

# PROTECTION OF ECOLOGICAL CORRIDORS IN SPATIAL PLANNING DOCUMENTS IN POLAND IMPLEMENTATION PROBLEMS

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**Abstract.** The paper discusses main theoretical and methodological assumptions regarding designation of ecological corridors and determination of their boundaries. It presents a review of concepts of ecological corridors prepared in Poland and draws attention to the lack of legal instruments which would ensure ecological network continuity. The paper discusses the state and scope of works on the implementation of the concept of the Lublin Ecological Network in updated spatial development plan of the Lublin Voivodship.

**Key words:** spatial policy, spatial development plan, ecological corridor, ecological network, Lublin voivodship, Poland

## INTRODUCTION

The international conference entitled “Implementation of the concept of ecological corridors in Poland” which was held in November 2008 in Białowieża, was a perfect venue for meeting and exchanging experiences by experts of various fields, such as spatial planning, nature conservation, forestry, transport and law. The aim of the conference was to develop joint activities and tools, which would ensure adequate protection of ecological connectivity between areas of great natural interest. Its lack leads to fragmentation of the environment and isolation of protected areas, and in result to gradual disappearance of species and decrease of the value of those areas. The protection of ecological connectivity between areas such as national parks or Natura 2000 areas enables migration of individuals and makes it possible for the populations of such species to live on large areas, owing to which they become healthier and more stable. It also ensures exchange of genes and preservation of genetic diversity. The best tool to ensure cohesion between areas of great natural interest are ecological corridors, which may be protected in different ways, but most of all through spatial planning, both at the local and higher level of voivodship, country or even continent.

Spatial planning is today regarded by many circles as an ineffective instrument of nature conservation, although the comparison of spatial planning and nature conservation shows that they have a common object, that is, the space, and common goal which is to determine the principles of rational use of resources and space values. In the spatial planning process the protection of areas of great natural interest, including ecological corridors, is realized by identification of their values and analysis of the conditions of their preservation, and by making planning arrangements, taking into consideration the purpose of the protection, included in the development goals, and conditions of their implementation (Szulczewska 2004).

In the current spatial development plans of voivodships the protection of natural resources is usually guaranteed by presentation of the existing forms of nature conservation, suggesting new areas to be protected and designation of areas which ensure the preservation of ecological coherence at the regional level (Cielma-Miłosz et al. 2009).

Periodic assessments of spatial development plans carried out in all voivodships pointed to the need for updating the existing documents, mainly due to the necessity to adapt them to the requirements imposed by the Act on spatial planning and development of 27 March 2003 (Journal of Laws Dz.U. of 2003, No. 80, item 717). Over the last years there were major legal changes which had an influence on the spatial planning process and which referred mainly to environmental protection—an obligation to designate Natura 2000 areas. All voivodships are currently updating their spatial development plans and preparing new networks of protected areas and concepts of preservation of their ecological coherence.

The paper discusses main theoretical and methodological assumptions regarding designation of ecological corridors and determination of their boundaries. It presents

a review of concepts of ecological corridors prepared in Poland and draws attention to the lack of legal instruments which would ensure adequate protection and preservation of ecological network continuity. The paper discusses the state and scope of works on the implementation of the concept of the Lublin Ecological Network in updated spatial development plan of the Lublin Voivodship.

## **ROLE AND SIGNIFICANCE OF ECOLOGICAL CORRIDORS**

Theoretical basis of ecological network concepts were developed in accordance with island biogeography theory (Mac Arthur and Wilson 1967) and metapopulation theory (Hanski and Gilpin 1997). The studies on landscape structure, conducted as part of landscape ecology—patch and corridor model (Forman and Gordon 1986) and geocomplex theory, which consists in identification, description and analysis of natural spatial units of various importance (Richling and Solon 1998; Pietrzak 1998) significantly contributed to the development of the network concept.

