TISCIA 29, 53-58 **Forum**

RIVER VALLEYS: ARE THEY ECOLOGICAL CORRIDORS?

L. Gallé, K. Margóczi, É. Kovács, Gy. Györffy, L. Körmöczi and L. Németh

Gallé, L., Margóczi, K., Kovács, É., Györffy, Gy., Körmöczi, L. and Németh, L. (1995): River valleys: Are they ecological corridors? - Tiscia 29, 53-58.

Abstract. "Ecological corridor" became a buzzword in ecology and nature conservation especially during the last five-six years when the ideas "econet" and "ecological network" have been widely spread. The importance and disadvantages of habitat strips ("corridors") are well known in the biogeography and the ecology of habitat islands. The flood plains of River Tisza and the tributaries are complexes of habitat zones, which have a significant role in the distribution of fauna and floral elements. The migration and distribution along habitat strips or a complex of them are not sufficient conditions for an ecological corridor, because the later assumes the existence of "core areas" (i.e., source and target areas of migration and distribution), too. It is demonstrated in this paper that the "ecological corridor" function is object-specific and the relevance of the river flood plains in the nature conservation is more than that of simple "ecological corridor": besides promoting the distribution of fauna and flora, they act as core areas, too.

Key words: habitat strips, river valleys, migration, distribution, higher plants, birds, insects.

L. Gallé, K. Margóczi, É. Kovács, Gy. Györffy, L. Körmöczi, L. Németh, Department of Ecology, József Attila University, Szeged, Pf 659 H-6701 Hungary.

Introduction

The term "ecological corridor" has become one of the most fashionable buzzwords in conservation biology and nature conservation, especially in relation to the use of the concepts "econet" and "ecological network" (e.g., Ribaut, 1995; Council of Europe, 1995a, 1995b). It is often used as a key word or slogan to promote the action-oriented activities and the utilization of financial sources for research and conservation. In this paper, our main aim is to investigate, weather the valley of River Tisza - which is often stated *a priori* as an ecological corridor, - meets the criteria of "ecological corridors".

Definitions, advantages and disadvantages of corridors

"Ecological corridor" is hardly regarded to be scientific term. It was introduced as landscape corridor more than thirty years ago (see Lewis, 1964). It is mainly used in the conservation practice, in the politics dealing with nature conservation, and in the conservation biology for such habitat strips that promote migration of fauna and floral elements. Some recent definitions of ecological corridors and related term are as follows:

"Migration corridors: The main directions for intensive geodynamic and bio-informational exchange, based on flow and migration channels" (Kavaliauskus, 1995).

"Ecological corridors: Within areas of moderate or low ecological value, natural corridors... (omission by the recent authors) are defined as the landscape units, which are hazardous for other uses such as agriculture, forestry or settlements" (Troumbis, 1995).

"Ecological corridors ("landscape connections"): Important landscape bands, e.g. river valleys and forest reaches, that connect a nature area" (Brandt, 1995).

"Ecological corridors comprise landscape structures and artificial provisions that contribute to migration between core areas" (van Zandelhoff and Lammers, 1995).

"Ecological corridors: (a) zones, which are thought to facilitate the movement of species between core areas and nature development areas; (b) (landscape elements which have) landscape structure and land use, and suitable environmental conditions comparable with those of sites that have to be connected" (DeBlust et al., 1995).

Main categories in ECONET concept: biocenters, biocorridors, potential biocorridors or interactive elements (Doms et al., 1995).

It is clear from the above definitions that although there is a multiple usage of this term, it is common in the majority of the definitions that ecological corridors are habitat strips, which promote the exchange of flora and fauna elements by migration between quasi-natural habitats ("core areas", see Fig. 1A). The promotion of migration by a longitudinal habitat or habitat complex (Fig. 1B) without core areas is not sufficient criteria for ecological corridors.

