



## ANELLA VERDA, A GREEN BELT AROUND BARCELONA METROPOLITAN AREA

*Antoni Montseny*

The green belt is a project of the Diputació (Provincial Council) of Barcelona aimed at preserving the natural surroundings of the Barcelona Metropolitan Area. It is a project that deals with country planning and which has as its objective, as far as its fundamental budget is concerned, to respect the environment. The region covers about 3,200km<sup>2</sup>, which, if we apply the statistical criteria of the Census Office of the United States, is increased by 50%.

The Metropolitan Area represents 10% of the territory, 70% of the population are concentrated in it, and it produces 72% of the GNP and 43% of the building expectations for Catalonia. All this means the establishing of a hierarchy and the transfer of decision-making functions to the end of a special "trophic chain". This has been established between the Metropolitan Area, as leader, and the rest of the territory as an "associate area", in such a way that the tendency of the former to absorb energy resources follows an upward continuous line.

The centre of the Area is the city of Barcelona. This city forms part of a polynucleus system of cities, whose outer crown forms an arch that goes from Vilanova i la Geltru to Mataró, through Vilafranca del Penedès, Sant Sadurn d'Anoia, Terrassa, Sabadell and Granollers.

In this context there are a series of territorial and ecological consequences of the model established in accordance with the identified limits.

Outside the metropolitan limits 409 municipalities which have dropped in population over the last 45 years and which have about 164,000 inhabitants, have to cope with more than 300,000 people during July and August. Within these limits there is a generalised phenomena of diffuse city which, between 1973 and 1992 lead to an occupation of 130% of the territory, whilst in the whole of Catalonia the population only grew by 17%, without a collective intermodal public transport system to rationalise it in terms of mobility. In the Metropolitan Area private transport increased by 7.9 points between 1991 and 1996, whilst public transport went down by 4.4% (CPSV). The Metropolitan Survey shows that those people over 18 who, when moving home also change to a different municipality, represent 22.3% of the total and that they are distributed between the first Crown (+4.7%) and

the second Crown (+17.6%) of the Metropolitan Area (IEM). This means a 75% increase in energy costs under this concept between 1978 and 1993, and the corresponding repercussion on global energy consumption, bearing in mind that transport represents 40% of this consumption and that 60% of the consumption for transport corresponds to short journeys of less than 6 km by private car. This means that the increase and the repercussions are due to an erroneous design in the territorial artefact as a whole. The sectioned mobility is associated with the disposition of the diffuse city estates on the territory, which is divided up and segmented, making the continuity of the surface of the natural environment impossible. In this way we need to see the whole from the perspective of the growth of the index of humanised ecological succession. The process may be described in terms of loss of biomass, predominance of the contribution of energy as opposed to the contribution of information, and loss of urban biodiversity, which is characteristic of a compact city and of urban structure in general.



*Park of Foix*

The specific complexity of the territorial artefact is decreasing parallel to the index of maturity, and this is contrary to the evolutionary pattern which human beings have shown over the last 4,000 million years and is unsustainable. The concept of "ecological traces", as far as these virtual limits are essential to maintain the resources and energy of a determined