The main goal of establishment of ecological networks is to ensure relative durability and stability of landscape functioning by preservation of spatially related natural and semi-natural areas. Thus, it should be created by areas relatively little transformed (degraded) as a result of human intervention, which are characterized by species abundance and stable functioning of ecosystems which can be found within their boundaries. Such areas are called “biocentres” in some concepts of ecological networks and “source” or “nodal” areas in others. They are the areas on which the nature defended or defends itself against “anthropopression.” The condition for their successful development, apart from adequate management, is to ensure connections with other areas of similar natural interest in order to prevent harmful isolation and protect and restore biodiversity of both protected and other areas of great natural value. This function is performed by ecological corridors (Szulczewska 2001).

Design of ecological corridors may be based on various theoretical and methodological bases. Two kinds of approach can be distinguished here, ensuing from the aims adopted (what they are for and what functions they are to perform) and principles of network development (methods adopted):

- complex—when the aim of the ecological corridor development is to ensure conditions for proper functioning of the natural environment of a given area, thus also the areas important with regard to development of water, climate and biological conditions are included in the network;
  - ecological—when the aim of the ecological corridor development is mainly to prevent isolation and create conditions for migration of living organisms in the landscape;
- and:
- structural—when the starting point is the study of structure and conditions of abiotic environment and on such basis an initial determination of spatial framework of the future structure;

- functional—when the network is created by connecting habitats identified as significant for the behaviour and migration of organisms, in particular rare, endangered and protected species (van Lier and Cook 1994).

Ecological corridor planning can be accomplished by observing real migration routes of organisms (radio telemetry, GPS, genetic studies)—a posteriori or assumptions regarding usefulness of particular pieces (elements) of landscape—a priori. In the latter case the basis for designation of corridors may include: presence of adequate linear elements, lack of barriers in space and quality and “friendliness” of particular elements of landscape mosaics (Solon 2009).

The method of designation of a corridor, its internal structure and management principles depend on the spatial scale adopted and designation for particular groups of organisms. A different set of criteria should be adopted for a network of corridors created at the local level, e.g. commune, and a different one for the continental level.

The major functions of ecological corridors include: prevention of isolation of particular habitat patches, facilitation of migration of organisms between them, and increase of gene flow between habitat patches which prevents the loss of genetic biodiversity. Ecological corridors ensure integrity of the national network of protected areas, including Natura 2000 areas (Jędrzejewski et al. 2005).

## **LEGAL PROTECTION OF ECOLOGICAL CORRIDORS**

In the 20th century major works regarding nature conservation were aimed at the protection of plant and animal species as well as areas of great natural interest, which were usually not very large (such as reserves or national parks) and which were to constitute sanctuaries of species diversity and act as gene banks. In the late 20th century it was discovered that the concept of nature conservation did not prevent global species extinction and loss of biodiversity at all life organizational levels (Jędrzejewska and Jędrzejewski 2009). Scientific studies proved that the only condition for biodiversity protection is to preserve and restore ecological continuity of habitats of great natural interest.

In the 1990s at the initiative of European institutions (Council of Europe, European Union), experts and non-governmental organizations (IUCN) several concepts of coherent ecological networks in Europe were created. The major ones include:

- EECONET (European Ecological Network)—adopted in 1992 by the Council of Europe as a pan-European concept of natural heritage protection system;
- PEEN (Pan-European Ecological Network)—preparation and implementation of the PEEN project was one of the several priorities of the Pan-European Biological and Landscape Diversity Strategy—PEBLDS, ratified in 1995 at the Third Ministerial Conference “Environment for Europe” by 54 European countries. This is so

far the only European initiative whose major and only goal is to establish by 2015 a functioning network of European natural areas connected by ecological corridors (Bloemmen and van der Sluis 2004).

- Natura 2000—this programme is an initiative of the European Union for nature conservation throughout the whole continent. The Member States are required to designate the Natura 2000 network by the Directive 92/43 on the conservation of natural habitats and of wild fauna and flora, a so-called Habitats Directive.
- Emerald Network—the network comprises Areas of Special Conservation Interest—ASCIs, singled out on the basis of the Convention on the Conservation of European Wildlife and Natural Habitats, a so-called Bern Convention.

