

habitat fragmentation due to transportation infrastructure



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EDITORIAL

Habitat Defragmentation: recovery of ecological connectivity in areas affected by transport infrastructures

The permeabilisation of new stretches of road and railways by wildlife passages has demonstrated an important advance in the past decade, since it is now common for projects to include wildlife passages, or better still, large viaducts or tunnels that maintain the connection between the habitats of the affected territory. However, there is an impending task: what is to be done in areas where transport infrastructure networks already in place pose barriers that fragment habitats and interfere with biological flows? Numerous surveys being developed in different areas of Spain demonstrate that here too there is work to be carried out and that things are moving forward at a good pace.

To de-fragment habitats firstly requires the clear identification of conflict points. This can be carried out on different scales, the most usual being the local scale. Stretches with accident black spots involving determined species are identified, or concentrations of traffic accidents caused by collisions with large mammals (see the news section for examples of the Iberian lynx, European mink and ungulates). This deals with stretches in which there is an intersection of transport networks with biological corridors used by wild animals as they move across the landscape. Another, less developed scale of analysis is the regional scale which consists of an entire analysis of the territorial matrix, identifying critical areas in which sectors of strategic interest for all the ecological networks, in particular the ecological connectors which link the Nature Network 2000 spaces together, are affected by barriers. Whichever scale of analysis is used, identifying the critical points or areas is an indispensable basis for the subsequent design, and application of measures that reconnect habitats, reduce wildlife mortality and increase road safety.

Measures for habitat de-fragmentation focus mainly on two fronts: the construction of new crossing structures (wildlife passages, ecoducts, viaducts etc.) which allow wildlife to cross existing roads and railways safely, and habitat restoration in areas of strategic interest in order to re-establish continuity between natural spaces and guarantee ecological connectivity. Different resources are necessary for financing these measures. The development of conservation projects for ecological connectivity improvement and the reduction of road mortality of threatened species can be financed through the European Fund for Regional Development (EFRD) or through the LIFE+, in the case of demonstrative projects, as carried out with the former programme LIFE Nature. On the other hand, projects developed within the framework of compensatory measures of new road networks stand out: the layout of the High Speed Railway has facilitated the construction of new wildlife passages in existing transport highways situated in the proximity of the new projects. It has also brought about a number of road widening and improvement projects, the incorporation of new wildlife passages and even large ecoducts situated in areas in which the connectivity between natural spaces is obstructed by highways currently in use.

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WORKING GROUP

The tenth meeting of the Working Group (a member of the Nature Protection National Commission) on *Habitat fragmentation caused by transport networks* took place last April. It was held in Madrid, at the Ministerio de Medio Ambiente y Medio Rural y Marino headquarters, and was attended by representatives from 13 Autonomous Communities, from the State Environmental and Public Works administrations as well as other organisations such as ADIF and CEDEX.

Firstly, the course the group has taken was underlined, from its constitution in 1998 within the framework of the European project Action Cost 341 to the present, tenth meeting. A letter from the chairman of the project Cost 341 and

promoter of the organisation IENE Hans Bekker, an engineer from the Dutch Ministry of Public Works and Water Management expressed recognition for the work carried out at the core of the Working Group and the implementation of the Europe-wide project results. He also thanked the group for their contributions over the years.

Secondly, the latest rough copy of the document entitled *Technical Prescriptions for the monitoring and evaluation of the corrective measure effectiveness of the transport infrastructure barrier effect was revised*. This was the second in the series *Documents for the reduction of habitat fragmentation caused by transport infrastructures* written up by the Working Group's technical commissions. Continuing with this series of documents, the general outline of the third document (in preparation) was shown, which



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focuses on the reduction of habitat fragmentation in the planning stage. In addition, the technical commission responsible for drafting the document was set up. Different proposals for the drafting of the following numbers in the series were debated and the subjects *Indicators for evaluating habitat fragmentation in relation to lineal transport infrastructures* and *De-fragmentation of habitats affected by existing roads* were selected.

