# 6. STUDY CASES

The use of the concept of ecological network within the European context has spread following the international conference held in Maastricht in 1993, where the EECONET (*European Ecological Network*) initiative was approved for the purpose of developing a pan - European strategy for the preservation of nature. The acknowledgement of the problems deriving from the fragmentation of habitats, basically linked with urban development processes, with the development of infrastructures and with that of intensive agriculture, led to a strategy aimed at the recuperation of the functionality of natural or semi - natural systems based, to a large extent, in the re - establishment of the connections linking them.

The EECONET initiative proposes five basic principles (see table 6.1) according to which the conservation network would consist of core zones or areas, usually scarcely altered locations, which maintain conditions of high naturalness and which, in addition, are key to the operation of the basic ecological processes (aquifer replenishment areas, heads of basins, etcetera); the network would also include locations that should be subjected to restoration or recovery and that have a potential value for the network, as well as other locations where traditional extensive uses are compatible with the conservation of important natural values.

The blueprint put forward by EECONET has been gradually adapted from the mid - nineties on in several western countries (Jongman, 1995a and 1995b). The key in the use of the concept of ecological networks is based on the search for connections linking the most natural areas within an integrated territorial system and reducing the fragmentation of the landscape, thus providing better conditions for the dispersal, migration and survival of the species.

We find examples of this approach in several Central European regions where the high population density, the intensification of the agrarian use and the fragmentation processes are quite common. From the review of experiences we select the cases of The Netherlands, Belgium, Denmark and Germany.

**Chart 6.1.** Principles suggested within the framework of EECONET for the design of a conservation network (Bennett, 1991).

- 1. The network must encompass the places of greatest importance for the conservation of the biological and landscape related diversity. The current concept of biological diversity entails dealing with the scales of species, community, ecosystem and landscape for the variability and abundance of life on Earth to be well represented. The preservation of the places of greatest importance due to the wealth of species and habitats is the objective of the Habitat Directive. The "pan European strategy for the biological and the landscape diversity " widens its perspective up to the landscape scale.
- 2. The network must guarantee the keeping of the ecological processes and the connectivity of the territory. The creation must be avoided of isolated nuclei by endeavouring to keep the ecological processes and the connectivity of the territory. In addition to the "core zones", the network's constituent elements would be the corridors, the buffer areas and the areas to be restored. According to this principle , the main elements are as follows:
  - *Corridors guaranteeing connectivity.* Following the identification of the main barriers or fragmentation levels, it is necessary to identify the corridors; in principle, linear and continuous structures such as bank based ecosystems, traditional systems for the demarcation of cultivated fields, etcetera, or crossing points, such as puddles, copses, etcetera, which improve the operation of natural systems.
  - *Buffer areas.* Their purpose is to guarantee the conservation of the network free form adverse external influences, such as contamination processes or hydrological changes.
  - *Areas to be restored.* Those elements of the ecosystem, habitat or landscape being relevant to the network's functionality which, due to their degree of alteration need to be restored.
- 3. *The conservation network must be incorporated into the planning of the territory* Not in all cases would the ideal solution consist in the application

of a conventional nature protection concept. Decisive actions in favour of conservation in the planning of different economic sectors may play a decisive role, which is why the coordination among action plans for the conservation of social and economic sectors becomes specially relevant, in particular those having a closer interaction with the biological and landscape diversity: agriculture, forestry, tourism, power generation industry and transport.

- 4. *The conservation network must promote sustainable development* Making the conservation of nature compatible with the use of the territory and the social and economic development is one of the main challenges which all countries have to face. The economic theory has contributed to the appreciation of natural spaces as a part of sustainable development with concepts such as the value of non use or indirect financial profits:
  - Sustaining ecological processes of economic interest (water cycle, prevention of erosion, etcetera)
  - Conservation of ecosystems, species and landscapes having a high social valuation (existence of emblematic species or unique spots)
  - Preventing the population from leaving the area through the development of activities linked with quality products and cultural tourism
- 5. *The efficaciousness of the conservation network requires the support of an appropriate legal framework.* Not all the constituent elements of the conservation network will enjoy the same level of protection. In principle, those areas being identified as core zones will be provided with a legal definition as protected areas. The degree of protection shall guarantee the necessary measures for the preservation of the species and the ecosystems being the subject matter of conservation. In the case of corridor and buffer zones or areas to be restored, since there is a great variability of situations, a great effort will be necessary to integrate the existing legislation and other new legislation around the objectives set by the conservation network.

