habitat fragmentation due to transportation infrastructure

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EDITORIAL

Strengthening green infrastructure

The concept of 'green infrastructure' has gained ground in recent years, particularly since its inclusion in *Our life insurance, our natural capital: an EU biodiversity strategy to 2020*. Specifically, "Action 6: Set priorities to restore and promote the use of green infrastructure" establishes that member states, with the aid of the European Commission (EC), shall draw up a strategic framework before the end of 2014 in which ecosystem restoration priorities will be set. In addition, the EC will devise a green infrastructure strategy before the end of 2012. The aim of this strategy will be to encourage the expansion of green infrastructure into urban and rural areas of the EU. In the planning, design and management of roads we have excellent opportunities to contribute to strengthening a region's green infrastructure.

Green infrastructure constitutes the basis for biodiversity conservation and provides environmental services for society, such as the production of agricultural and forestry resources, the regulation of water and air quality and defence against natural risks such as floods. It also facilitates adaptation to and mitigation of climate change impacts and, in general, fosters a better quality of life by providing spaces for leisure, tourism, spiritual and artistic activities.

The term 'green infrastructure' is used frequently, but not always with the same meaning as that given by the EC: "a network of high quality green spaces and other environmental features". According to the EC, examples of landscape features that are part of a region's green infrastructure are protected natural areas and ecological corridors. These are the crucial points in the network, in which the most valuable elements are concentrated. In addition to these spaces, green infrastructure is comprised of restored areas and those that are used for agricultural and forestry purposes. Even urban parks managed with suitable biodiversity conservation criteria are included in this concept (see more information here).

In some cases, transportation networks that have been designed and constructed with great attention to environmental aspects can be classified as 'green infrastructures'. However, this use of the term should not be confused with the concept of 'green infrastructure' as defined by the EC.

Although a road in itself does not form part of green infrastructure, it may contain aspects that can strengthen the green network if they are suitably designed and managed. Ecoducts, viaducts, tunnels and wildlife passages can be essential links for ecological connectivity. When they are well designed and linked to the surrounding habitats, they form part of a region's green infrastructure. Ecological restoration of the area around a road is essential to overcome its barrier effect and to facilitate the dispersion of certain organisms or the continuity of habitats. This contributes to ensuring the long-term conservation of ecosystems. Road verges can also form part of the green infrastructure, if they are maintained in good condition. However, it is important not to create unwanted edge effects, such as the attraction of animals to zones that have a high risk of mortality, the promotion of exotic invasive species or the propagation of forest fires.

For further information, download a document here or visit the EC's website.

WORKING GROUP

Ministry of Agriculture, Food and the Environment

Last May, the 14th meeting of the Working Group on Habitat Fragmentation due to Transportation Infrastructure was held in Madrid. This group is part of the National Commission of Nature Protection and Biodiversity.

Unlike the previous meetings, on this occasion the morning session was open to the public. The session began with the talk "Ecological Connectivity and Green Infrastructure" by Richard Forman from Harvard University, who is author of works such as *Landscape Ecology* and *Road Ecology*.

He presented his vision of a new, safer transportation system in which the impact of roads on the natural environment (including accidents, pollution, noise and habitat fragmentation) would be notably lower. This vision of a future road network, which Dr. Forman predicts will be widely used in the next two decades, has been presented in a recent paper in the journal *Solutions* titled: *The future of roads: No driving, No emissions, Nature Reconnected*.

Another presentation at the meeting was that given by José Vicente de Lucio from the University of Alcalá on the project "Paisaje e Infraestructura Verde. Experiencia de Estados Unidos y España" (Landscape and Green Infrastructure. The Experience of the United States and Spain; see the News section). There was also a presentation on the state of work on the document *Identificación de puntos a desfragmentar para reducir los impactos de las infraestructuras de transporte sobre la conectividad ecológica* (Identification of points to defragment to reduce the impact of transportation infrastructure on ecological connectivity), which is being drawn up by the Working Group. This presentation was given by Javier Viñuela from the Research Institute of Hunting Resources (IREC-CSIC) and Carme Rosell, from Minuartia. The meeting concluded with an interesting debate on green infrastructure and the other concepts that had been presented in the talks.