It is often disregarded that the term "ecological corridor" is plural, similarly to the environment, niche and other basic terms of ecology. Clearly the same habitat strip does not act as a corridor for birds, plants, beetles, ants, etc. at the same time and at the same scale. Therefore it is senseless to speak of ecological corridors *per se*, without a reference ecological object (e.g., a population).

The advantages and disadvantages of ecological corridors are known for at least one decade (see Simberloff and Cox, 1987; Noss, 1987). When this term is employed as a campaign slogan, however, for political or science-political aims, the scientific reasoning is disregarded. In popular or semi-popular texts, even if they appear in the context of landscape ecology, only the advantages of corridors are emphasized. Such misinformation has probably contributed to the suggestions to protect and establish ecological corridors without any critical assessment of the particular circumstances, e.g., if they promote the migration and distribution of protected species or only introduced weeds. The plural character of the ecological corridors is also neglected in the Sofia Conference: "We call for promotion of nature protection, both inside and outside protected areas, by implementing the European Ecological Network, a physical network of core areas linked by corridors and supported by buffer zones, thus facilitating the dispersal and migration of species" (Ministerial Conference, 1995).

River Tisza valley as an ecological corridor

By the above mentioned definitions, the ecological corridors should meet the following

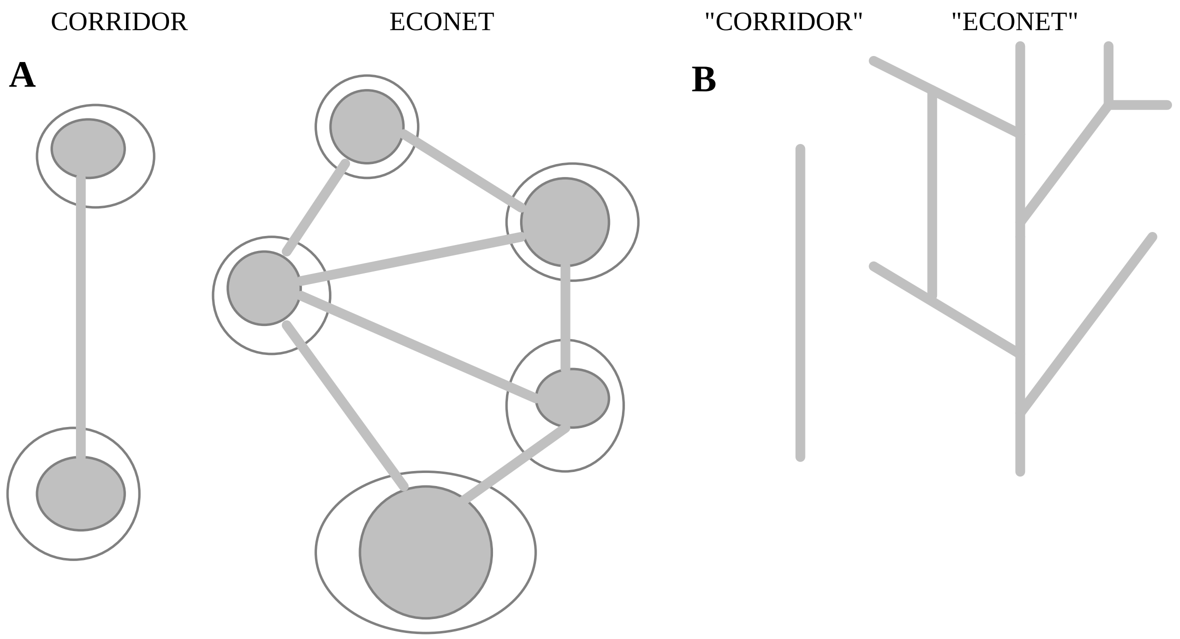

Fig. 1. The basic question of this paper if river valleys are "real ecological corridors" linking core areas, that are supported by buffer zones (A), or simple routes without core areas (B).

criteria (Gallé et al., 1995): (1) they should promote the migration and/or the distribution of particular population(s); (2) they should connect natural or quasi-natural core areas by this function; and (3) they should contribute to the dispersion of those species that are valuable from conservation points of views.