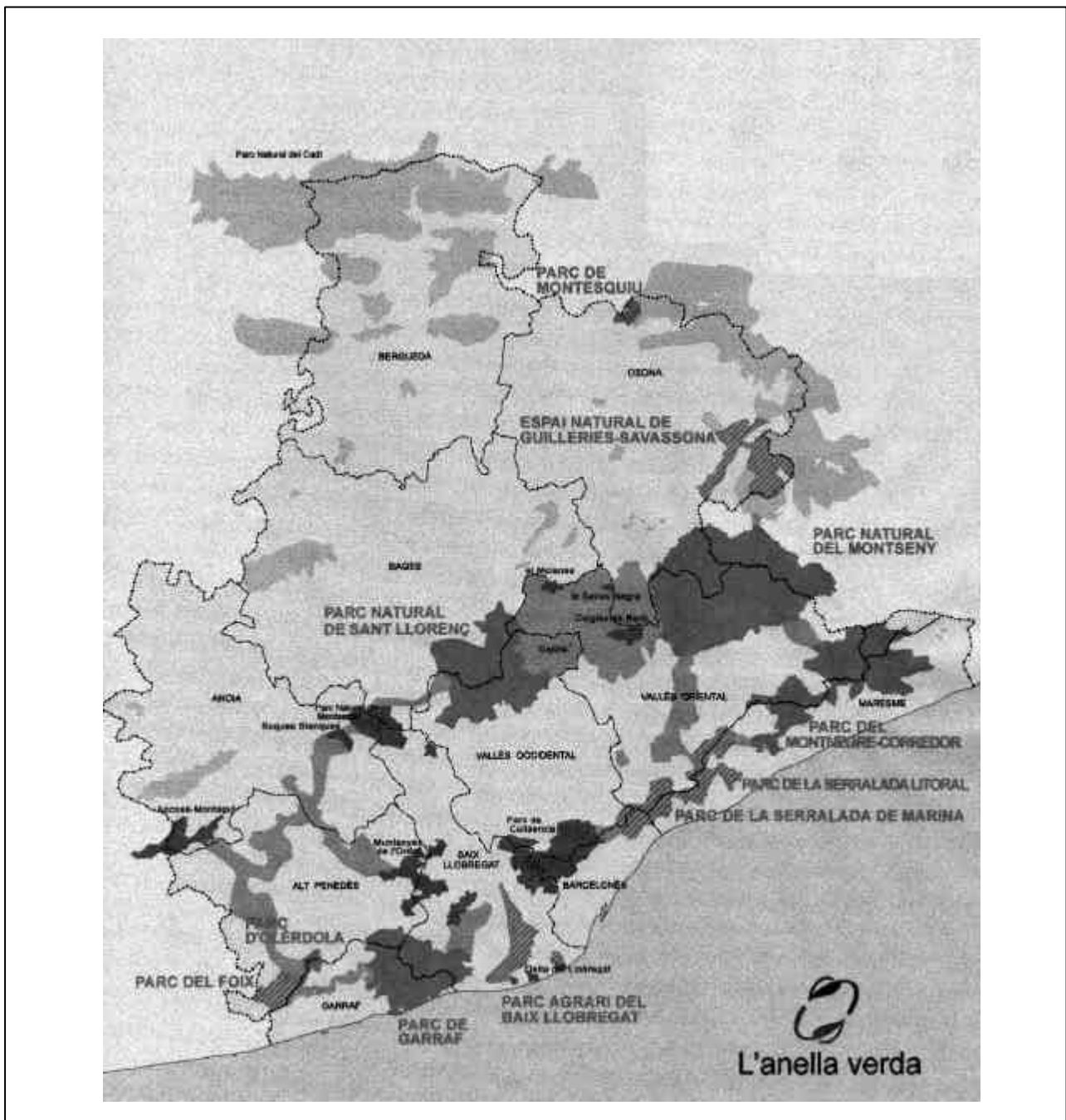
territorial artefact, tells us that Barcelona alone is already one and a half times the surface area of Catalonia. The process is continuing and tending to increase, as shown in the results of the latest studies of the Centro de Política del Suelo y Valoraciones (Centre for Land Policies and Valuation) of the UPC and the Insitituto de Estudios Metropolitanos (Institute of Metropolitan Studies) Metropolitan Survey.

The consequence for the environment is the progressive transformation of a fragmented countryside, which clearly corresponds to the paradigm of imbalance.

In order to attempt to slow down these dynamics, we need to go straight to the necessity of preserving the

natural surroundings and, in this particular case, the Serralada Prelitoral and the Serralada Litoral.

However, this process has not been the result of just putting together natural spaces, but the whole area was subjected to an analysis characterised by assuming holistic criteria, which incorporate disciplines which are essential at the end of the millennium; structuralism, cybernetic theory of complexity, thermodynamic approximations and the conception of a complete urban system in terms of ecosystems. The achieved result has allowed us to formulate a system of spaces that are specially protected as a part of this system of cities, a substantial part of which adopts a network scheme and guarantees the continuity of the



*Diputació de Barcelona and the system of environmental continuity around the metropolitan area .*

natural systems and the preservation of the biodiversity.