A major contribution in the creation of ecological systems was made by the Polish tradition of nature conservation. Already in the course of the works on the Large-Spatial System of Protected Areas in the early 1970s the necessity to single out certain structures in the landscape, which would assure migration of species through environmental corridors and would contribute to preservation of gene pool, was taken into consideration (Kozłowski 1980). Such structures were the areas of protected landscape.

Despite numerous initiatives undertaken so far ecological corridors are still not well established, either in the European or Polish legislation. Article 10 of the Habitats Directive encourages the Member States to develop and protect “linear or continuous landscape elements, which are essential for the migration, dispersal and genetic exchange of wild species.” This is particularly important due to “improving the ecological coherence of the Natura 2000 network,” and should be taken into consideration at “land-use planning and development policies of the states.”

A regulation regarding ecological corridors appeared for the first time in the Polish legislation in an amended Nature Conservation Act of 16 October 1991 (Journal of Laws Dz.U. of 2001, No. 3, item 21). This Act defines an ecological corridor as “an area between two or more protected, non-developed areas, which facilitates migrations of plants and animals.” The current Nature Conservation Act of 16 April 2004 (Journal of Laws Dz.U. of 2004, No. 92, item 880), Article 5.2, contains the following definition “ecological corridor—an area facilitating migration of plants, animals or fungi.” And Article 3.3 says that “The goals of nature conservation are achieved by: preparing and implementing the provisions of conservation plans for [...] habitats and migration routes of protected species.” Ecological corridors are again referred to in Article 23.1, where the legislator, referring to protected landscape points out that it covers “areas protected due to distinctive landscape of diversified ecosystems, valuable due to the possibility to satisfy the needs related to tourism and leisure or the function of ecological corridors.” Article 80.1 reads as follows: “The minister for environmental matters in agreement with the minister for agriculture shall determine [...] technical and environmental conditions for tree planting, [...] following the need for landscape protection, biodiversity, establishment of ecological corridors [...]”

Another legal act regarding the protection of migration of animals is the Environmental Law of 27 April 2001 (Journal of Laws Dz.U. No. 62, item 627) Arti-

cle 73.2 provides that “Communication lines, overhead and underground pipelines, cable lines and other linear objects are carried and laid in a manner which limits their impact on the environment, including: (2) the possibility of wildlife migration.”

Other legal acts (Act on Spatial Planning and Development, Forest Act, Building Law, Water Law) contain no provisions referring directly to ecological corridors.

## **NATIONAL NETWORKS OF ECOLOGICAL CORRIDORS—REVIEW OF PROJECTS**

There are several projects of ecological corridors at the national level which have been prepared in Poland so far. The first of them was the project of the ECONET-PL National Ecological Network (Liro 1995, 1998), which constitutes the Polish part of the ECONET European Ecological Network. The network structure is formed by the nodal areas and connecting ecological corridors. The nodal areas were designated in relation to zone natural landscape arrangement in Poland, so as to protect areas, on which landscapes, communities and species characteristic for a particular zone are preserved in the state closest to their natural state. The basis for verification of boundaries of nodal areas and connecting corridors was the analysis of occurrence of selected plant species, invertebrates, fish, birds and mammals, taking into consideration, in particular, bats and otter (Liro 1995). The ECONET-PL network project gives priority to ecological corridors stretching along rivers.

An undisputable advantage of the ECONET-PL project is complex and in-depth study, taking into consideration many indicator species, such as endangered vascular plants, invertebrates, fish, birds and some mammals. At the designation of ecological corridors their role as routes for species expansion, gene exchange and regular migration was identified properly. But the criteria adopted, which they make the ECONET-PL network refer too much to the water network, with the omission of aspects regarding land ecosystems, raise objections.

The basic fault of the ECONET-PL network project is the lack of continuity of environments which ensure migration of land species, including mainly rare forest species. The criteria adopted regarding the occurrence of selected plant and animal species as basis for designation of ecological corridors are not sufficient since they do not allow designation of migration routes of animals.