Another topic that was debated at the meeting was the preparation of a technical workshop that will take place at the end of 2008 (see Workshop section). Finally, as usual in all this Working Groups' meetings, various contributions on measures to prevent the impact of transport networks on wildlife and its habitats were presented.

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NEWS

The effect of transport infrastructures on the Spur-thighed tortoise populations

The Cartagena-Vera highway crosses the area of the principal populations of the European Spur-thighed Tortoise (*Testudo graeca*) which extends over more than 2,000km² between the provinces of Murcia and Almeria. General conclusions have been reached from the programme on corrective measures and environmental observation about the possible long-term effective correction of the impact created by this kind of infrastructure on the Spur-thighed tortoise. The Miguel Hernandez University's Department of Applied Biology



Department of ecology. Miguel Hernández University

and the company BIONET, in accordance with the Environmental Impact Declaration (BOE of 18 June 2003), carried out the work for this programme.

The mortality of individuals during the construction phase can be corrected through the correct rescue and translocation of animals at the right time. Radio tracking animals translocated to the vicinity for two years and non-translocated animals (control) proves that, in the short term, this does not cause relevant alterations in the patterns of use of space, phenology, physiological state or reproduction. On the other hand, there are technical solutions for mortality when the road is already in use based on habitat connection using viaducts, tunnels, and false tunnels, or the construction of specific passages. In practise, its effectiveness depends on adequate maintenance work.

Habitat loss can be avoided through the correction of layouts or compensated by land acquisition. In any case, the greatest impact of the road (little visible thanks to the application of the environmental observation programmes) is due to the fragmentation of populations that has effects on two different scales. On a local scale, it leads to smaller populations, increasing the possibility of extinction in the mid or long run. On a larger scale, it reduces the size of large population units and the genetic flows between them, making them more vulnerable to extinction. The development of wildlife passages minimises these impacts and specific technical solutions need to be researched which determine the characteristics of these passages. As a complementary measure, an adequate perimetral enclosure is necessary and the acquisition of those areas that act as a passage between populational units where the wildlife passages are situated.

The Cartagena – Vera highway is a good example of where efforts should be

directed. Despite the enforcement established in the Environmental Impact Declaration, this infrastructure has fragmented small populations of high density that acted as a source for other populations. Consequently, not only are local populations but also metapopulations at risk of extinction. In addition, in some cases, these small populations acted as connectors between large populational units like the Sierras de Almagrera and Almagro. A previous, adequate diagnosis and strategic design of the project are basic elements that would have prevented these impacts.

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Action for reducing European mink mortality on Navarra Roads

Within the framework of the project LIFE GERVE (Ecosystem management of rivers with European mink), the Navarra Government is developing a series of measures to improve road infrastructure permeability and reduce the risk of road accidents with mink. The Departments of Public Works, Transport and Communications and Rural Development and the Environment together with the public company Navarra Environmental Management, Nurseries and Repopulation, are responsible for this development.



Javier Forcada

In addition to the construction of passages for this species in new road infrastructures, is the task of adapting existing drainage in existing roads to enable the European mink to cross intersections between watercourses and roads without abandoning the riverbed. To do this, dry lateral sides are prepared in the drainage system using jetties and are staked, which give a natural appearance or, lateral treated wooden ledges are installed, anchored to the walls of the structure using squares of galvanised steel. Both systems allow animals to cross the drainage system through these lateral margins that are kept dry, apart from when the base of the drain is flooded.

Another line of action consists of adapting road margins in the most conflictive stretches where irrigation ditches cross. In these sectors, the margin vegetation is eliminated and regrowth is avoided by using cement or geotextiles. This method aims to increase visibility, caution, and the animals' detection of approaching vehicles.

These actions are complemented with the creation of wetlands and the restoration of quality habitats for the European mink in copses, gullies, or abandoned meanders and in addition help mink move across areas not intercepted by roads, therefore decreasing the risk of road accidents.