This network, close to the previously mentioned system of cities, is formed of a belt of 150,000 hectares. The network continues beyond this belt, but the singularity of this form and the fact that 95,000 hectares are already being managed by the common agreement of a hundred municipalities, has led us to formulate the Green Belt as a specific project within the general limits of preservation of the environment.

Understood as a component of the urban ecosystem as a whole, the Green Belt greatly contributes to slowing down the distortion of the ecology.

From this perspective, the traditional territorial intervention of the Diputació (Provincial Council) becomes an essential action aimed at preserving the



*Natural Park of Montseny*

whole urban system, exploring the limits of its possible growth in relation to a sustainable maintenance of the whole.

The context in which the Green Belt operation should be put is that of improving the quality of life of the citizens, this being the demand of the local community.

The question is whether the local community, which together with the autonomous and state regulated ones, shapes the constitutional framework of the limits of political representation and action of our citizen surroundings, can ignore the previous approach.

One possible answer would be to take refuge in the territorial division of the municipalities to resolve, locally and specifically, the defects of each area considered.

This is impossible due to the very nature of the problem. The actions of the other authorities, the autonomous and state ones, which do not act "from within a territory" and are further removed from the direct problems of the citizen in his immediate territorial framework, are not sufficient.

On the other hand the latest actions of these areas have been discouraging. For example the new state Land Law, which allows all land which is not the object of a specific protection, to be urbanised, which a) is unaware of the character of the system that the ecological matrix of the system has, and b) given that

general town and country planning is municipal, creates resentment arising from inequality between the private individuals in the different municipal areas affected by the land classifications that respond to the same concept, but that may be treated differently according to the autonomy of the municipality when authorising the degree of protection. Another example would be the Plan Territorial General de Catalunya (The General Territorial Plan for Catalonia), which makes 50% of land in Catalan territory (all land with less than a 20% slope) susceptible to urbanisation, whilst only 2.7% is urbanised (LANDSAT) and only 5.5% would be urbanised if all the provisions of the general urban planning schemes of the municipalities of the country were fulfilled.

Therefore, the local community has to act bearing in mind the character of the system with an integrated environment, in planning for the territory that tends towards municipal parameters and to adopt initiatives as a whole, co-ordinating them with the other areas (autonomous and state regulated) in such a way that coherent actions are taken for the territory.

#### **Model of action and a proposal for management on a local scale.**

The relevant generic of the model of action which is explained here is the mandate which is established in chapter 28 of Programme 21 which was approved in the Rio Summit (June 1992). A reference that originates in the local community is the letter of Aalborg (May 24<sup>th</sup> to 27<sup>th</sup> 1994). In part 1.2 the letter says "environmental sustainability implies, in addition, the maintenance of biological diversity". When discussing urban economy focused on a sustainable growth (part 1.8) the first of the four most important themes is "to invest in the preservation of existing natural capital", and the third is "to alleviate the pressure on the reserves of natural capital creating other new resources, such as parks for urban leisure, with the aim of easing the pressure that there is on natural forests". Finally part 1.10 considers it fundamental "to protect the world's biomass resources, such as the forests".

Just as important as the forests is the agricultural space, which, even though it means disturbances to the ecological matrix underlying the territory, allows for a continuity of the natural systems and presupposes the verification of fundamental ecological functions with relation to the water cycle, the absorption of gases and the stability of the land.

The problem that arises is the fixing of the matrix. The areas identified must be consolidated. Therefore they have to adopt a shape within the current law, whether this be the Land Law or the Environmental Law, or preferably both. What is required is to formulate and manage special plurimunicipality plans and those derived from the Plan for Places of Natural Interest in such a way that they form a double shield for the spaces that are integrated in the network of the territorial ecological matrix.

