définir l'importance biologique des zones (approche de hiérarchisation développée dans la biodiversity visions network)

De mon point de vue c'est une approche combinant à la fois connectivité structurelle (la plus facile à identifier et à restaurer) et fonctionnelle qui doit être mise en place (mais là son évaluation est beaucoup plus difficile et coûteuse).

Les étapes doivent être à la fois descendantes : cartographie d'un optimum de corridor au niveau transnational (aux frontières) et national et remontantes : réaliser localement des restaurations/ préservations de corridor et les faire connaître.

SPIEGELBERGER: The most important elements of the different methods are:

A (WWF): Starts at "zero" and remakes the inventory of priority zones based on existing data and expert evaluation. Important in my eyes is the ranking of the priority areas for biodiversity conservation (even if I do not completely agree with several points of the list) and the gap analysis.

B (ALPARC): The only approach which also looks on thematic connectivity between priority areas. Uses the synergy between already existing structures (national parks, protected areas), which are highly aware of the problem of connectivity. Gives good overview about already existing tools (legislation, financial incitations) which can be used to increase the connectivity.

C (PEEN): Works on a larger scale. Can be used for the integration of neighbouring lowland habitats for connectivity beyond the Alps.

D (REN): Traceability of the creation process of corridors through mathematical models. Validation through local authorities & experts of the model previously developed for whole Switzerland. Concrete methods for the evaluation of the progress in connectivity

In general, the most complete approach is A (WWF). It's include a large number of the elements (biogeographic aspects, species and habitat approach, gap analysis) making it a good base for further development. However the heterogeneity of the available data and the large amount of additional data that must be collected makes it at the same time a very time and cost intensive method. This is the greatest inconvenience and the biggest advantage of method B (ALPARC). From a scientific point of view I largely prefer approach A; however I am aware of the immense costs this implies. The biggest advantage in my eyes of method B is that it tries to connect existing zones which are in proximity of each other and were already some thematic connections exist. This is the only approach which pays attention to some social aspects! Maybe it could therefore be a possibility to identify the priority areas with the methods elaborated by WWF with the adjustments proposed above and to focus for the implementation on areas, which were identify by method B.

The WWF-method has the further inconvenience that – at the current stage - it does not propose a method for the implementation of the connectivity areas as it is done for example by approach D (REN). I would therefore propose to combine the approach A with D for the aspect of local implementation including the very important consultation process (validation by local actors and the cantons in the REN). Moreover, D proposes an interesting and in my eyes complementary approach for the evaluation of the effectiveness of the newly created corridors with the analysis of the network elements (chapter 6.6).

At a larger scale, PEEN is important for the connectivity towards other habitats outside the Alps and should be definitively taken into consideration when defining corridors within the Alps.

Concrete steps for the implementation of an ecological continuum would be a) the creation of an alpine-wide standardised method for the continuously monitoring of important species and habitats and b) based on this data, developing an ecological continuum plan in coherence with the areas planed by PEEN.

JAFFEUX : Les quatre approches ont chacune leur avantage. Bien que privilégiant le PEEN comme résultat à atteindre c'est à dire la structuration d'un réseau écologique transalpin avec les quatre types de zones, je pense que la méthode développée par ALPRARC est celle qu'il convient de mettre en place à condition qu'elle ne soit pas seulement réservée aux problématiques transfrontalières mais concerne l'ensemble du territoire alpin en partant des espaces protégés

existants. Elle a le mérite de mettre l'accent sur les défauts, les lacunes, les dysfonctionnements écologiques, les obstacles à la connectivité entre les espaces protégés. En parallèle, l'apport du WWF pourrait compléter l'approche d'ALPARC en ne raisonnant pas seulement avec l'existant des zones protégées mais prenant en compte tous les espaces remarquables alpins riches de biodiversité protégés ou non.