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Characterisation of stretches where collisions with ungulates are concentrated on Catalan roads

Collisions with ungulates, in particular, wild boar and deer, are a risk to road safety and are a focus for both environmental administrations and road management teams. With the aim of locating stretches where a concentration of accidents occur and defining measures to reduce them, the Medi Ambient i Habitatge y de Política Territorial i Obres Públiques of the Generalitat de Catalunya have carried out an exhaustive inventory and subsequent analysis of the places where collisions have occurred.



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The project takes data from 3,057 accidents caused by ungulates in the period 2000 to 2006. Numerous departments collected this information: the environmental technical services, natural parks, forest rangers, and

road maintenance organisations etc. as well as other road safety administrations (Departamento de Interior) and the State road networks (Ministerio de Fomento). The analysis has identified 178 Stretches of Collision Concentration, with ungulates located on 73 roads. Amongst these, 36 stretches have been designated "priority attention", where the intensity of the problem justifies the urgent application of palliative measures. In the rest of the cases, action will be taken as improvement projects of the respective roads are carried out.

The wild boar is the species most greatly involved in collisions, and is the cause of 95% of the accidents (2,057 in total during the period analysed). In second

place comes the roe deer, at a considerable distance (2.3%), although a progressive increase in accidents caused by this small deer can be seen.

The measures to apply have been specified for each stretch, and recommend solutions adapted to each situation. In some cases, the simple improvement in perimetral fencing in bad condition is required, whilst in others the construction of new wildlife passages is proposed or leading the animal, using perimetral enclosures to tunnels, viaducts or other types of existing structures, allowing them to cross the roads without accessing the platform. In some stretches of local roads, measures are proposed which are temporary effective, such as cutting vegetation alongside of the roads, or olfactory barriers, combined with reinforced warning signs or other measures. In all cases, the inventory of the Stretches of Collision Concentration is the basic tool to consider in both road maintenance tasks and improvement projects for a progressive reduction of the problem.

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Ratification of the European Landscape Treaty of the European Council

On 1st March 2008, the European Landscape Treaty came into force, after its ratification by Spain last 26th November. As a result, the landscape will be treated like any other part of the territory just as the population perceives it, and whose character will be the result of the action and interaction of natural and/or human factors. It will include natural, rural, urban and peri-urban areas, and in addition, areas of land, coast and inland bodies of water; it refers to both exceptional and normal or degraded landscapes.

One of the main principles of the Treaty includes the integration of the landscape in sectorial politics. This should be carried out through the adequate procedures that systematically integrate the landscape in all the political sectors that have an influence on site quality. In order to do this, the Treaty places special emphasis on its correct incorporation in territorial planning and sectorial and parcial instruments, including correct ways of reaching agreements within the political sectors and between the relevant organisations. The Treaty presents a scheme of the general landscape planning process and highlights the need to change the content of the Environmental Impact Evaluation proceedings – environmental impact evaluation and environmental strategic evaluation. In doing so, the analysis and evaluation of the landscape are not considered as a sectorial topic attached to environmental components, but as a global form in the project for appropriately evaluating its effects on the territory. See more information [here](#).

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Infra Eco Network Europe (IENE) opens a new period with a change in those responsible for the organisation

Last April a meeting was held with the coordinators of the countries that make up the organisation IENE, promoter of Action COST 341. A new period opened during which the Biology Department of the University of Evora will assume responsibility for activity development in the organisation.

Representatives from 21 European countries attended the meeting, including those countries responsible for the organisation's foundation and leaders in the application of mitigation measures such as the Netherlands, Belgium or Sweden, and a considerable number of newly incorporated countries such as Poland, Croatia, Lithuania and Slovakia. Each country's representative presented a State of the Art assessment within their territorial fields, with a valuation of notable changes in the last ten years. The coordinator of the organisation for Spain underlined the notable advance in the work towards road permeability by wildlife passages and the growing attention paid to the conservation of ecological connectivity in both environmental legislation and in the practice of the environmental impact evaluation. The presentation of the Working Group's activities on fragmentation caused by transport networks was one of the aspects that aroused the most interest, especially due to the cooperation between transport and road administrations from different regions and the production of publications.