In Eastern European countries, where there is a deeply - rooted planning tradition in physical geography, the nature conservation strategies take the whole of the territory into consideration. So - called "eco - stabilization" measures are put forward, or ecological compensation areas based on a concept of landscape as being polarised between the most natural areas and those zones of intensive use and centres of human activity. The design of conservation networks is characterised by the designation of territories to act as ecological compensations

for deeply exploited territories, and by the linkage of these compensatory territories in an area of coherent and unitary management. We find examples of this approach having been put into effect in countries such as Estonia, Lithuania, the Czech Republic, Slovakia and Poland.

The social and political changes undergone over the last decades by the Eastern countries and the prospect of their future integration into the European Union, have strengthened the international cooperation and have contributed to the integration of the EECONET principles into the development of their territory conservation and planning systems.

In the Mediterranean countries, where a series of peculiar characteristics not to be found in other European regions do merge, such as the predominance of extensive uses, a relatively low density of population, large territories which are still home to natural values, the criteria concerning ecological networks or comprehensive conservation systems have been hardly developed. From the review carried out in this paper we highlight the cases of Navarre and Catalonia as examples initiatives aimed towards the definition of functional networks of natural areas.

Section 6.2. records the experience, recently set in motion in Andalusia, for the definition of a coherent conservation network.

On the other hand, the experiments carried out in the American continent show some common elements to the European ones as well as other different and interesting, such as the involvement of private entities or the concern over the integration of aspects linked with the social and economic development. For example, the initiatives promoted by the *Wildlands Project*, a non governmental organization devoted to promote protection and restoration projects through the establishment of systems of linked reserves, have as their final purpose to devote 50% of the American continent to the preservation of biological diversity (Noss, 1992).

This strategy is based on the creation of natural reserve networks where core zones are identified, defined by using as a starting point publicly owned territories such as national forests and parks characterised by their huge surface and where human use is minimal; buffer zones, usually privately - owned areas adjacent to the core zones and where human use is allowed, always under the premise of the management of the biodiversity; and corridors, located both in publicly and privately - owned land, usually along the rivers and in migration routes used by the different species.

The *Wildlands Project* is supported by hundreds of groups working for its long - term implementation and it has received millions of dollars from foundations and private companies such as the Turner Foundation, Patagonia, W. Alton Jones Foundation, Lyndhurst Foundation, etcetera.

Other recent initiative is the one set in motion in Central America, where the conservation of biological diversity and the fight against poverty have been approached at the highest political level by means of the generation of economic - growth alternatives through a new regional cooperation instrument officially known as Central American Biological Corridor.

Below we include the summarised file cards showing the most relevant initiatives undertaken in the American continent and in Europe. A summary of the main features of the cases that have been studied in Europe appears in Table 6.1.

#### The Mesoamerican Biological Corridor

The Mesoamerican Biological Corridor is a territorial planning proposal, that sets up an interconnected network, whose goal it is to give shape to and strengthen hundreds of protected areas all over the region, as bioregional management nuclei and, concurrently, the creation of opportunities to develop environment - friendly agricultural and timber production systems in the zones interconnecting protected areas. It also carries out ecological restoration activities and fosters environmental services and ecological tourism, among other alternatives. The purpose of the project is that of articulating national programmes and local initiatives in order to create before 2006 solid bases to regenerate the environment between Panama and the Yucatan peninsula, as well as to improve the inhabitants' living standards.

From an official standpoint, the Central American Presidents, having met under the aegis of the Alliance for the Sustainable Development in the Americas (ALIDES), agreed that the Central American Commission for the Environment and Development (CCAD), dependent on the Central American Integration System, be the institution responsible for the putting of regional plans into effect.

The CCAD, together with the United Nations Development Programme (UNDP) and with the resources provided by the World Environmental Facility

(WEF) and the German Agency for Technical Cooperation (GTZ), did launch a programme for the consolidation of the Corridor starting from the priority protected areas, in the main, those being bi - national and tri - national in character. Nowadays, the region's governments are integrating the Corridor into their national environmental development plans, in association with the multilateral cooperation bodies, the bilateral contributors, the NGOs devoted to the environment and the development, as well as groups from the civil society and the private sector.

The total cost of the Programme amounts to 16.6 million dollars, 10.9 million of which are provided by the WEF. The GTZ contributes about two million dollars. The eight Central American governments take part by providing human and technical resources valued at around four million dollars.