The project of ecological corridors suggested by Kiczyńska and Weigle (2003) refers to the ECONET-PL project. Another study used in the concept of these authors was the National System of Protected Areas. Each element of the National System of Protected Areas (with the exception of protected landscape areas) was assigned the status of a potential corridor in the Natura 2000 network. Ecological corridors were verified based on the CORINE Land Cover database and agricultural evaluation map of the production space, which enabled identification of areas

necessary to preserve coherence of the ecological network. This study disregarded the areas the preservation of which had no significance for preservation of coherence of the Natura 2000 network (Kiczyńska and Weigle 2003).

In 2005 the PAN Mammals Research Institute, in cooperation with the “Wilk” Association for Nature and PAN Museum and Zoology Institute, prepared a project of ecological corridors connecting the Natura 2000 European Network in Poland. The main aim of migration (ecological) corridor network is to prevent isolation of areas of great natural interest, enable migration of animals and other organisms and gene flow through the territory of the whole country and between particular areas of great natural interest. In order to achieve coherence of the whole network at the national level its boundaries include the majority of legally protected areas (such as national and landscape parks, natural reserves, protected landscape areas), majority of the Natura 2000 network areas, large and dense forest complexes and the whole network of narrower landscape strips connecting particular elements. The network suggested should be treated as a crucial supplement or extension of the National System of Protected Areas, which ensures its coherence and protection of biodiversity (Jędrzejewski et al. 2005).

At the designation of the corridor network environmental analyses and continuity of more natural (woody) areas with fewer buildings were mainly taken into consideration. Depending on the possibility river valleys were included in the network if they were not densely built up by city buildings. Also historical reconstructions and analyses of present migration routes of indicator species (mainly wolf and lynx) and available genetic study results (mainly of the wolf population in Central and Eastern Europe) were taken into consideration. At the determination of the route of ecological corridors also all previous projects were considered (Jędrzejewski et al. 2004).

As part of the project seven main corridors, called international corridors, and national corridor network connected with them, were designated. The corridor network designated ensures migration of larger land animals.

This network, despite of its general character, was taken into consideration in the expert project of Concept of Spatial Development of the Country by 2033. It should be expanded and supplemented at the level of each voivodship, and then commune. It should result in changes in spatial development plans.

In mid-1990s there were several natural studies published, which referred to large river valleys (Vistula, Odra, Bug) and their ability to play the role of ecological corridors. At the request of the Department for Nature Conservation of the Ministry of Natural Resources Environment and Forestry the “Project of national ecological corridors designated on the basis of the water network” was prepared (Gacka-Grzesikiewicz 1995). The expansion of the Project was the programme of river valley protection in Poland (Gacka-Grzesikiewicz and Cichocki 2001). Unfortunately, the programme of river valley protection was not implemented; there even were no efforts undertaken to implement it systemically.

## **THE PROBLEM OF IMPLEMENTATION OF ECOLOGICAL CORRIDORS IN THE PLANNING DOCUMENTS**

At the Mammals Research Institute in Białowieża a detailed analysis of current spatial development plans of voivodships, and in particular of the graphic materials they contained, was conducted. Scientific studies were supplemented with questionnaires, which were sent to voivodship spatial planning offices throughout the country. All voivodships were asked to provide in the questionnaire information on the implementation of the concept of ecological corridors in spatial development plans with division into current and updated ones (Cielma-Miłosz et al. 2009).

The studies show unambiguously that all voivodships took the need to implement the concept of ecological corridors into consideration. Six voivodships (6/16) created the concept of voivodship ecological corridors based on the ECONET-PL network, 6 voivodships (Lublin, Lubusz, Łódź, Silesian, Świętokrzyskie and Greater Poland) conducted additional analyses of ecological connectivity and suggested including new areas of regional significance in the ECONET-PL ecological network, and 3 voivodships (Kuyavian-Pomeranian, Podlasie and Pomeranian) suggested different ecological corridor networks based on their own studies and ecophysiological analyses. The ecological corridors in 13 voivodships were presented in the figures attached (Cielma-Miłosz et al. 2009).