Future hot topics were also discussed at the workshops; in particular, the necessity to produce manuals for monitoring the effectiveness of measures and improving the maintenance of these measures, and also developing a wider focus of the fragmentation caused by transport networks which include landscape and social aspects.

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Estudio de las medidas correctoras para reducir las colisiones de aves con ferrocarriles de alta velocidad.

The publication, which is included in the series of monographs edited by CEDEX (Ministry of Works), is divided into three parts: description of the problem, types of available measures, and recommendations applicable to high-speed railways. An exhaustive bibliographic summary of the measures applied to different types of transport infrastructures identifies applicable measures for reducing the problem. Information about the measures applied to other elements that can cause bird mortality, such as electric lines, windmills or aeroplanes has been used.

Reference:

Rodríguez Sánchez, J.J., García de la Morena, E. & González Nicolás, D. (2008). *Estudio de las medidas correctoras para reducir las colisiones de aves con ferrocarriles de alta velocidad*. Ministerio de Fomento. CEDEX. Madrid. 141 pp. This can be obtained through the [CEDEX](#) Sale of Publications Service.



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Manual de ecología del paisaje aplicada a la planificación urbana y de infraestructuras.

This handbook contains criteria for putting ecological conservation into practice in the different areas of territorial planning. The first part of the document explains the basic principles of landscape ecology in addition to the principle elements (habitats, ecotones, biological corridors etc.) The second part illustrates, through the review of four real cases of recent territorial planning in the Spanish State, the need to incorporate landscape ecology criteria into territorial planning practice in order to conserve the biodiversity of affected territories.

Reference:

Español, I. (2006). *Manual de ecología del paisaje. Aplicada a la planificación urbana y de infraestructuras*. Colección Seignor, 38. Colegio de Ingenieros de caminos, canales y puertos. Madrid, 235 pp. This can be obtained through the [CICCP](#) Book Service.



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Libro Blanco de las carreteras y los espacios naturales protegidos de Andalucía.

The Andalucía Council has developed legislation and planning tools destined to reduce the impacts of road infrastructures in protected natural spaces (PNS). In 2004, the first Workshops on road infrastructures and protected natural spaces took place, and different recommendations emerged for reconciling roads with social and economic needs, territorial balance and the preservation of natural and cultural patrimony.

From these bases, the Department from Public Works and Transport and Environment have created the Libro Blanco de las carreteras y los espacios naturales protegidos de Andalucía, a collaboration with technicians and experts in engineering, nature conservation and socioeconomic sectors.

The document describes the current state of road infrastructures and the protected natural spaces in Andalucía. It proposes recommendations for resolving the conflicts generated by the interaction between roads and these protected areas and for the functional integration between them.

Reference:

JUNTA DE ANDALUCÍA (2007). *Libro Blanco de las carreteras y los espacios naturales protegidos de Andalucía*. Consejería de Obras Públicas y Transportes / Consejería de Medio Ambiente. Junta de Andalucía. Sevilla, 79 pp. It can be obtained through the Library and Publications Service of the Consejerías de [Medio Ambiente](#) and [Obras Públicas y Transporte](#).



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Diseño de obras de paso compatibles con la migración de peces. In the article published in nº 139 of the magazine *Ingeniería Civil* by Jorge García

Molinos (School of Natural Sciences, University of Dublin), Antonio Llanos (Michael Love and Associates, California) and Andrés Martínez de Azagra (ETS Agrarian Engineers, University of Palencia), different methods are detailed for facilitating the adaptation of drainage to aquatic (in particular fish) wildlife passages.

The publication describes two techniques in detail. The first is the fluvial imitation method, which consists of recreating the original conditions of the natural riverbed in the interior of the drainage structure. The second is the hydraulic method that aims to ensure that when the species of fish considered are migrating, the existing hydraulic conditions in the drainage system are adequate in relation to their swimming capacities and biological requirements.

Reference:

García Molinos, J. A. Llanos & Martínez de Azagra, A. (2005). *Diseño de obras de paso compatibles con la migración de los peces*. In *Ingeniería Civil*, 139: 132-139. This can be obtained through the [CEDEX](#) Sale of Publications Service. The article can be requested her [author](#).