By the end of 2006, the Programme intends to cover the following aspects:

- An information and monitoring system to guarantee the uninterrupted and systematic generation of and access to relevant information concerning the biodiversity, the economic development of their communities, the bilateral and multilateral support to conservation and development projects, the analysis and legal and political reforms, as well as the training programmes.
- A sub-programme for the strengthening of capabilities for the purpose of reinforcing the main groups of interested parties and the nuclei of personnel in charge of planning, administration and operations in the different production and conservation sectors; as well as that of catalysing the incorporation of the main work lines of the Central American Corridor project into national and regional education programmes, formal as well as non formal ones.
- An awareness and divulgement sub programme aimed at widening the knowledge of societies and governments from the region about the value of the biodiversity for the region's sustainable development.
- Specific mechanisms for the participation of groups of interested parties in the national and regional planning, management and monitoring of the development and sustainability of The Mesoamerican Biological Corridor.

Information sources: http://www.undp.org.ni/cbm/index.htm

### The case of the State of Florida, United States

In Florida an ecological network has been devised known as *Greenways.* It design takes the analysis of potential connectivity and the identification of priority areas as a starting point to build a system of natural reserves, based on an active programme of land acquisition. The network approximately encompasses half the surface of the state, with more than half its connection network located in protected areas or in public-domain waters. The use of geographical information systems to develop a support model for the decisions making proved to be decisive.

In 1991 a governmental commission was established, whose constituent parties included the Departments of Environmental Protection and Transportation, which originated a report published in 1994. The actual design of the network was based on a regional approach which would make it possible: to conserve the critical elements of ecosystems and landscapes; to restore and to maintain the connectivity of the ecological systems and processes; to enhance the capability of the ecosystems and landscapes as dynamic systems and to keep the biota's potential for evolution against environmental changes.

In the selection of priority ecological areas several layers of information were used, such as areas with strategic habitats for rare or threatened species, wetlands, zones with a high potential for restoration, roadless zones or with a low road infrastructure density, public land and privately - owned reserves (managed by societies such as Audubon or *The Nature Conservancy*).

The network does link the publicly - owned large conservation areas and includes territories of importance for the operation of the network as a whole; in particular, all those federal, state, regional or local land - protection or acquisition programmes.

One of the most complex challenges to contribute to the maintenance of the connectivity is the review of the state's road systems. The Department of Transportation has put into effect interesting breakthroughs such as the building in sensitive areas of a crossing - point system for large mammals such as panthers, black bears and other species. The Department of Environmental Protection did introduce in 1998 a strategy in which the conservation agreements are basic, as it was established in state law when a ten - year extension of the land acquisition programme was approved. The design of the reserve is an iterative process open to the incorporation of many entities. The results of the Florida GAP analysis project, the projects prepared by *The Nature Conservancy* concerning the ecoregional planning or the works of the Commission for the conservation of fisheries and wildlife in Florida, will contribute to the improvement of the system.

Information Sources : Hoctor et al, 1999.

Table 6.1. Summary of the study cases under consideration in Europe.

Main restrictions	Iby Availability of space for the creation of corridors the creation of corridors	Act Fragmentation of the territory Rejection by the agricultural and forestal sectors Lead uncertainties	Deforestation Pressure by agrarian organizations	Fragmentation	t, Changes in the ownership of the land.
Legal Framework	National Conservatio Policy Plan, approved Parliament in 1990	Nature Conservation (1997), Landscape Conservation Act			Nature Protection Act 1994. Sustainable Development
Instruments	Acquisition of land, subsidies, designation of protected areas, compensatory measures	Acquisition of land	Not developed	Support for ecological agricultural programmes Furtherance of local initiatives	Actions to compensate for fragmentation or loss of connectivity due to de
Scale	National level (on a scale of 1:600.000), implementation at provincial level	Provincial level	Regional scale; implementation at municipal level	Regional scale (Länder) (1:25.000)	National, district and local scale. Plans on a scale of 1:200.000 and
Network design criteria	Core zones: threatened or rare species Restoration areas: geo - morphological and hydrological and dharacteristics, closeness to core zones. Buffer areas: agricultural landscapes surrounding core zones	Biodiversity Sustainability Representativeness Vulnerability	Agricultural, omithological, botanical, geological, geomorphological, cultural and recreational values	Protection status for the species	
Network Structure	EECONET Model: * Core zones * Restoration areas * Ecological corridors * Buffer areas	Groene Hoofdstructuur. core zones and multifunctional zones (corridors, research areas). VEN+IVON	* Buffer zones around rivers and lakes * Regional ecological corridors	Verbetza Biotopsysteme * Biotopes * Core zones * Corridors * Scale points * Measures aimed at the sustainable use of the landscape	Ecological compensation areas. Hierarchical system
Case	The Netherlands	Belgium, Flanders	Denmark	Germany (Rhineland Palatinate)	Estonia