The possible migration and dispersal route function of the Tisza Valley is in the focus of interest of the biologists working in this region, because since the time when the river was regulated, the valley has formed a landscape strip consisting of such habitats that differ from the neighboring ones. The importance of River Tisza in the distribution and migration of water fauna and flora is obvious, therefore we do not discuss it here. The role of this river valley in the migration and overwintering of the birds is also well known from the black stork (*Ciconia nigra* L.) to the bullfinch (*Pyrrhulla pyrhulla* L.) (e.g., Molnár, 1995). The most apparent example for the distribution of terrestrial birds along the River Tisza is the case of olivaceous warbler (*Hippolais pallida elaeica* Lindl.). This species found unsaturated communities and therefore unutilized resources in the bushy willow forest vegetation by the river beds (*Salicetum triandrae* plant community) and the olivaceous warbler's distribution could be followed in these habitat strips from year to rear (Bankovics, 1975, 1977, 1995). From among the insects, the best classical examples were given by Erdõs (1935), who studied the role of River Maros (one of the tributaries of River Tisza) in the dispersion of beetle fauna. He described a lot of beetle species that had not been known from the southern Hungarian Plain before and supposed that these species' distribution was supported by the river floods. Their presence, however, is not an evidence of the successful colonization and persistence. In some cases, Erdõs (1935) discussed the possibilities of survivorship and he found it very probable in some species originated from the mountain beetle fauna (e.g., *Thonobius longipennis* Heer, *Bledius dissimilis* Er., *Patrobus atrorufus* Ström). Gausz (1967) studied the dispersal of southern, mainly Mediterranean, grasshopper and locust species to the North along River Tisza Valley. He found unequivocal evidences for the role of Tisza valley in distributing *Pezotettix giornae* Rossi, and *Phaneroptera quadripunctata* Br. W. Gallé (1967) likewise found that some "southern" elements of the ant fauna (e.g., *Messor structor* Latr, *Plagiolepis* species) spread along the dikes, whereas the mountain species were found in those moist habitats of the flood area, which are not intensively influenced by the inundation. The influence of River Tisza Valley on the distribution of other invertebrate groups is given by Kolosváry (1967, harvestmen) and Bába (1995, mollusks). On plants, Újvárosi (1940) and Timár (1950, 1953), citing also Lányi's (1914, 1916) previous studies, provided good examples. Timár (1953) also referred to the role of Tisza valley in the distribution of weeds.

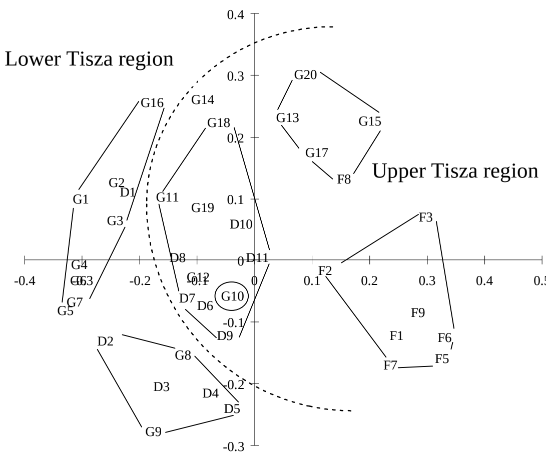

Fig. 2. PCoA scattergram of sampled habitats according to their vegetation. Capitals indicate different types of habitat: G=grasslands, D=Tisza-dikes, F=forests. The sample sites belonging to the same cluster in hierarchical cluster analysis are outlined by edges.