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EVENTS

II Environment on Roads National Congress. Sustainable Road. Santander, from 21st to 23rd May 2008. Organised by Asociación Española de la Carretera. More information [here](#).

Congress of Local Mobility and Territory. Barcelona, from 11th to 13rd June 2008. Organised by Asociación Española de la Carretera and Diputació de Barcelona. More information [here](#).

The IUCN World Conservation Congress. Barcelona, from 5th to 14th October 2008. Organised by: International Union for the Conservation of Nature (IUCN). More information [here](#).

Workshop Ways to diversity - harmonizing transport infrastructure with the landscape. Uppsala (Sweden), from 7th to 9th October 2008. Organised by: Programme INCLUDE (Integrating ecological and socio-cultural dimensions in infrastructure management). More information [here](#).

XI Congress of Environmental Engineering. Bilbao from 4th to 7th November 2008. Organised by: Basque Country University and the Bilbao Exhibition Centre (BEC). Held within the framework of the first Sustainable Development Show GEO2. More information [here](#).

2nd International Congress of Landscape and Infrastructures. Infrastructures and landscapes in transition. Granada from 12th to 15th November, 2008. Organised by: Asociación Española de la Carretera and Junta de Andalucía. More information [here](#).

De-fragmentation of habitats affected by road infrastructures. Albufera Natural Park of Valencia, 25th and 26th of November 2008. Organised by the Ministerio de Medio Ambiente y Medio Rural y Marino and Conselleria de Medi Ambient, Aigua, Urbanisme i Vivenda of the Generalitat Valenciana. More information [here](#).


9th National Congress of the Environment (CONAMA). Madrid from 1st to 5th of December 2008. Organised by: Foundation CONAMA. Within the session entitled *Infrastructures and Transport*, a technical workshop is included entitled *Sustainable planning of transport infrastructures. Indicators*. More information [here](#).

Previous workshops and available minutes

1st Landscape and Infrastructure Congress. Seville 2006. The book of minutes can be obtained at the Asociación Española de la Carretera, via fax: 915 766 522.

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Within the framework of the European project and the Working Group, which has given continuity to the project, various materials have been generated which contribute to the knowledge and reduction of the effects of habitat fragmentation caused by transport infrastructures. Specifically, the following documents have been published:

- **COST 341. La fragmentación del hábitat en relación con las infraestructuras de transporte en España.** Revision of the State of the Art published in 2003.
- **COST 341. Fauna y Tráfico. Manual europeo para la identificación de conflictos y el diseño de soluciones.** Published in 2005; translation of the document *Wildlife and Traffic* editay el 2003 as colophon of the project.
- **Prescripciones técnicas para el diseño de pasos de fauna y vallados perimetrales**  (1,8 MB) Published in 2006 and constitutes the first in the series **Documents of the reduction of habitat fragmentation**. This publication includes detailed prescriptions for designing adequate wildlife passages for making roads and railways permeable for different species of wild animals to cross.

These publications can be obtained at National Park Autonomous Organism's Publication Service of Parques Nacionales del Ministerio de Medio Ambiente y Medio Rural y Marino (Tel. 91 596 4943, 91 596 4973, 91 596 4842; Fax 91 596 4897), or through other distributors of their products (www.educacionambiental.net; www.catalogoinneo.es).

Other products from the European project can be obtained through the Infra Eco Network Europe (IENE) Website.

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- This publications comes within the framework of the Fragmentation Habitat Due to Transportation Infrastructure Project. It is promoted by the Dirección General de Medio Natural y Política Forestal of the Ministerio de Medio Ambiente y Medio Rural y Marino. They have collaborated in this number José Daniel Anadón, Xavier Baulies, Javier Forcada, Jorge García-Molinos, Andrés Jiménez i Antoni Sorolla. The technical secretary's office of the project runs in charge of [MINUARTIA](#).
- Previous bulletins: Number 0, Number 1, Number 2, Number 3/4, Number 5.
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