Referring back to the Green Belt Project, for more than thirty years the Diputació (Provincial Council) has

implemented policies with the objective of saving natural spaces. Thus, whilst urban plans were drawn up (the County Plan of 53, the General Metropolitan Plan of Barcelona of 76) and territorial plans (The Provincial Plan of 59, the Director Plan of the Metropolitan Area of Barcelona of 68, the General Territorial Plan of Barcelona of 95) and the sectional plans ( The Metropolitan Arterial Network of 74, the Sewerage Plan of 82, the Road Plan of 85, the Plan for Spaces of Natural Interest of 92) the Diputació (Provincial Council) approved special plans that allowed for the real preservation of Sant Llorenç del Munt and Serra de l'Obac (1972), Montseny (1977) Garraf (1986) and Montnegre-Corredor (1989).

In 1993 these parks made up 65,000 hectares actively managed by the Diputació (Provincial Council).

However, the idea was to arrange for protection for the whole of the Serralada Litoral and to close off its extremities (at Penedès and Vallès Oriental) thus making the perimeter slope of the Green Belt. This means increasing from 75,000 hectares managed by the Diputació (Provincial Council), including Collserola, to an estimated 150,000 hectares for the exterior of the belt as agreed upon in the project.

Over the last three years the park of Sant Llorenç has been extended from 9,500 to 14,000 hectares), the park at Olèrdola has also been extended and the park at Garraf is at present being enlarged by more than 2,000 hectares, which are also strategic as they form the ecological corridor that joins Garraf to Olèrdola and the Foix. In a parallel way five consortiums have been

established (Serralada de Marina, Sant Mateu Cèl·lècs, Foix, Guileennes-Savassona and the Agricultural Park of Baix Llobregat) which manage the areas within their zone and the last link was the constitution of the other consortium between the Diputació (Provincial Council) and the Metropolitan Association for managing the Park of Collserola. The Diputació (Provincial Council) drew up and approved the Special Plan of the Foix reservoir and is drawing up the rest of the consortium. Its basis being the perimeters of planning, but with the reality of effective management implemented by logistic staff and a budge, it grew from 75,000 to 95,000 hectares in 1998 (an increase of 25%) and the number of municipalities involved in the operation increased from 61 to 100 (an increase of 62%).

From these beginnings relevant studies have been done for the constitution of the ecological parks at Sant Celoni-Gualba-Campins (between Montseny and Corredor-Montnegre), Sant Llorenç-Montseny (through Sant Llorenç Savall, Granera and the Riscos de Bertí) and Roques Blanques with Olèrdola-Foix (through Penedès), Garraf-Ordal and Collserola-Serralada de Marina (through the Montcada hill). The cost of the present management of the areas already under management comes to 3,100 million pesetas (including Collserola). We should also add the 425 million pesetas contributed by the Metropolitan Association of Barcelona and the consortiums of Collserola and Serralada de Marina.



*Park of Garraf*

# RIVERS: GREEN CORRIDORS FOR EUROPE

T. van der Sluis, R. Foppen, N. Geilen

## Introduction

In this article we present a method for evaluating habitat networks. The proposed method will be illustrated with results of a pilot study of the corridor functioning within the entire Rhine basin. The study was performed for the Ministry of Transport, Public Works and Water Management in the Netherlands as an elaborate example of a possible strategy applicable within the framework of the International Rhine Commission. This commission, among others, aims at planning and realisation of a cohesive habitat network for the entire Rhine basin.

Since Roman times people have settled in riverine areas. Due to a combination of factors the river was attractive to settle: transport possibilities, availability of water, fish, fertile soils for agriculture and often a strategic location for road crossings, to mention a few. Nowadays these settlements or cities form important barriers for wildlife species, even for mobile species like birds. Besides development of infrastructure, there is a lot of habitat destruction and rivers therefore do not function anymore as a corridor.

## Corridors on European level

There are different habitat networks that are important for species at a European scale. Obvious examples are the coastal wetlands, which function both as habitat, stepping stones and corridors for migratory birds or

wader birds. Also mountain ranges, like the Alps, Apennines, Pyrenees, and Balkan, can be considered as one potential network, especially for large species like wolves, bears or vultures (Randi 1993,).

Other important networks on a European scale are the (transboundary) rivers. Rivers can be seen as natural ecological corridors. Rivers form ribbons of a linked mosaic landscape with forests, marshland, brushwood and floodplain channels, which not only connect areas within the river zone to each other, but also the areas located along the floodplains. In this abstract an example from the basin of the river Rhine will be used as illustration.