In the afternoon, a meeting was held in the more usual format with representatives of the state and regional governments' environment and transport departments. The focus was on activities and news of interest in the respective regional areas and preparation began on the next technical meeting of the Working Group, which will be held in 2013.

NEWS

Spanish and US researchers cooperate on the "Green infrastructure and landscape" project

Minuartia

The project "Infraestructura verde y paisaje: experiencia de Estados Unidos y España" (Green infrastructure and landscape: the experience of the United States and Spain) is carried out at the Benjamin Franklin University Research Institute of North American Studies, which is part of the University of Alcalá. The aim of the project is to combine interdisciplinary work in the field of green infrastructure by forming a research group.

During this three-year project, the experience of developing green infrastructure in the United States and Spain will be compared. This will be the starting point for a long-term study on analysing an entire region to identify the value of green infrastructure as a support and driving force for development and on the various activities that can be carried out throughout a region.

An analysis will be undertaken of the various models for introducing comprehensive regional policies that are being developed on both sides of the Atlantic, including the analysis of road networks.

The members of the working group come from various disciplines, such as ecology, conservation biology, law, geography, engineering, sociology and other knowledge areas, including the humanities. The starting point is the experience of a group of Spanish and US researchers.

The project began with meetings and seminars, held in Madrid and Valencia in March and April 2012. Participants included Spanish researchers, as well as Richard Forman and José Antonio Gómez Ibáñez, who are lecturers at the Kennedy School of Government and the Graduate School of Design at Harvard University.

In addition, work has begun on case studies on the development of green

infrastructure in the state of Massachusetts and the autonomous regions of Madrid and Valencia. In these regions, there is an extensive metropolitan area, along with notable natural heritage management objectives and needs. In 2008, the planet's urban population overtook the rural population and this figure will continue to rise in the next few decades. The pressure of cities on the surrounding environment is increasing, due to the expansion of infrastructure.

Attempts to ensure sustainability are often based on sector policies that are mainly considered to be limiting and not of value at regional level. The existing models and proposals tend to be one-dimensional and exclusive. The aim of managing natural heritage as green infrastructure is to reveal the capacity of natural capital to contribute to economic prosperity and human well-being.

Source: Dr. José Vicente de Lucio. University of Alcalá (UAH).

The University of Alicante develops a new ecological connectivity model to identify critical points

Connectivity models are a useful tool for studying ecological processes and species movements, and for planning and managing natural resources. In particular, they can be a good tool for planning green infrastructure in a region.

The *Estación Científica Font Roja Natura* – University of Alicante has recently incorporated all of the teams that have been creating models in recent years to identify these corridors.

Estación Científica Font Roja Natura- University of Alicante

In May 2012, the group began the project "Elaboración de un modelo para el análisis de atropellos de fauna y fragmentación de hábitats causada por carreteras" (Creation of a model for analysing collisions with wildlife and habitat fragmentation caused by roads), funded by the Regional Government of Valencia's Department of Infrastructure, Land Planning and the Environment.

The main aim of the project is to establish a model for regional analysis that can identify potential habitat fragmentation due to existing or future transport networks. The model will be based on calculating the lowest cost routes and incorporating information on collisions involving some species of mammals that are used as a reference.

The project is expected to conclude in September 2012, once the model has been assessed and validated.

Some results of the project's preliminary studies can be found in: Rico-Guzmán, E.; Cantó, J.L.; Terrones, B & Bonet, A. 2011. Impacto del tráfico rodado en el P. N. del Carrascal de la Font Roja ¿Cómo influyen las características de la carretera en los atropellos de vertebrados? *Galemys*, 23 (NE): 11-21.

Source: Gabriel Ballester. Directorate-General of the Natural Environment, Regional Government of Valencia.

The Spanish Herpetological Society takes part in a Europe-wide study to prevent collisions with amphibians on roads

Collisions with animals on roads and motorways are the most visible impacts of habitat fragmentation caused by transportation infrastructure. At first glance, it may seem that they affect mainly medium-sized or large species. However, numerous studies carried out over the years have shown that small species, such as amphibians, can be strongly affected by road networks, which may have a considerable impact on the conservation of their populations.