Case	Network Structure	Network design criteria	Scale	Instruments	Legal Framework	Main restrictions
	at different levels: * micro - level at farm scale * meso - level or communit level at district scale * macro or national level			development of road and railway infrastructures	Act, 1995. Coastal, Marine and Continental Zones Protection Act, 1995. Forestal Act, 1993. Hunting Management Act, 1994. Planning and Infrastructure Act, 1995. Under the terms of the Under the terms of the Strategy, 1997. Environmental Action Plan 1998	Uncertainties in view of the change to the capitalist system.
Lithuania	Natural Hramework: hierarchical structure of geo - ecological divisions, stabilization areas and corridors	Geomorphological position Natural diversity Ecological flows Degree of crop intensification	Regional scale (1:50.000)	The Biodiversity Protection Strategy, prepared in 1995, does envisage as an does envisage as an dreation the development of the Mahural Framework	Environmental Protection Act, 1992 Protected Areas Act, 1993 Act, 1995 Act, 1995 Act, 1995	Reduction of agricultural activity to enlarge the forest area
Czech Republic	Territorial System of Ecological Stability (STEE): bio - centres, buffer zones y bio-corridors	Supra - regional scale: representativeness, loca- tion and protection status Regional scale: biodiversity Local scale: Biotype location and representativeness	National, regional and local	Designation of protected areas Landscape management measures Planning projects which must incorporate the STEE	Nature and Landscape Protection Act, 1992	Changes associated with the new social and economic conditions, intensification of ground uses
Slovakia	Territorial System of Ecological Stability (STED: bio - centres, (Mer zones and bio - corridors and eco - stabilization mesaures	Representativeness, ecological relevance, edgree of maturity, size, shape, geographical position, legal protection	National: on a scale of 1:500.000 Regional: on a scale of 1:50.000 1:50.000 1:10.000	General Territorial Development Plan, 1997 Regional District Territorial Plans	Nature and Landscape Protection Act, 1994, Territorial Planning Act, 1992	Changes associated with the new social and economic conditions, intensification of ground uses
Poland	Ecological System of Protected Areas (SEAP): core zones, buffer areas and corridors	Habitat representativeness at regional level Status and distribution of species Landscape structure	National level: on a scale of 1:500.000	In an early development stage. It lacks official status even though it was approved by the Ministry	Nature Conservation Act, 1991	Integration into sectorial policies (industry and agriculture). Industrial pollution

Table 6.1. Summary of the study cases under consideration in Europe. (Cont.)

## The ecological network in The Netherlands

The Dutch ecological network is part of the National Plan for Conservation Policy enacted by Parliament in 1990. The purpose of the Plan is the development of an ecological network over the next twenty to thirty years. The conservation policy is focused on the restoration of a coherent territorial structure which can absorb the effects of the loss of natural habitat surface (75% since early twentieth century) and the subsequent fragmentation and isolation of the most natural areas.

Even though its design has been carried out at a national level, the implementation of the network depends on the provinces, and each one of them can follow different strategies. The development of the network is based on three general principles:

- Selection of representative ecosystems at a national and international level
- · Increase in the size and connectivity of semi natural ecosystems
- Ecological relations are to be taken into consideration at a landscape scale; basically, those linked with hydrological processes

The main elements to be used in the design of the network are as follows:

- Core zones (of at least 500 hectares)
- Areas to be restored
- Ecological corridors
- Buffer areas

The selection of core zones is based on the presence of fauna and flora species, either threatened or rare, of a national or international importance. The buffer areas are basically agricultural landscapes surrounding the core zones. The selection of corridors is based on the presence of linear structures (old canals, dams, brooks and hedgerows). The restoration areas are selected according to their geomorphological and hydro-geological characteristics, taking into consideration their closeness to the core zones.

The instruments being available for the development of the network are: existing legislation, the acquisition of land, project subsidies, the designation of protected areas and the establishment of compensation measures as a result of infrastructure projects. In some projects special emphasis is placed on direct cooperation with the owners with a view to establishing the best ecological, financial and political solutions.

The main restrictions for the operation of the Dutch network are centred around intensive agriculture and the availability of space for the creation of corridors.