Only one voivodship, Masovian, did not join the project of changes in the spatial development plan. The remaining voivodships are at various stages of the planning procedure (analyses of external and internal conditions, preparation of an initial project of changes, issuing opinions and agreeing on the project of changes.) The materials collected suggest that the concept of ecological corridors will be taken into consideration at the update of all spatial development plans of voivodships. The manner and stage of the works on the designation of the corridors are different. Voivodship networks of ecological corridors are established based mainly on the two studies: ECONET-PL (Liro et al. 1995) and ZBS PAN (Jędrzejewski et al. 2005). At the establishment of the network of ecological corridors 9 voivodships (9/15) took the ZBS PAN concept and their own studies into consideration, 4—ZBS PAN, ECONET-PL and their own studies, 1 (Kuyavian-Pomeranian)—its own studies, and 1 (West Pomeranian)—the ECONET-PL concept and its own studies (Cielma-Miłosz et al. 2009).

Ten voivodships already prepared an initial concept regarding the boundaries of ecological corridors in a graphic form. Five voivodships (Kuyavian-Pomeranian, Lesser Poland, Subcarpathian, Świętokrzyskie and Warmian-Masurian) are currently preparing such studies. Greater Poland, Łódź and Opole Voivodships use the existing concepts for analyses and supplement them with regional ecological connections. Lublin and Silesian Voivodships conducted their own complex analyses at the voivodship level (Cielma-Miłosz et al. 2009).



## **LUBLIN ECOLOGICAL NETWORK**

Lublin Voivodship is a region of great natural value which consists in large biodiversity and landscape diversity. There are ecological patterns of international significance across the area of the Lublin Voivodship, along the Vistula, Bug and Wieprz River valleys and forest ecological corridor, covering Janowskie Forest and Solska Forest (Indicative map of the Pan-European Ecological Network for Central and Eastern Europe).

Ecological corridors in the Lublin Voivodship are protected under the “Spatial Development Plan of the Lublin Voivodship” and provisions which are included in the Strategy of the Development of the Lublin Voivodship for the Years 2006–2020 and Programme of the Protection of the Lublin Voivodship Environment.

As part of the implementation of the ECONET-PL national network on the territory of the Lublin Voivodship the following was designated:

- 5 nodal areas of international significance (Middle Vistula, Polesie Area, Lower Bug Valley, Roztocze and Janowskie Forest);
- 4 nodal areas of national significance (Siedlce Area, Southern Roztocze, Zamość Area and a part of the Middle San Valley);
- 3 ecological corridors of international significance (Bug—on two sections called Włodawa Area and Wołyń Area as well as Biłgoraj Area);
- 4 corridors of national significance (Urzędów Hills and Western Roztocze, Middle Wieprz Valley, Lower Wieprz Valley and Krzna Valley with branches).

By the resolution of the Minister of Environment the Natura 2000 ecological network was established within the territory of the Lublin Voivodship, which currently comprises 23 bird sanctuaries (around 13% of the voivodship area) and 48 habitat sanctuaries (almost 4%). Five habitat sanctuaries were regarded as potential sanctuaries and were listed on a so-called Shadow List.

Since 2001, pursuant to the Nature Conservation Act, ecological corridors were an element of the system of protected areas. They connected the protected areas which themselves did not have effective protection of continuity of ecological connections. Additionally, the corridors were designated linearly which significantly hindered their protection in the local plans.

The lack of effective legal regulations and lack of implementation of the assumptions of the ECONET-PL network constitute the main reasons which prevented and prevent proper preservation of continuity and protection of ecological corridors at the local level. Failure to undertake activities aimed at expansion of the course and manner of presentation of boundaries of the ecological corridors designated (from spot-like or linear to space) enabled a lot of freedom in location of the investment within their area. The “Report on Changes in Spatial Development of the Lublin Voivodship” pointed out the need for expansion of the ecological corridor network of regional significance in the Voivodship Plan also with regard to the strengthening of coherence of the Natura 2000 network. And the analysis of the studies of

conditions and directions of spatial development of communes within the voivodship territory disclosed extensive narrowing of the corridors, lack of continuity of some corridors between communes, lack of understanding of the concept of the protection of ecological connections or total lack of ecological corridor network designated. This prevents the corridors from performing their basic function, that is, connecting (Michalczyk 2009).