These, above mentioned studies provided evidences on the level of populations that the flood area and the river dikes work as migration routes for several terrestrial plants and animals. Community-level information can be gained from the differences and similarities of the community composition between the upper and lower Tisza district (Margóczi et al., 1995). High community-level similarities presumably indicate a homogenizing effect and therefore an ecological corridor function by the river valley habitats. We compared the composition of the vegetation, the leafhopper (Auchenorrhyncha) and the ant (Formicoidea) assemblages of habitat sets at the upper (vicinity of Tiszadob and Kesznyéten) and a lower Tisza district (Szeged district) by PCoA ordination, employing Czekanowski similarity algorithm. The upper and lower Tisza sites as well as the dikes and the grasslands in the protected flood plain are clearly separated in their plant and leafhopper assemblages (Figs. 2 and 3). The sampled habitats joined into five main groups according to their vegetation. These groups can be distinguished not only by their geographical position (upper and lower Tisza district), but by their naturalness values, too. The leafhopper assemblages of the dikes are similar to that of grasslands with strongly disturbed vegetation. We found no differences between the upper and lower Tisza region in the PCoA ordination space of ant assemblages (Fig. 4), therefore, a homogenizing effect by the river valley can be assumed. The smaller scale dissimilarities are mainly brought about by the habitat quality, which is indicated by the ants in a manner differing from both vegetation and the leafhoppers assemblages.

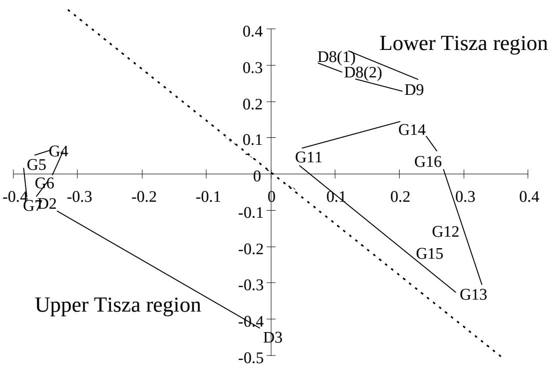

Fig. 3. PCoA scattergram of sampled habitats according to their leafhopper assemblage. For legends see Fig. 2.

The migration and dispersal are not sufficient conditions to regard Tisza Valley as an ecological corridor, because there should be natural or "core" areas, between which the migration and dispersal take place. This is a crucial problem, because in the majority of cases, no core areas can be identified, only larger regions, e.g., North Hungarian Central Range, the Hungarian Great Plain or even the Danube flood plain are mentioned. It is not possible to outline the conservation value of the flood plains as ecological corridors from these general statements. The studies of the habitat islands by the river valley (Gallé, 1990a, 1990b; Gallé et al., 1989, 1992) revealed that the flood area of River Tisza, especially the dike-side grasslands, flood plain meadows and forests, biologically communicate with the habitat islands outside the protected flood area. This is, however, not an ecological corridor function simply, because in this case River Tisza Valley is a species pool or one of the "core areas". The natural values (i.e. plant and animal populations, ecological communities) of River Tisza have been documented in details during the forty years of Tisza research (see the back volumes of Tiscia). Therefore it can be stated that the Tisza Valley is a complex of habitat zones, and contains valuable natural biota. The stripe-like character of the habitats promotes the distribution of species. The corridor function of River Tisza Valley is only secondary, its main relevance is that it works as a species and propagula pool for the nearby ecological islands at least in some animal populations. In the case of plants, which have more restricted distribution ability, the capacity of the narrow dike-sides (width is 40-50 m at most) to produce propagula is probably insufficient for recolonization of ecological islands.