On this basis ideas are being developed on ecological corridors, e.g. for the river Meuse and the river Rhine (Reijnen *et al.* 1995, Foppen *et al.* 1998a, 1998b, 1999), but also for the central Apennines (Romano, 1996).

## The concept of Metapopulations

As a starting point we use the concept of metapopulations. The habitat for most animal species in Europe is often highly fragmented, as a result of development of infrastructure, habitat destruction and urban development. Therefore we can not speak of 'a population' but of physically divided sub-populations. Between sub-populations there is still exchange of individuals, by dispersal. We call such a network of

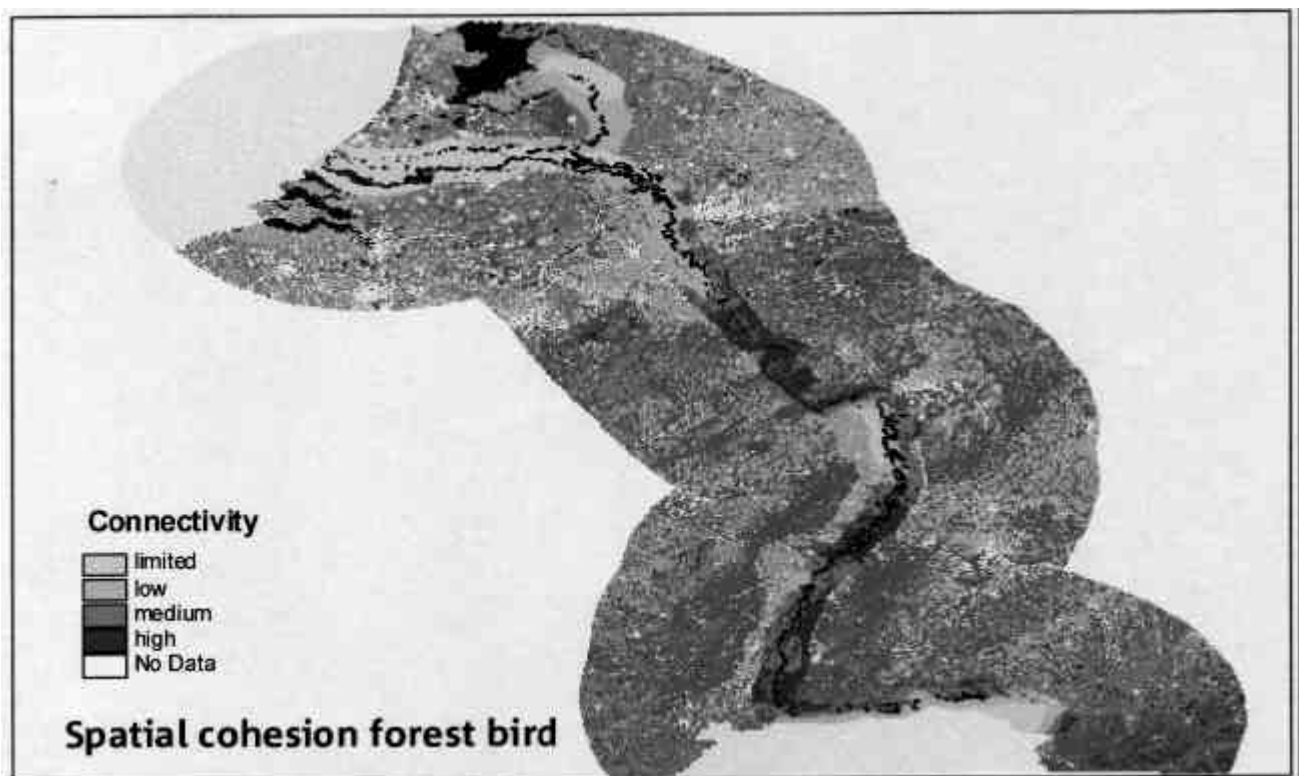


Figure 1

sub-populations a metapopulation.