Information sources: Ministry of Agriculture, Nature Management and Fisheries, 1990; Lammers and van Zadelhoff, 1996; Jongman and Kristiansen, 1998.

### The case of Flanders, Belgium

Flanders is one of the European regions with the highest density of population (420 inhabitants per square kilometre). The dense network or roads, railways, canals and intensive agriculture areas has originated a high degree of territory fragmentation as well as the isolation of the best preserved zones. Since 1990 the environmental policy and nature conservation plans are being developed. One of the objectives of such plans is the implementation of an ecological network. The first proposal, submitted by the end of 1991 and known as the "Green Structure" (*De Groene Hoofdstructuur*), basically consisted in a map on a scale of 1:100.000 where four types of elements were identified: core zones, restoration areas, corridors and buffer areas. The general criteria used for the development of the network are the values of biodiversity, sustainability, representativeness and vulnerability.

The legal support for the development of the network is provided by the 1997 Nature Conservation Act and by the Landscape Conservation Act, which include provisions for the prohibition of changes of use as well as management agreements.

The core areas include those having natural values higher than those of the territory as a whole. A minimal size has not been defined, but it is understood that it must be appropriate to guaranteeing that ecological requirements be met to maintain the naturalness conditions.

The restoration areas include the following categories:

- Areas with habitats comparable to those found in the core zones, although smaller in size and highly fragmented. The restoration projects are aimed at increasing the size and, as a last resort, at their being transformed into core zones.
- Areas void of high natural values but having environmental characteristics enabling the development of important habitats in the short term and with a limited effort (for instance, polluted rivers whose morphological conditions remain intact).
- Areas containing rare animal species which depend on the enforcement of specific restrictions concerning the use of the ground. For instance, wintering or breeding zones of certain species.

The buffer areas are defined according to the specific conditions of the zone they protect and depending on the factors having a negative influence on the conservation of the core zone values.

The total area being the subject matter of this proposal encompasses 532.000 hectares, 38.6% of Flanders, although following conflicts with the agricultural sector and with the owners, the objectives intended to be achieved by 2003 were reduced to the designation of 125.000 hectares devoted to core zones and development areas, plus 150.000 hectares of multifunctional areas (corridors, integration areas). In these multifunctional areas the goals of sustainable agriculture, forestal use and nature conservation must be reconciled.

In the network design process a lot of resistance has been encountered from farmers, the forestal sector and the owners. A large part of the problems do derive from the lack of clear implementation procedures, as well as from the lack of compensation and incentive commitments and the uncertainty concerning legal protection measures.

The concept of ecological network has been reviewed with a view to incorporating it, in a more integrated manner, into the planning of the whole of the territory. Nowadays, the network consists of two types of zones: the VEN (Flemish ecological network), made up of the core zones or large natural areas together with wide areas for its development, and the IVON (or multifunctional integrated and VEN support network), which includes interconnection areas or corridors.

> Information sources: De Blust, 2002; De Blust and Kuijken, 1996; Jongman and Kristiansen, 1998.

### The Danish case

Since 1937 Danish law has had provisions concerning what we now call corridors and buffer areas. The main problem facing nature conservation in Denmark is deforestation and, concurrently, the fact that two thirds of the territory are devoted to intensive agricultural production.

The policy of designation of protected areas based on the national park philosophy was deemed to be utopical already in the nineteen seventies, which is the reason why the followed strategy is focused on the protection of the as yet unspoiled territory, by selecting areas of high natural value, but also productive areas in which protection measures are put into effect by restricting the type of use of the territory without implementing financial compensation measures.

The 1992 Nature Conservation Act does designate buffer zones around water streams and lakes (between 6 and 25 - metre wide in the river banks, although the pressure by agricultural organizations has managed to reduce it to 2 metres), and includes serious restrictions on small biotopes in agricultural landscapes.

Since the mid - eighties more than half the municipalities include in their physical planning considerations concerning ecological networks so that ecological links be guaranteed. The criteria are somewhat different depending on the municipalities, which have a certain degree of autonomy. In some of them, the corridors are small water courses; in others, mosaics made up of natural zones and small biotopes.

The current network includes zones of agricultural, ornithological, botanical, geological and geomorphological, cultural and recreational value.

The cartography of the regional ecological corridors belonging to more than half the municipalities has been published between 1982 and 1987, based on regional - scale studies.

Up to now, only a small part of the regional planning has been put into effect, although since 1997 all municipalities are compelled by virtue of a Decree from the Ministry of the Environment to design ecological networks and to prepare guidelines for their protection.