At the order of the Spatial Planning Office in Lublin the Zamość Nature Association prepared the assumptions of the Lublin Ecological Network (LubSiEk). Its main elements are: natural sanctuaries (biocentres), buffer zones and ecological corridors. Natural sanctuaries were designated based on regional criteria for selected species, prepared on the basis of data from the programmes such as IBA, IPA, CORINE, Natura 2000, ECONET-PL. The study takes into consideration the assumptions of ecological corridor network of national and international significance (PEEN and Natura 2000). During the identification of ecological corridors two designation methods were applied: continuity of ecosystems (structural criterion) and connectivity between natural sanctuaries (functional criterion). Based on the first method major valley and forest patterns were designated in the Lublin Voivodship. The second criterion was used to ensure connections between natural sanctuaries and structural sanctuaries and corridors (Michalczyk 2009).

Arrangements resulting from the assumptions of the Lublin Ecological Network will be, after their acceptance by local government, introduced to the currently updated "Spatial Development Plan of the Lublin Voivodship." The implementation of a new network provides for:

- designation of areas (natural sanctuaries) for individual protection (nature reserves, ecological land, etc.)
- designation of areas to be included in the Natura 2000 network,
- introduction of protection principles of each element of the ecological network,
- designation of "hot spots" and determination of principles to minimize conflicts,
- determination of "death hot spots" (spots of highest number of animal deaths),
- designation of areas to be afforested (Michalczyk 2009).

## **SUMMARY**

Protection of ecological corridors in the Polish law is disproportionate to the role they play in preservation of biodiversity of the country. It is necessary to introduce adequate provisions in numerous acts, resolutions and documents.

Planning documents, from the concept of spatial development of the country to the study of conditions and directions of spatial development of communes, contain provisions which are coordinating but not binding for third parties. They are not hierarchically subordinated to each other, so the provisions included in the documents of higher significance are not automatically introduced in the documents of

lower significance. Practical implementation of the concept of ecological corridors is possible only at the level of local spatial planning—the only planning document, which is more like a local law and thus is binding for third parties.

Graphic synthesis of the boundaries of ecological corridors designated in current and updated spatial development plans of each voivodship points to the lack of coherence between the voivodships. The present state points to the need for common method of designation of ecological corridors and determination of priority elements of natural environment, which should be taken into consideration when establishing a coherent ecological network for the whole country. It is important to present clear guidelines for its implementation and development at lower levels. Such a network should be established based on existing studies (ZBS project) and additionally supplemented with the results of detailed analyses, and most of all with migration corridors for water species and perhaps birds. Additionally, the corridor network should refer to the Pan-European Ecological Network (PEEN) and take into consideration the areas protected under both Polish and European law.

The corridors should be designated by area, since it is easier for them to be subjected to planning protection (in the form of protection plans and studies aimed at determination of acceptable functions on a given area). The procedure of preparing the planning documents and their updating may significantly delay the implementation of the assumptions of planning protection of ecological corridors. An essential element of the actual implementation of the concept of ecological corridors in Poland should be propagation of ecological awareness in the society, introduction and enforcement of responsibility of regional and local authorities for the protection of ecological connectivity. Communes should have an obligation to implement the principles of the protection of ecological corridors in the studies of conditions and directions of spatial development of communes within a certain time or introduce effective legal protection.

An essential problem which may occur during the works on the national ecological network may be the lack of GIS data in some voivodships or lack of possibility to make them available. The application of GIS tools and mutual exchange of information would enable cooperation between voivodships and experts of various disciplines, and adequate coordination of works, for example, by the Ministry of the Environment.

Despite the fact that the “Project of Ecological Corridors Connecting the Natura 2000 European Network in Poland” has no legal basis, in practice it became a useful tool in nature conservation. It is widely used, for example, in the evaluation of the impact on the environment, with consideration of linear investments and analysing their conflicts with the natural environment.

This project needs to be updated and amended. The major works in this regard should supplement the network with disregarded sections of river valleys (mainly due to water species), supplement the network with new protected areas (including

new Natura 2000 areas) and correct the boundaries based on new maps, satellite and air pictures. Such works are currently conducted at the PAN Mammals Research Institute.

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