La 1ère étape (2008-2009) devrait être l'identification de toutes les zones nodales existantes, nouvelles, potentielles ou à restaurer sur l'ensemble de l'arc alpin, indépendamment du statut conféré actuellement à ces zones.

La seconde étape (2009-2010) devrait être consacrée à la caractérisation et à l'identification des liaisons et continuités écologiques entre ces zones nodales, que ces continuités et corridors soient existants et fonctionnels, à renforcer, à rétablir ou à aménager. A noter que la continuité écologique ne doit pas seulement être étudiée et réalisée du seul point de vue intra alpin. Elle doit être aussi assurée avec les bassins et régions écologiques périphériques aux Alpes.

La troisième étape (au-delà de 2010) devrait se consacrer à la gestion du réseau, c'est-à-dire à faire et entreprendre tout ce qui sera nécessaire pour garantir et assurer son fonctionnement optimal pour qu'il puisse produire tous les effets attendus sur le maintien, dans un bon état de conservation favorable de la biodiversité alpine. Il s'agira, notamment d'adopter et de développer des plans d'action ciblés sur des objectifs précis (par exemple suppression des obstacles au franchissement des infrastructures routières et ferroviaires, comme le fait le département de l'Isère en France, ou adapter les plans de gestion des aires protégées pour faire face au changement climatique.

CABEZA : Ideally, I would follow the systematic conservation planning frameworks so much promoted by Pressey, Possingham, Williams and others (e.g. Margules and Pressey 2000; Cabeza and Moilanen 2001). These approaches emphasize the need for explicit objectives and quantitative analyses. As I have not seen much of these in the 4 approaches assessed here, I describe a framework, that I believe would be doable if the data put together for the 4 different approaches could be combined. Obviously, the way to proceed will depend on the final objectives of the project, which, as stated before, are not yet clear to me (what are the strategic goals? Is the network supposed to be a guide in landscape planning? Is it supposed to be protected? Do we want to consider protected areas alone, or the actual naturalness of the system, no matter if areas are protected or not? Or do we want to consider the current situation, the pressing threats and the needs to preserve connectivity to avoid these threats? Do we want to enhance persistence of all the species? of large carnivores? of threatened species? species representative of the Alps? Do we want to identify hotspots of diversity (areas rich in number of species or rich in number of endemisms), or focus on areas that may not be as rich but that all together represent a large amount of biodiversity and can be better connected than the centers of high species richness? etc). Thus. the protocol I describe before has to be taken with caution

I would start by integrating in the network all current protected areas and areas that have been identified for their protection needs (e.g. including Natura 2000, Emerald sites, IBAs).

1. Set practical objectives,

   -Set targets for the species of interest, e.g. all species in annexes I and II (Birds and Habitat Directives), or at least species in these annexes for which the Alps contains major part of their distribution.

   -Identify a set of species for which connectivity is important at different scales and for which one could have data (e.g. large carnivores at a pan-European scale, butterflies for regional planning)

   -Additionally, and given that there is not knowledge for all species, one may require to protect major habitat types. Define habitat types/ecosystems of interest and targets for them (favor largest and best connected clusters)

2. Combine a bottom up and a top down approach.

   Identify gaps

- Assess current protected areas and identify gaps: identify those species and habitats in need for additional focus, account for habitat integrity and neighborhood disturbance

- e.g.: identify pressures outside protected areas for each of the habitats, especially for those less well represented (and connected) when considering protected areas alone. Weight the need for additional protection of each habitat based on current representation in protected areas and pressures outside

- search for improvement for those species that are not yet protected or those that have not enough protection (account for species specific habitat size and connectivity needs, if possible). e.g. for the species for which connectivity is important at a regional scale, assess at a higher resolution whether populations of these species are well connected in protected areas;

Identify actions

Restoration vs protection

Starting from an analysis of the current protected areas at a pan-alpine scale, assess what areas are needed to complement the current network: for species, habitats, connections

Can one achieve the targets by adding areas to the network?

