

# habitat fragmentation due to transportation infrastructure



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## CONTENTS

- > Editorial
- > Working Group
- > News
- > Publications
- > Past Events
- > Coming Events
- > Documents of the Working Group

## PREVIOUS NEWSLETTERS

- > Number 0
- > Number 1
- > Number 2
- > Number 3/4
- > Number 5
- > Number 6
- > Number 7
- > Number 8
- > Number 9
- > Number 10
- > Number 11
- > Number 12
- > Number 13
- > Number 14
- > Number 15
- > Number 16
- > Number 17
- > Number 18
- > Number 19
- > Number 20

## EDITORIAL

Irrigation canals may affect biodiversity, causing habitat fragmentation and constituting barriers for wildlife movements. This fact has been already reported in [bulletin number 19](#), and a new case study can be found in the News section. This influence may be especially important at the local scale, where these infrastructures may cause similar impacts on wildlife to those caused by roads or railways. However, the effects of irrigation canals on vertebrates have been seldom studied when compared with other causes of non-natural mortality. The two main effects caused by irrigation canals are:

First, the network of irrigation canals in agricultural areas constitute a barrier to wildlife movement, contributing to habitat fragmentation. Second, the U-shape of many of them, together with strong water currents, make them a death trap for the wildlife. So far, mitigation measures have been focused in helping wildlife to get out from the canals by building escaping paths, or canal fencing that prevents big animals to get access to the canal. In spite of their effectiveness, it should be noted that fences increased the habitat fragmentation created by these infrastructures.

The law 42/2007 on Natural Heritage and Biodiversity state that both the National and the Regional governments, in their respective scopes of action, should implement the required measures that guarantee biodiversity conservation. Regarding irrigation canals, authorities have implemented some initiatives to reduce these impacts. From the planning point of view, for instance, the [National Plan for Crop Irrigation](#), from the Ministry for Agriculture, Fisheries and Food, includes a guide to help environmental impact assessment of irrigation projects. In this guide, a set of previous assessments is provided, showing how irrigation canals acts as barriers and traps for wildlife. These studies also includes the mitigation measures implemented, such as escaping ramps, floating elements that help animals to rest and guide them to escaping paths, etc. This guide also offers tips on how environmental monitoring on these infrastructures should be done. In addition, both in the designing phase, and during the exploitation of the infrastructure, the river catchment authorities are implementing some [correction measures](#), although they did not always perform as expected (see News section).

There are still many pending issues regarding mitigating measures in irrigation canals. It would be helpful to implement a national action plan including a diagnosis, inventory and analysis of these impacts in Spain, as well as tested mitigation measures, monitoring, public awareness and outreach. It is also required to increase research on the effects of irrigation infrastructures on biodiversity, including all involved animal groups, behavioral responses, seasonal patterns of mortality, and effectiveness of mitigation measures. This knowledge is key to design new action plans including effective measures to be implemented in the near future.

Some of the activities to be done in the framework of the upcoming National Strategy for Defragmentation and permeabilization of linear infrastructures (see News) may serve to pave the way towards reducing the negative impact of irrigation canals on biodiversity.



Picture: Servicio Territorial de Medio Ambiente de Burgos. Junta de Castilla y León.

## WORKING GROUP

The Working Group on Habitat Fragmentation due to Transport Infrastructures met on October 6 to inform on the activities and news developed during the last months by the different assisting authorities and organizations. Among them, two running projects were introduced and discussed: BISON project, where the Catalonia Government acts as partner, and SAFE project, launched by the Ministry for the Ecological Transition and Demographic Challenge (MITECO). The methods implemented in the last one were designed by the Doñana Biological Station (CSIC) and they were explained by Jacinto Román, as representative of this Research Institute.

**The consulting service** regarding habitat fragmentation due to transport infrastructures is still active, also giving support to SAFE. Any question on this topic can be sent to: [habitat\\_infraestructuras@ebd.csic.es](mailto:habitat_infraestructuras@ebd.csic.es)

## NEWS

### **Kick-off of the National Strategy for Defragmentation and Permeabilization of linear infrastructures**

During the next two years, the General Directorate of Biodiversity, Forests, and Desertification, belonging to the Ministry for the Ecological Transition and Demographic Challenge (MITECO) will lead a project to develop the Strategy for Defragmentation and Permeabilization of linear infrastructures with the technical assistance of TRAGSATEC.