The main obstacles preventing them from being set in motion are conflicts of interest with farmers, the lack of instruments for the management of the territory and, above all, the financial support given to agricultural production.

Information sources: Brandt, 1995; Jongman and Kristiansen, 1998.

## The case of Rhineland-Palatinate, Germany

The responsibility for the management of nature in Germany falls on the Länder. In Rhineland -Palatinate the ecological network or *Vernetza Biotopsysteme* is the core of the conservation strategy. The starting point is the fact that regional planning must take the territory into consideration as an integrated whole, so that the impacts caused on agricultural landscapes be envisaged, the said impacts being, to a great extent, responsible for the loss or decline of the populations of many species. The planning envisages biotopes and communities, large core zones for the long - term development, corridors and scale points, as well as measures for the sustainable use of the landscape.

The fragmentation of the landscape, in particular in the western part of the country, is one of the key aspects which must be dealt with in conservation policy.

The basic information used for designing the network are biotope maps, ground use maps, forest maps, water quality maps, data concerning fauna and flora species and potential vegetation. In addition, the protection status and historical use maps are taken into consideration. The first selection was made on the basis of the types of biotopes, refining it on the basis of the data concerning certain species.

Until 1998, the majority of regional network plans had been completed (on a scale of 1:25.000). Such plans will become part of the spatial planning system. Among the instruments used, the support of an ecological agriculture programme must be highlighted. Local initiatives play a relevant role, by trying to set up representative projects in cooperation with local communities.

Information sources: Burkhardt et al, 1996.

## The Estonian network

The concept of ecological network is being used in Estonia since the early eighties and stems from the so - called ecological compensation areas based on an understanding of the landscape as being polarised between more natural and intensive use areas and centres for human activity. The network of compensation areas, or ecological network, may be considered a landscape subsystem which equilibrates the impacts caused by man - made infrastructures in the territory. The first protected areas were located in the coast and in the western part of the country, which are characterised by the greater rareness and diversity of fauna and flora species. New inland areas and other areas in the eastern zone were added in the sixties and seventies. Following the enactment of the Nature Conservation Act in 1994, the state of the protected areas was reviewed according to the new legal classification and to European trends (Natura 2000 Network, representativeness within the European contexts, etcetera), at the same time as the reform of land ownership was carried out. Nowadays 9.4% of the Estonian territory is protected (423.000 hectares), of which 1% belongs to IUCN category I. In keeping with the ideas behind the ecological networks, protected areas are deemed to be, in principle, network nodes connected by corridors.

Between 1979 and 1982 physical planning maps were used and redesigned for the devising of a network of ecological compensation areas on a scale of 1:200.000 scale. Between 1983 and 1988 more detailed maps were drawn on a scale of 1:100.000.

In the design of the ecological network, the ecological compensation areas constitute a hierarchical system at different levels: at a national scale, large core zones are defined (more than 1000 square kilometres) with their buffer areas and wide corridors (more than 10 Km wide); at a municipal scale, small core zones are defined (between 10 and 1000 square kilometres) and corridors linking those zones (valleys, semi-natural recreational areas, between 0,1 and 10 Km wide); and at a more detailed level, at the scale of farms, small dots of wet grazing land, puddles, hedges (smaller than 10 square kilometres) are defined as well as smaller corridors (less than 0,1 Km wide).

The ecological compensation areas cover 55% of the whole territory in a country whose population density is 34 persons per square kilometre.

The radical changes undergone by land ownership and the economic system have created formerly unknown problems for landscape conservation. Privatisation requires urgent measures for the protection of the most valuable territories. It is necessary to modify legal, administrative and planning - related measures to protect the current network of protected areas. The 1997 National Environmental Strategy, and its development through the 1998 Environmental Action Plan, does develop that kind of measures.

> Information sources: Mander et al, 1995; ENES, 1997; Jongman and Kristiansen, 1998; Sepp et al, 1999.

### The Lithuanian Natural Framework

In the nineteen eighties, the *Natural Framework* concept was coined based on the division into zones of green belts, recreational areas and protected zones. The 1992 Environmental Protection Act, the 1993 Protected Areas Act and the 1995 Territory Planning Act include the *Natural Framework* concept. A hierarchical structure of geo - ecological division, stabilization areas which compensate for urban development areas and migration corridors has been gradually created. The *Natural Framework* is characterised by the lack of urban and industrial activities and its purpose is to cover 60% of the territory. Up to now, protected areas only amount to 11% of the territory. Agricultural areas cover almost 55% of the territory, and it is intended to increase the forest area by 10 to 15% by reducing agricultural activity.