Which are the species and habitats that are under more pressure and would require additional protection of areas? (rank)

Chose 'selection units'. One may want to work on grid cells, pre-defined polygons of different sizes, etc. , depending on the source of the data. I find that when dealing with large systems and data from different sources it is easier to use grids. Based on the selection units selected, and if there is data at higher resolution than that for the selected units, assess the quality of the units (this step won't be needed if the units are of small sizes, e.g. <1km, but may be required for larger unit sizes. I can give a hypothetical example: there is a butterfly species that occurs only in 3 10x10km units, that are close-by. One of this units has a dense network of meadows, the other 2 are largely fragmented, and the butterfly can barely persist there; connectivity within the unit is of relevance to the butterfly, and if one needs to select areas, one would like to ignore those that are too fragmented as long as there are better places

-identify priority areas to add to the network, considering potential areas for species with special spatial requirements

One may not be able to achieve the objective by just identifying bits of the current landscape to be included in the 'network'. Restoration or other regulations may be needed for habitats and species that are currently in poorest condition both within and outside protected areas. Identify those

My main two messages here are not so related on how to integrate current approaches, but more on what I would not use from current approaches. One of the bigger issues is to tread biodiversity and connectivity as separate elements, i.e., first identify important areas for their biodiversity content, then try to connect them. The value of the important biodiversity areas has to reflect not only the value of these areas for their contents, but for their prospects in maintaining biodiversity. While integrity/size/quality seems to be taken into account often at this stage, connectivity is often not, but it should. Leaving important biodiversity areas isolated may result in loss of biodiversity in the coming years (e.g. Cabeza and Moilanen 2003); but trying to connect these important areas after their identification may be harder than doing it before hand. I still want to emphasize the problem of identifying areas based on the number of species they contain (though this may be ok depending on the objectives of the project!) e.g. one may find several areas very rich in species numbers, but these areas can be a) not only very isolated but also b) similar in composition, while one may miss other species or habitats that do not occur in such aggregations.

All the 4 approaches assessed here had something to contribute to the framework I describe, but none of them accounts for all these points. For instance, WWF looked at integrity, PEEN identified focal species of conservation interest with connectivity needs at a pan-alpine scale. ALPARC has analysed several metrics (size, density, distance, etc) for protected areas and looked at management and interaction . REN provides a good start for computing at least structural connectivity; other simple measures are available too. Many of them can be modified to account for functional connectivity more explicitly, using the extensive expert knowledge on particular species. Several of the approaches have considered pressures (distance to urbanized areas, roads and railway, land use, etc). Altoguether, data on protected areas is available, species data is available for some groups, and there is a good network of experts identifies and associated.

11. Your personal vision: what would be the greatest success of the connectivity project at its supposed end after 5 years?

BAL: Identification of the most important barriers/problems and information of the responsible managing authorities, proposed solutions

Identification of the main lacks of knowledge needed to fulfil the aims and proposed solutions to fill the gaps!

GRABHERR:
- a catalogue of localised projects which help to maintain natural and seminatural habitats (e.g. improved connectivity of wetlands in the wetland core areas – see REN);

- a clear vision for the large carnivores

- a clear vision for the rivers

- improved awarness of the public for the connecticity problem

REIMOSER: The process of the project as well as the results should work as a basis to realise the biological connectivity in the national policies and implementations of all alpine countries. Better understanding and cooperation of different stakeholders towards ecological connectivity of the Alps, based on concrete data and priorities, should emerge from the procedure and the results of this project. A participatory process should be initiated by the project (e.g. advisory board, stakeholder platform for discussions).

SCHAAD: Every person engaged in nature conservation and protection areas management knows the measures proposed by the project. The proposals are accepted and implemented. The measures have the desired impacts and biodiversity is stable or even rising again.

The members of the pre-projects are happy to have chosen the right methods ;-)

STÖCKLEIN: The greatest success of the connectivity project in my personal vision is the harmonizing the implementation possibilities in the authorities of the various countries in the Alps.