This strategy constitutes a step forward of the recently approved "National Strategy on Green Infrastructure, Connectivity and Ecological Restoration". The strategy aims to stop and reverse the degradation of ecosystem and ecosystem services, the fragmentation of populations and ecosystems, and the loss of habitat connectivity. Therefore, the Strategy for Defragmentation is crucial to achieve these goals, and it will be built on past and current activities already developed by the different organisms involved. Among them, it should be highlighted the panel of national and regional institutions represented in the Working Group on Habitat Fragmentation due to Transport Infrastructures, These institutions, using the technical and scientific expertise of companies and Research Institutes authored a set of documents on reducing the impact of transport infrastructures on biodiversity. These documents can be accessed by [this link](#). They also organized several workshops and events that greatly contribute to increase our knowledge on the topic.

By using all this previous work and the technical and scientific knowledge developed in other areas of the MITECO, a new conceptual framework could be built to integrate and analyze the available information. Such a framework will allow establishing participative processes where all involved administrations, organizations and stakeholders can decide on the most effective actions of prevention, mitigation, and permeabilization, and the spatial and temporal hierarchy that allow prioritizing these actions to improve, or at least preserve the biodiversity in the different territories of the country. It is also planned to widen the focus to include other linear elements not directly associated with transport infrastructure that also contribute to habitat fragmentation, therefore eroding biodiversity.

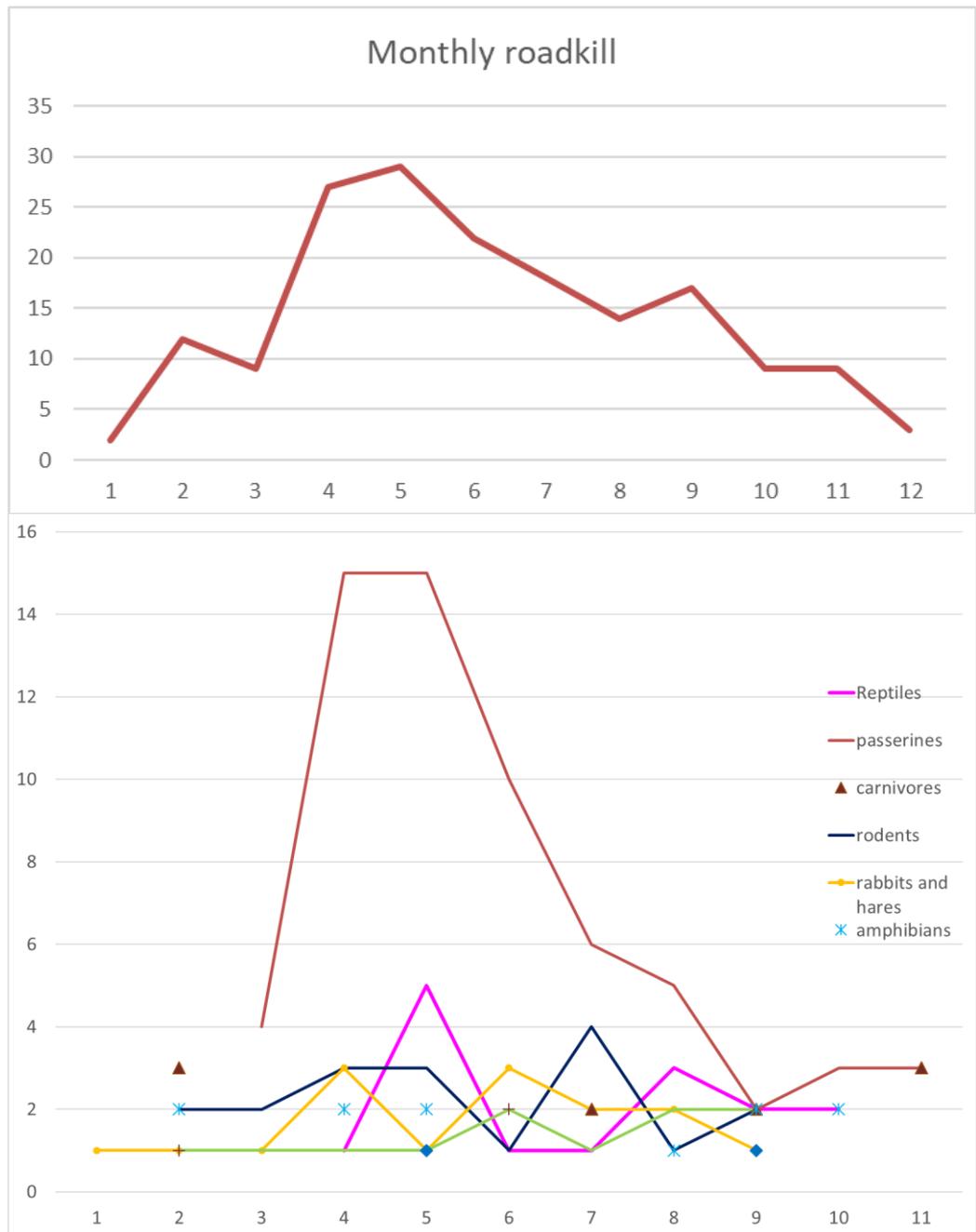
Source of information: MITECO.