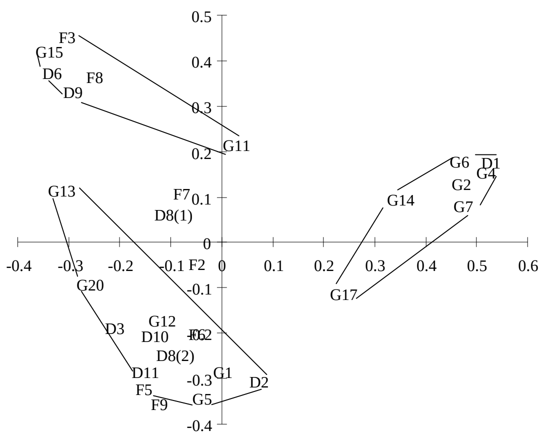

Fig. 4. PCoA scattergram of sampled habitats according to their ant assemblage. For legends see Fig. 2.

To maintain both core area and corridor functions, it is necessary that natural and semi-natural habitats should form continuous strips and should have large areas, at least in those regions, where the protected flood area is wide enough. This latter criterion is necessary to protect species with larger area demands (e.g., eagles, falcons, other raptors, herons, black stork etc.). We suggest to maintain continuous strips of bushy willow forests (*Salicetum triandrae*) strips by the river bed, willow-poplar forests (*Salicetum albae-fragilis*), hard-wood forests (*Fraxino pannonicae-Ulmetum*), meadows in the protected flood area (*Alopecurus pratensis* and *Typhoides arundinacea* dominated plant communities), dike-side grasslands (*Alopecuretum pratensis, Cynodonti-Poetum angustifoliae* and *Salvio-Festucetum rupicolae* plant communities in the majority of cases) and the plant belt along the dike roads (*Schlerochloo-Polygonetum avicularis*). Some habitat types, however, contribute to the spread of induced, habitat-strange species. Among others, *Amorpha fruticosa* L., *Acer negundo* L., *Fraxinus penssylvanica* Marsh. plant species are spreading in the planted forests of introduced poplar and willow species. These zones should be interrupted and replaced by natural forests.

Since the flood plains in the Hungarian Great Plain are not only corridors but core areas, too, it is necessary to establish buffer zones, which support both functions of the protected flood area. The minimal width of the buffer zone is 150-200 m. Buffer zones have a similar character, as the habitats inside the flood area as a rule. In some cases, however, they can be of different type, if they are in some biological connections with the flood area, e.g., saline lakes are the foraging habitats of herons breeding in the flood area.

The habitat islands outside the flood area (see Krausz et al., 1995) could be supported by stepping stones (small habitat patches promoting migration) and transversal ecological corridors, i.e., habitat strips between the virtual islands and the flood area. These corridors are usually stripes of grasslands along road, forest strips and marshy areas along tributaries of River Tisza etc. The maintenance of these strips can support the ecological communication between the flood area and the habitats outside.

Acknowledgment

This paper was supported by OTKA grant 1/4 No. 5337 and by the Tisza Program by the Ministry of Environment Protection and Regional Planning. Authors thank the Directorate of Bükk National Park for the permission of field work.

References

Bába, K. (1995): Personal communication.

Bankovics, A. (1974): Spreading and habitats of *Hippolais pallida elaeica* (Lindl.) along the Tisza. - Tiscia 9, 105-113.

Bankovics, A. (1975): Data on the comparative ecology of the scrub warbler (*Hippolais pallida elaeica* (Lindl.)) and its spreading along the Tisza in the years 1973 to 1974. - Tiscia 10, 81-83.

Bankovics, A. (1995): Personal communication.

Brandt, J. (1995): Ecological networks in Danish planning - Landschap 12, 63-76.

Council of Europe (1995a): Pan-European Biological and Landscape Diversity Strategy. - CDPE 9, 1-42.

Council of Europe (1995b): Pan-European Biological and Landscape Diversity Strategy. Summary. - CDPE 9 (add.), 1-6.

De Blust, G., Paelinckx, D. and Kuijken, E. (1995): The Green Main Structure of Flanders. - Landschap 12, 89-98.

Doms, M., Steffek, J. and Jancova, M. (1995): Ecological network(s) in Slovakia. - Landschap, 12, 39-50.