GRAF:Five years is a short period. This period will probably not allow us to improve habitat quality in farmland in the Alps on large areas. However, it would be a great success, if the ecological continuum project could generally stop and reverse the intensification in the farmland in the Alps. This can only be achieved by influencing/changing the system of subsidies in a way to improve habitat quality for endangered farmland species. On the long term, this would probably solve many nature conservation problems by improving the reproduction of many species of various taxa (e.g. birds, insects, reptiles), by improving connectivity of open habitats and permeability of open habitats for forest or ecotone species.

In five years, the important, human-induced ecological barriers (e.g. highways, settlements) should be identified for the entire alpine arc and several projects to overcome these barriers are launched/ started or already done.

BERTHOUD: En 5 ans, à l'échelle de l'Arc alpin, Il est tout à fait possible de développer l'outil de travail « Réseau écologique sur SIG».

A savoir :

- le modèle cartographique de réseau écologique général (= infrastructure écologique de base pour les espaces naturels) utilisable au minimum à l'échelle 1 :100'000^{e}

- Une base détaillée de données SIG des espaces protégés.

- Une base détaillée de données SIG des zones d'extension/développement sur la base d'une typologie standardisée d'habitats.

La mise à disposition de l'outil « Réseau écologique sur SIG» doit permettre rapidement de tester le modèle spatial, d'évaluer l'efficacité fonctionnelle de l'entité géographique alpine, de hiérarchiser les zones de protection et de définir des priorités dans les mesures de connectivité à développer.

Concrètement, en parallèle au développement de l'outil. La cartographie des éléments des réseaux écologiques peut permettre d'établir :

- Une liste provisoire des corridors prioritaires avec leurs attributs (espèces concernées, état de fonctionnement, obstacles majeurs à aménager).

- Un programme de monitorage à moyen et long terme pour une description détaillée des éléments constitutifs des réseaux spécialisés. A savoir : les zones nodales y compris les zones protégées, les zones d'extension, les continuums, les corridors.

- Un programme de suivi de l'évolution du paysage en fonction des projets d'aménagement : Nouvelles zones gérées et protégées, extension d'infrastructures de transport, extension de zones à vocation touristiques, urbanisation, gestion des zones à risques, exploitation sylvo-pastorale.

- Un programme de monitorage de la végétation liée aux modifications climatiques (programmes existants ou futurs).

- Un programme de monitorage des espèces animales emblématiques des Alpes : espèces menacées, espèces représentatives des fonctionnements en métapopulations, espèces en expansion.

FASEL:To get areas that make possible:

- the connection of isolated populations, especially of ungulates and big carnivores;

- the installation of qiet, protected large areas for ungulates and big carnivores;

- "footpath"- and feeding areas for migrant birds on the migrant routes;

- the installation of biotop-networks in regional areas for endangered species, especially endangered amphibians;

- the restoration of links between watercourses, wetland and lakes.

TOCKNER:

1. To increase the awareness of the rapid changes in the Alps (direct and indirect impacts)

2. To develop a spatially explicit (e.g. at the catchment, subcatchment scale) and comparative data base on the key environmental pressures (present and future), on selected biota (e.g. fish, amphibians, mammals, birds, some insect groups), and to come up with clear recommendations on the how to set priorities in increasing connectivity among the various core areas.

3. To trigger a few demonstration projects that will apply the proposed approaches, and to develop a clear strategy on how to assess the success of the "connectivity projects".

4. To develop an ecological risk map for the Alps that identifies areas that are at high future risk but play important roles (similar to the "red" zones for natural disasters)

5. To increase the public sensitivity on this issue (a few excellent maps and interactive visualisation tools may play an important communication role; see for example the "game" that Bafu in CH developed for riparian corridor management, presented at the MUVA in Basel this year).

6. A large PanAlpine scientific project that focuses on the functional aspects of connectivity and considers both aquatic and terrestrial processes/functions.