Minuartia

Amphibians are vertebrates whose populations have declined considerably worldwide. They can move large distances to and from their breeding sites (pools, ponds, rivers, etc.). On rainy or very humid nights in particular, mass migrations can occur. If amphibians have to cross a road, they may be hit by vehicles.

To reduce this cause of mortality, wildlife passages can be built for this group, in combination with specifically designed fences (see File 11 of the document *Prescripciones Técnicas para el diseño de pasos de fauna y vallados perimetrales*). However, before such actions are carried out, the most conflictive stretches of road need to be identified clearly.

The Spanish Herpetological Society (AHE in Spanish) took part last March in the "Froglife's European Workshop. Looking at preventing the deaths of amphibians on the roads". This meeting was held in Peterborough (United Kingdom) and was organised by the NGO Froglife. Participants included experts from 12 European countries who addressed problems with amphibians and roads. One of the first activities was information gathering to identify the most conflictive stretches, as a step prior to the start of a European project on the problems that affect amphibians specifically.

The AHE has a database on amphibian observations in Spain. It has changed its procedure for adding new observations and has informed its members about the project, to improve data gathering on this problem and to help to identify more accurately the areas in which measures are needed to reduce mortality caused by collisions with vehicles.

For further information, see: http://www.herpetologica.es.

Source: Albert Montori. Spanish Herpetological Society.

Various projects use video to disseminate fauna protection measures' monitoring results

ADIF

The technology of capturing images using sensor-activated cameras and videos provides extremely useful material for verifying the effectiveness of measures to prevent impacts on wildlife. In addition, the material can be used to draw up documents that summarise the most relevant monitoring results and contribute to demonstrating the value of investments in measures to prevent or mitigate impacts.

Some examples of these materials are videos showing the use of wildlife passages in the M-501 highway: "Los pasos de fauna se consolidan como lugares de tránsito habitual de animales" (Autonomous Region of Madrid, 2011), and the results of the installation of a screen to reduce the mortality of bats along the high speed railway: "LAV Córdoba-Málaga. Medidas de protección ambiental sobre una colonia de murciélagos" (ADIF 2012).

Through the Infra Eco Network Europe (IENE), a video has been distributed that was created by the Polish highway authority (see http://youtu.be/clcpDLnY458). This video shows various groups of wolves using the 30 to 45 m-wide wildlife passages that have been built in the Polish A4 motorway.

In recent decades, the monitoring of measures to reduce the impact of road networks on wildlife has incorporated the use of new technology such as movement sensor-activated videos, cameras and infrared, as well as ultrasound-recording devices for studying bats. This technology has enabled the use of a structure by wildlife to be detected and quantified and additional information to be obtained, such as the time at which passages are used. For some species, animals can even be individually identified, enabling a quantification of the number of individuals that use a passage.

These techniques also facilitate the dissemination of the results of monitoring and assessing the effectiveness of measures, beyond the strictly expert forums in which this type of information is generally presented.

Source: Infra Eco Network Europe (IENE) - ADIF – Directorate General of Roads, Regional Government of Madrid.

At the Rio+20 Summit a commitment is made to conserve low road density areas

Google Earth Engine

Habitat fragmentation has repeated been highlighted as one of the main causes of biodiversity loss. Therefore, the areas of the planet that have little-developed or no road networks are of great interest for ecosystem preservation.

Progress was made at the Rio+20 Summit in the protection of roadless areas, with the presentation of a world map to locate them.

The presentation was organised by the United Nations Environment Programme (UNEP), the International Union for the Conservation of Nature (IUCN), the Society for Conservation Biology (SCB) and the NGO Indigenous Peoples' International Centre for Policy Research and Education (TEBTEBBA) (see the press release here).

The opportunity to contribute to biodiversity conservation by preserving areas in which

there are few roads has been reinforced by tools that facilitate their identification worldwide. For example, a Google Earth application entitled Global Roadless Areas has been developed by the European Parliament and the SCB. The application enables us to explore the planet from a new perspective. It uses a range of green tones to present an analysis of the distance between roadless areas and the nearest road, railway or navigable canal. The darker the green, the greater the distance between the area and linear infrastructure. The Amazon, the Sahara Desert, the northern forests of Canada, the islands of Indonesia and Borneo are the areas with the least road development. In contrast, central Europe appears to be one of the areas of the planet with the greatest density of infrastructure.