Erdõs, J. (1935): Maros torkolatának árvízi és ártéri bogárvilága biológiai szempontból. - Thesis, pp. 87.

Gallé, L. (1967): Tisza-ártéri Formicoidea tanulmányok. - Thesis, pp. 125.

Gallé, L. (1990a): Ökológiai izolátumok szünzoológiai vizsgálata. - Környezet-gazdálkodási Kutatások 4, 5-33.

Gallé, L.(ed.)(1990b): Ökológiai izolátumok szünzoológiai vizsgálata. - Technical report pp. 146+11.

Gallé, L., Györffy, Gy., Hornung, E. and Körmöczi, L. (1989) : Indication of environmental heteromorphy and habitat fragmentation by invertebrate communities in grasslands. - In: Bohac, J. and Ruzicka, V. (ed.): Proc. 5th Internat. Conference, Bioindicatores Deteriorisationis Regionis I., Ceske Budejovice pp. 167-171.

Gallé, L., Györffy, Gy., Hornung, E., Kocsis, A., Körmöczi, L., Szõnyi, G. and Vajda, Z. (1992): Arthropod communities of ecological islands surrounded by agricultural fields. - Proc. 4th ECE and XIII SIEEC, Gödöllõ 1991, 186-190.

Gallé, L., Margóczi, K., Kovács, É., Györffy, Gy., Körmöczi, L. and Németh, L. (1995): A Tisza-völgy, mint ökológiai folyosó: Frázis vagy tudományos tény? - Szegedi Ökológiai Napok és 25. Tiszakutató Ankét, Abstracts, 7.

Gausz, J. (1967): A adriamelléki és pannón-medencei Orthopterák faunisztikai-biocönotikai egybevetése. - Thesis, pp. 140.

Kavaliauskas, P. (1995): The nature frame, Lithuanian experience - Landschap 12, 17-26.

Kolosváry, G. (1967): Personal communication.

Krausz, K., Pápai, J. and Gallé, L. (1995): Composition of Orthoptera assemblages in grassland habitats at Lower-Tisza flood plain. - Tiscia 29, 47-52.

Lányi, B. (1914): Csongrád megye flórájának elômunkálatai. - Magy. Bot. Lapok 13, 232-275.

Lányi, B. (1916): Újabb adatok Csongrád vármegye flórájához. - Magy. Bot. Lapok 15, 267-268.

Lewis, P.H.J. (1964): Quality corridors for Wisconsin. - Landscape Architecture 2, 100-108.

Margóczi, K., Kovács, É., Györffy, Gy., Körmöczi, L. and Gallé, L. (1995): The role of the valley of River Tisza in maintaining regional biodiversity. - 7th European Ecological Congress, Abstracts, 54.

Ministerial Conference (1995): Environment for Europe, Ministerial Declaration. - UN ECE 23, 1-12.

Noss, R.F. (1987): Corridors in real landscape: A reply to Simberloff and Cox. - Conserv. Biol. 1, 159-169.

Ribaut, J.P. (1995): Ecological Network Experience gained by the Council of Europe. - Landschap 12, 11-16.

Simberloff, D. and Cox, J. (1987): Consequences and costs of conservation sorridors. - Conserv. Biol. 1, 63-71.

Timár, L. (1950): A Tiszameder növényzete Szolnok és Szeged

között. - Ann. Biol. Univ. Bebrec. 1, 72-145.
Timár, L. (1953): A tiszamente Szolnok-Szeged közötti szakaszának növényföldrajza. - Földr. Ért. 2, 87-113.
Troumbis, A. (1995): Ecological networks in Greece. - Landschap 12, 51-62.
Újvárosi M. (1940): Növényszociológiai tanulmányok a Tisza mentén. - Acta Geobot. Hung. 2, 169-214.
van Zadelhoff, E. and Lammers, W. (1995): The Dutch ecological network. - Landschap 12, 77-88.