GUGERLI: The specific implementation of appropriate measures to establish ecological corridors in pilot areas, and proof of their (re-gained) functionality (i.e. gene flow!), in particular where formerly connected species occurrences had been interrupted owing to fragmentation and/or (human-induced) barriers

SKOBERNE: To make at least a good map of highlights and problems which could prevent some stupid decisions which could cause serious fragmentation in Alpine ecosystems. This map can help to build understanding about the rational of the continuum, specially in light of the climate change.

RIGHETTI: Tja!!! –

Angesichts der Umstände,

- dass mehrere Länder daran beteiligt sind,

- dass die nationalen Gesetze unterschiedlich sind,
- ….

Angesichts wichtiger, ausstehender Entscheide/Grundsatzdiskussionen oder fehlender Rahmenbedingungen wie etwa

- bezüglich der Zugehörigkeit oder nicht der Schweiz zur EU,
- den Status der Schweiz im Rahmen der Alpenkonvention,
- den Entscheiden der Ministerkonferenz im Oktober 07 in Belgrad – etwa zum PEEN im Jahr 2010
- ….

Tue ich mich ziemlich schwer! Darum: Ich hoffe, wir schaffen es, mit dem vorliegenden Projekt eine gemeinsame Basis erarbeitet und für die wichtigsten Vernetzungsachsen im Rahmen von Fallbeispielen deren Sicherung/Festigung/Wiederherstellung in die Wege geleitet zu haben.

VANPEENE : De réussir à susciter un grand nombre de projets locaux acceptés et portés par les élus, habitants et décideurs locaux y compris entreprises.

D'avoir réussir à supprimer les actions parfois antagonistes de différentes politiques publiques .

SPIEGELBERGER: One of the main achievements would be an Ecological Continuum Plan in coherence with the PEEN based on widely accepted standards and methods.

This implies the harmonisation of data available and the maps representing the data (and the ways they are created) between administrative units. Having the different attempts of the European Community in this field in mind, 5 years may not be enough…

If in one model region (perhaps start with an "easy" region, where awareness is high and ecological barriers simply to overcome) some of the proposed connectivity areas could be created, this would be a great achievement, but maybe this will take more than 5 years.

It is very important to keep in mind that the time scale to needed to test the efficacy of the proposed connections between habitats is decades or even centuries (cf. PEEN p. 93). Therefore the expectations shouldn't be too high meaning that it'll be quite improbably that increasing the connectivity between different habitats will increase the genetic/species/habitat diversity within 5 years!

JAFFEUX : Une carte devrait identifier tous les éléments du réseau transalpin. Elle donnerait de la visibilité à ces concepts un peu théoriques et abstraits pour le grand public et les décideurs. A cette carte devrait être associée une base de données donnant accès à la connaissance de la biodiversité alpine par quelque clics de souris et mettre en valeur cette biodiversité comme une ressource partagée entre les différents pays alpins. Il conviendrait aussi de pouvoir disposer d'une batterie d'indicateurs pour suivre l'évolution de la biodiversité alpine au travers du réseau et d'en évaluer l'efficacité (cf la méthode d'évaluation de l'état de conservation des habitats de la directives habitats-faune-flore CEE). Cette batterie d'indicateurs pourrait être intégrée à l'observatoire des effets du changement climatique sur la biodiversité alpine que j'ai proposé à la plate forme réseau écologique et qui est repris dans l'avant projet du plan climat au sein de la convention alpine préparé par le présidence fr'ançaise.

CABEZA : 11. What would be the greatest success of the connectivity project?

I find this initiative challenging and admirable. I believe this is the first network planning initiative at such scale, and if properly done, it will become a great example. If the project manages to put together some of the data that has been gathered for the 4 projects separately, I believe there is great potential to improve upon any of the 4 approaches, as it seems that most of them have taken particular directions due to data limitations. Importantly, if the project manages to establish clear (quantitative if possible) objectives, I believe that the data and the expertise is here to address them.