Furthermore, the European section of the SCB has promoted a study to analyse the existence of roadless or low-traffic areas in Europe and their relationship with biodiversity conservation. These areas include relatively untouched habitats that are of clear benefit to biodiversity. However, they are not considered protected areas in most countries' environmental regulations, and most of them have not been included in the Natura 2000 network. The authors of the study, which was published in the journal *Environmental Management* under the title *Roadless and Low-Traf?c Areas as Conservation Targets in Europe*, propose drawing up an inventory of these areas and increasing efforts to conserve them.

Source: Infra Eco Network Europe (IENE).

PUBLICATIONS

Plan Estratégico del Patrimonio Natural y de la Biodiversidad 2011-2017 **(Strategic Plan for Natural Heritage and Biodiversity 2011-2017)**. This publication presents the goals, objectives and actions included in the Strategic Plan, whose aim is to "halt the loss of biodiversity and the degradation of ecosystem services and tackle their restoration". To achieve this, six-year objectives have been set, with associated indicators and success criteria so that the results can be assessed. The long-term target of the plan is the vision of biodiversity conservation established in 2010 by the European Union's Council of Environment Ministers. Objective 2.2., to "promote ecological restoration, environmental connectivity of the territory and landscape protection", includes actions related to the reduction of habitat fragmentation, including that caused by transport infrastructure.

Reference:

MAGRAMA. 2011. *Plan Estratégico del Patrimonio Natural y de la Biodiversidad 2011-2017*. Ministry of Agriculture, Food and the Environment, Madrid.

EVENTS

Linking environment and society: 19th ialeUK conference. Edinburgh (United Kingdom), 4 to 6 September 2012. Organised by the International Association for Landscape Ecology – UK Region and the University of Edinburgh.

Landscapes in transition: 49th IFLA World Congress. Cape Town (South Africa), 5 to 7 September 2012. Organised by the International Federation of Landscape Architects and the Institute for Landscape Architecture in South Africa.

UICN World Conservation Congress. Jeju (Korea), 6 to 15 September 2012. Organised by the International Union for Conservation of Nature.

The 8th European Conference on Ecological Restoration. Ceské Budejovice (Czech Republic), 9 to 14 September 2012. Organised by the University of South Bohemia, the Czech Republic's Academy of Sciences, the Czech Republic's Agency for the Conservation of Nature and Landscape Protection, the European Commission's Directorate-General for the Environment and the Society for Ecological Restoration (SER Europe).

Landscape Ecology: From Theory to Practice. 16th International Symposium on Problems of Landscape Ecological Research. Smolenice (Slovakia), 24 to 27 September 2012. Organised by the Institute of Landscape Ecology and the Slovak Academy of Sciences.

Fourth Urban Landscape Forum. International symposium of practical cases

"Urban and regional green infrastructure in UNESCO networks". Vitoria-Gasteiz, 18 October 2012. Organised by the Centre for Environmental Studies, Vitoria-Gasteiz Town Council.

IENE 2012 international conference. Safeguarding ecological functions across transport infrastructure. Postdam-Berlin (Germany), 21 to 24 October 2012. Organised by the Infra Eco Network Europe.

IUFRO Landscape Ecology Conference. Sustaining humans and forests in changing landscapes: Forests, society and global change. Concepción (Chile), 5 to 12 November 2012. Organised by the International Union of Forest Research Organizations and the University of Concepción.

ICOET 2013. International Conference on Ecology & Transportation. Scottsdale (Arizona, USA), 23 to 27 June 2013. Organised by ICOET and the Arizona Department of Transportation.

Changing European Landscapes. Landscape ecology, local to global. IALE 2013 European congress. Manchester (United Kingdom), 9 to 12 September 2013. Organised by the International Association for Landscape Ecology – UK Region.