As a result of fragmented natural habitat, distances between sub-populations often are too large, and barriers form unsurpassable obstacles. This hinders gene flow between populations, and also successful recolonisation after occasional extinction of a population. This in turn poses a risk of extinction to the total population in the long term.

We study the impact of fragmentation at species level. By assessing the landscape from an animal's viewpoint, we gain insight into the functioning of the network for the species.

#### **Instruments for assessment of corridors: LARCH and LARCH-SCAN**

The Dept. of Landscape Ecology of the Netherlands Institute for Forestry and Nature Research developed an instrument called LARCH (acronym for Landscape Analysis and Rules for Configuration of Habitat), to assess the quality of a habitat network for different

LARCH has proven to be an effective tool for studies, for evaluation of governmental policies, but also assessment of alternatives for development, e.g. different road alignments or different scenario's for river development. The strength of LARCH lies in the fact that different scenario's are compared with regard of their effect at the (meta-) population scale. It is a relative simple tool, which can give insight in functioning of wildlife populations.

LARCH does require detailed information on habitat: both type and quality of habitat is needed to assess the carrying capacity. Particularly for studies on a European scale this proves to be an important setback.

Data is often not available on this scale, or it is not homogeneous for different countries.

Therefore another tool was developed which requires less input of data and gives insight in the functioning of corridors, by calculating connectivity for different areas: LARCH-SCAN.