The *Natural Framework* is a territorial system within which ecological compensation zones are identified which perform functions such as the purification of air and underground water, the protection of recreational resources or the aesthetic improvement. One of the principles of the Lithuanian approach is that of location wherever there is a need. Such needs derive from the analysis of the landscape and the geo - ecological structure. Three types of areas of geoecological importance are identified: "Natural windows" in the high positions and in the system entries (heads of basin, refill areas, coastal zones, ...), "natural corridors" to facilitate the migration and the flow of materials, located at low gravitational positions (flow and migration channels, valleys or riverbeds) and "natural buffer zones and filters" in intermediate positions, capable of protecting natural diversity or transforming lateral flows (forests, prairies, wetlands, ...). From the management standpoint the network consists of three subsystems which have been mapped at a national and regional scale:

- 1. Ecogeological divisions, or belts between different ecosystems performing ecological compensation functions at an intersystem level
- 2. Internal stabilization areas, which perform compensation functions inside the geo - systems, and which include the biologically relevant areas
- 3. Migration corridors, which perform functions related to the exchange of geodynamic and biological information flow

For the time being, the *Natural Framework* remains at the project stage. At a national level there are projects on a scale of 1:300.000 and 1:100.000. At a regional level there are projects on a scale of 1:50.000 and 1:100.000. At a local level the scale of the projects is 1:10.000.

The development of a bio - ecological network as a subsystem within the *Natural Framework* has been incorporated into the National Strategy for Environmental Protection, and into the National Action Plan for the Conservation of Biodiversity, prepared in 1995.

Information sources: Kavaliuskas, 1995, 1996; Environmental Protection Ministry of the Republic of Lithuania, 1998.

#### The Ecological System of Protected Areas in Poland

In 1977 the concept of Ecological System of Protected Areas (ESPA) was coined for the purpose of establishing a coherent system consisting of core zones surrounded by buffer zones and connected by corridors (forests, valleys and prairies). Although it was approved by the relevant Ministry, neither its official planning nor its implementation have followed.

Legal support is provided by the 1991 Nature Conservation Act. Eighteen per cent of the territory is protected; basically, forests and state properties.

Using the SEAP concept as a starting point, 3 different protection categories were established: national parks, landscape parks and protected landscape areas.

Several projects have been recently prepared in order to develop the ESPA under IUCN initiatives using the EECONET principles. The Polish objectives are as follows:

- To integrate the regionally representative habitats into an ecological network
- To guarantee the spatial and functional unity to protect the migratory species
- To incorporate the zones currently being designated as protected
- To include areas of traditional agriculture and aquaculture

The criteria used to select the areas to be integrated into the network are the biological diversity, the naturalness, the rarity and the level of threat, together with more complex analyses of geomorphological structures, hydrological and biotic conditions and the structure of the landscape.

The development of the network is at a very early stage. The mapping carried out in 1995 on a scale of 1:500.000, includes core areas, biocentres and buffer zones of national and international importance, as well as ecological corridors of international and national importance. Many difficulties have been encountered concerning the integration into sectorial policies (industry and agriculture). One of the main threats is the strong industrial pollution deriving, to a great extent from the use of obsolete technologies.

Information sources: Jongman and Kristiansen, 1998; Liro, 1995.

# The Territorial System of Ecological Stability in the Czech Republic

The legal framework is the 114/1992 Act for the Protection of Nature and the Landscape. The responsibility for the conservation of nature falls on the Ministry of the Environment and on the Czech Environmental Inspectorate. The NGOs, such as the IUCN project office, the Society for the Sustainable Life and the Czech Conservationist Union, play an important role in the development of ecological networks.

The concept of Territorial System of Ecological Stability (STEE) was developed in the eighties in the academic centres of Brno and Bratislava, and it is incorporated into the environmental legislation of the Czech and Slovak republics after 1989. In the Czech Republic the STEE attaches more importance to the basic elements of the system, consisting of biocentres, buffer zones and bio - corridors.

The STEE proposes a hierarchical structure, in which the real function of the elements is at a local scale. There is a dense network of local corridors (of approx. 1 km) linking local biocentres (1 to 3 hectares). The function of regional biocentres is that of preserving the regional biodiversity. At the regional level, corridors have a width ranging from 20 to 50 metres, and a length ranging from 300 to 1000 metres. The first corridor was planned in 1984. Regional corridors normally consist of several local biocentres. The supra - regional level includes biocentres with an area of more than 1000 hectares.