Events that have already been held

Course "El impacto de las infraestructuras lineales sobre la fauna: de la evaluación de impacto ambiental a las infraestructuras verdes". Salamanca, 17 to 20 July 2012. Organised by the University of Salamanca.

IVth International Wildlife Management Congress. Durban (South Africa), 9 to 12 July 2012. Organised by the Wildlife Society. Further information is available here.

Fourth Urban Landscape Forum. International Symposium "Infraestructura Verde en la Ciudad: El papel de los espacios naturales urbanos y periurbanos". Vitoria-Gasteiz, 22 June 2012. Organised by the Centre for Environmental Studies, Vitoria-Gasteiz City Council. Further information is available here.

VI Icon-la International Conference. Green Infrastructure: from global to local. St. Petersburg (Russia) and Uppsala (Sweden), 11 to 15 June 2012. Organised by the European Federation for Landscape Architecture. Further information is available here.

ICOET 2011. International Conference on Ecology and Transportation "Sustainability in Motion". Seattle (Washington, USA), 21 to 25 August 2011. Organised by the Center for Transportation and the Environment. Further information is available here.

IENE 2011 Scientific Workshop and General Assembly. Nymfeo and Kastoria (Greece), 21 to 24 Septembre 2011. Organised by Infra Eco NEtwork Europe. Further information is available here.

DOCUMENTS OF WORKING GROUP AND ACTION COST 341

As part of the European project COST 341 on Habitat fragmentation due to transportation infrastructure and the Working Group that has led to the project's continuity, various resources have been created to contribute to increasing knowledge of habitat fragmentation caused by transport infrastructures and to reducing its effects.

The following documents have been published:

- ***COST 341. La fragmentación del hábitat en relación con las infraestructuras de transporte en España***. (Habitat fragmentation due to transportion infrastructure in Spain). Review of the state of the art, published in 2003.
- ***COST 341. Wildlife and traffic. A European Handbook for Identifying Conflicts and Designing Solutions*** (40 MB). Published in 2003 as a coda to Action 341, drawn up by experts from various European countries.
- ***COST 341. Fauna y Tráfico. Manual europeo para la identificación de conflictos y el diseño de soluciones*** (33 MB). PPublished in 2005; a translation of *Wildlife and Traffic*.
- Series ***Documentos para la reducción de la fragmentación de hábitats causada por infraestructuras de transporte*** (Documents for the reduction of habitat fragmentation caused by transport infrastructure).
  - ***No 1. Prescripciones técnicas para el diseño de pasos de fauna y vallados perimetrales*** (1,8 MB) (Technical prescriptions for the design of wildlife passages and perimeter fences). In 2008 the Catalan version was published ***Prescripcions tècniques per al disseny de passos de fauna i tancaments perimetrals*** by the Department of the Environment and Housing, Regional Government of Catalonia.
  - ***No 2. Prescripciones técnicas para el seguimiento y evaluación de la efectividad de las medidas correctoras del efecto barrera de las infraestructuras de transporte*** (2 MB) (Technical prescriptions for monitoring and evaluating the effectiveness of measures to correct the barrier effect of transport infrastructure). Published in 2008.

- ***No 3. Prescripciones técnicas para la reducción de la fragmentación de hábitats en las fases de planificación y trazado*** (45 MB). (Technical prescriptions for the reduction of habitat fragmentation in planning and alignment phases). Published in 2010.
- ***No 4. Indicadores de fragmentación de hábitats causada por infraestructuras lineales de transporte*** (31 MB). (Indicators of habitat fragmentation due to linear transport infrastructures). Published in 2010.
- ***No 5. Desfragmentación de hábitats. Orientaciones para reducir los efectos de las infraestructuras de transporte en funcionamiento.*** (Habitat defragmentation. Guidelines to reduce the effects of operating transport networks). In press.

For further information, see the MAGRAMA and IENE sites.

- This publication is part of the project 'Habitat fragmentation due to Transportation Infrastructure', which is promoted by the Ministry of Agriculture, Food and Environment. Directorate General of Quality and Environmental Evaluation and Environment. The technical secretary's office of the project runs in charge of Minuartia.
- Any information for publication can be sent here.