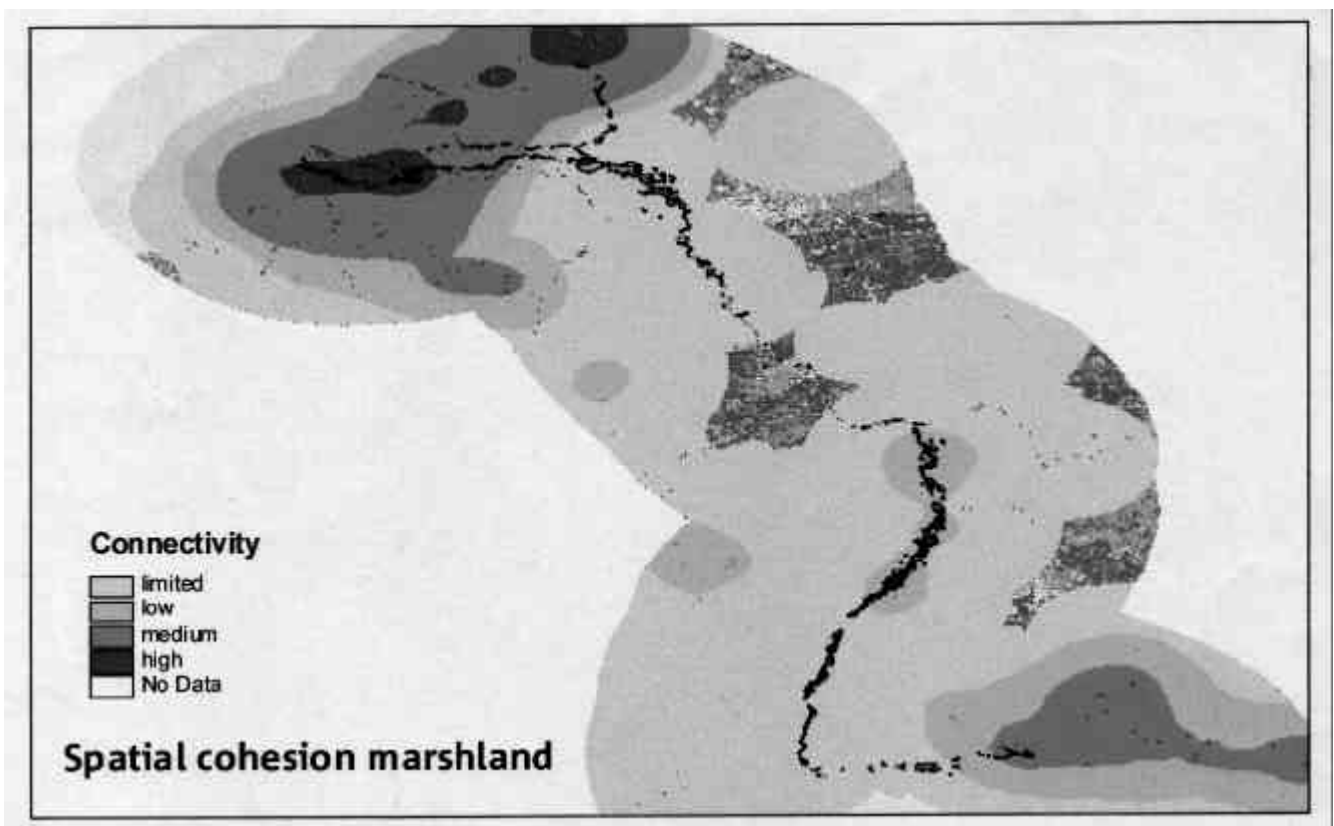


Figure 2

species. The function of each habitat patch is assessed on the basis of guidelines: whether a habitat patch is large enough to support a reproductive unit. If this is the case, does it contribute to a sub-population? If the number of individuals in sub-populations exceeds a threshold of a key population the risks of extinction are very limited (less than 5 %). These guidelines are derived at by empirical evidence, literature review and modelling results.

#### **LARCH-SCAN**

LARCH-SCAN (SCAN = Spatial Cohesion Analysis of Networks) basically requires a map with a vegetation type. On the basis of this map the connectivity can be calculated. The connectivity is an algorithm developed by Verboom *et al.* (1991) and Hanski (1994), based on distance between and size of habitat patches and species dispersal capacity.

i.e. how much each patch is connected with surrounding patches. The connectivity is based on:

- the dispersal rate of a species, and
- the amount of surrounding habitat of a certain type

In LARCH-SCAN we study groups of animals, which can be defined on the above mentioned characteristics. It is obvious that a bird like a marsh heron, which can easily reach marsh areas more than 50 km. away, has a larger habitat at its disposal than an animal with a small dispersal rate like the Italian (agile) frog, which won't migrate more than a few kilometres. The connectivity of the latter will therefore be much lower in the case of habitat located more than a few kilometres apart. The connectivity is calculated in a GIS-environment. The connectivity is a relative measure that can visualise the weakest parts in the network for a certain species. On the basis of this network study, choices can be made for development of additional habitat, or, alternatively, it can be assessed what the impact is of habitat destruction on the habitat network.

### Results Rhine-basin pilot study

In the case of the Rhine-basin pilot study LARCH-SCAN proved to be a useful method for a quick scan of the spatial cohesion of biotop types within a large study area as the Rhine basin is. Despite the fact that the available data were not optimal, the results clearly showed the potentials for river management and landscape policy. This is illustrated in the accompanying figures. A quick scan showed that marshlands within the Rhine basin fall apart in two distinct areas: the Lower Rhine marsh areas in the Netherlands and upstream areas around the Bodensee, near Konstanz (fig. 1). Nowadays, there is no connection between these two sites, and the justified question based on these results is if measures should be undertaken to achieve such a connection.

The results for the forest biotopes (fig. 2) showed a potentially well established corridor in large parts of the Rhine basin. Fragmentation or isolation in this case is mostly due to urbanisation (Ruhr area) and agricultural use of floodplains (e.g. the Netherlands).

Results like these produce essential information about potential valuable areas for the realisation and maintenance of cohesive habitat networks. This

information can be used in landscape planning, nature restoration strategies etc.

### Prospects for further developments

Larch Scan quickly provides insight in potentials and bottlenecks for dispersal of animals and potential dangers of fragmentation. The required input is limited, and therefore there are no vast costs involved. For more fundamental research, however, the information needs to be more specified.

Results can be improved by improving detail of the baseline habitat mapping. This can be improved with use of Remote Sensing data, and additional use of infrastructure data where required, which is especially important for ground-dwelling species.

Larch Scan can be used at different scales, from local to regional and international scale, from floodplain to watershed management, as is shown by this example of the river Rhine. There are no limitations on species groups, as long as ecological information regarding habitat requirements and dispersal capacity is available.

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Netherlands wetlands

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Photo by B. Romano



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