At a local level, the criteria are their location and, to a lesser extent, the representativeness of certain biotopes. At a regional level, the criterion is the biodiversity and at a supraregional level, the representativeness, the location and the protection status.

The STEE is based on hydrological and climatic data, on the composition and diversity of the species. Historical documents have been used to confirm the existence of the corridors designed for the fauna and flora.

The STEE is at a development stage. The plans have been made at a supra - regional scale (on a scale of 1:500.000) for the whole country. The plans must be put into effect at a local level. The instruments for the implementation of the STEE are the designation of protected areas and the introduction of measures for landscape management. The planning projects must inevitably include a STEE project as a basic document.

Information sources: Jongman and Kristiansen, 1998.

### The Slovak Network

The Territorial System of Ecological Stability (TSES) is the core of the 1994 Act for the Protection of Nature and the Landscape. The TSES must obligatorily be reflected in all forestal regulation projects and plans, hydrological plans and regional plans, as provided for in the 1992 Territorial Planning Act. At a general level, it has been incorporated into the General Territorial Development Plan of the Slovak Republic in 1997. At a regional level, it is included in the Territorial Plans of the Regional Districts.

The first TSES project, defined on a scale of 1:200.000, was approved by the government in 1992. The TSES envisages the whole of the territory as the complete spatial structure of the interconnected areas, and includes not only the biocentres and bio - corridors envisaged in the Czech case, but also eco - stabilization measures which affect the whole of the territory. It, therefore, does cover the whole of the territory and, according to the structure of the landscape, elements are identified having a different degree of ecological stability, as well as different uses of the ground. It is the purpose of the system to guarantee the internal operation of the ecosystems and the spatial and functional relations among them, as a prerequisite for the maintenance of the biological diversity.

The TSES has two parts: the general framework made up of the basic elements (biocentres, bio - corridors and interactive elements which play a role as buffer zones) and the eco - stabilization measures.

The biocentres, which are equivalent to the core zones in the Dutch or Belgian initiatives, are identified according to three types of criteria:

- *Selection criteria*: representativeness, ecological relevance, internal ecological stability (degree of maturity), size and shape.
- *Location criteria*: geographical position, role played in the protection of the soil and the water resources, etcetera
- Application criteria: existence of legal protection, etcetera

Corridors are selected on the basis of their capability to make the dispersal of species possible, the existence of migration routes and their contribution as habitats for species living in core zones.

The areas for the development of nature have a treble function: with regard to the conservation function, those areas are selected that have the potential to become core zones, as buffer areas to protect the core zones or the corridors from man - made disturbances, or as areas to be restored through the re - creation of landscapes. The network is configured as a hierarchical system, where each element belongs to one of the different levels. This entails a priority cascade from the highest levels to the most local ones. From this hierarchy different requirements can be deducted for the management of ground uses and that of nature conservation.

The implementation has been recently assessed of the project for the establishment of the ecological network within a project coordinated by the IUCN. The goal of the definition of the network is deemed to have been reached with the identification of the indispensable territories for the operation of the network in keeping with internationally established criteria, as well as the description of the core zones and the corridors. All this has been done on a scale of 1:500.000. The results of the network design process have been as follows:

- 1. The production of distribution maps with summarised information on groups of threatened species.
- 2. The digitalisation of key maps for the proposed ecological network.
- 3. The assessment of the current system of protected areas.
- 4. The assessment of the current supraregional territorial system of ecological stability. The network proposal was based on the existing TSES. All biocentres are treated in the new network as core zones, as corridors or as restoration areas.
- 5. A synthetic proposal of ecological network.
- Over the next few years the following aspects need to be strengthened:
- Legal protection for all core zones and ecological corridors. The proposal includes several core zones which are not a part of any protected area.
- Monitoring of the state of the core zones. Many core zones are threatened by impacts related to new economic conditions and the subsequent intensity in the use of natural resources.
- Preparation of models of sustainable development. It will not be possible for all the core zones to have a maximal protection status. It is necessary to develop models which take into consideration the exploitation of forest, agricultural, recreational and tourist resources; the management of water resources and transport.
- The widening of the debate on the network proposal among governmental and non -governmental bodies. The assessment of the proposal must make it possible to achieve the most precise definition of the boundaries of the core zones, the revision of the categories assigned to some zones and the possible inclusion of more restoration areas.

Information sources: Miklós, 1989; Sabo et al, 1996.