### **One year of SAFE's pilot sampling**

To check the performance of the proposed sampling method to be applied in the SAFE project, the Doñana Biological Station (CSIC) carried on a set of pilot samplings covering the three different sampling types (by foot, by bicycle, and by car). This pilot samplings allowed a better description and suitability to the final goal of the project. The pilot transect by bike already has 12 consecutive sampling months, showing some interesting preliminary results. This transect is 18 km long and runs along three different roads: National N-630 between kilometer 791 and 799, Regional A-460 between kilometers 0 and 4 y, and local SE-3411 between kilometers 0 and 6 (approximately). These roads mainly cross agricultural habitat with some patches of Mediterranean scrubland and forest in its northern tip.

We recorded 170 carcasses, averaging 9 roadkill per kilometer and year with a seasonal distribution that show a clear peak during spring (see first figure).

Disregarding the different persistence rate and detectability of the different animal groups, passerines were the most frequent group and the one with highest seasonality, probably because of the high mortality of juveniles during the spring (see second figure). Notice that month 12 (December) is not present in this figure because carcasses were not identified with the required taxonomic accuracy.



Source of Information: Doñana Biological Station (CSIC).

**La Rioja Government published in the Regional Official Bulletin the action plans against traffic noise in its road network**

2021 was the deadline for updating action plans of the Regional Network Infrastructures of La Rioja. Current action plans against traffic noise (valid for 5 years) were reviewed to adapt them to current circumstances (more than 3.000.000 vehicles/year in the regional network).

Building on the strategic maps developed during the third phase, and evaluating the current situation, three road sections were prioritized as local action plans:

Local plan PZ1-LR115: Urban area of Arnedo, influencing 4,9% of the population in the locality.

Local plan PZ2- LR250: Estrella neighborhood, located in the Southeast of Logroño (main city in the region), influencing 0,33% of the population in the locality. The proposed action was already suggested in previous plans and considered a traffic detour by the Industrial area of La Portalada.

Local plan - PZ3 - LR250: Village of Villamediana de Iregua, influencing 5,2% of the population in the locality.

The main goal of this action plan is improving the noise conditions of the regional roads in these three areas to comply with the



European Directive 2002/49/49 CE, and National laws (Law 37/2003 and orders therein).

This plan focus on reducing the number of people suffering traffic noise according to the standards established by the World Health Organization (WHO Europe, 2018). In this case, the final goal proposed match the European Action Plan: "towards zero pollution for air, water and soil". That is: reducing at least a 30% the people currently suffering chronic diseases caused by transport noise until 2030.

The studied alternatives and proposed actions are:

Ensure speed limit to 40 km/h in the urban section of Arnedo by using speed control measures and apply phonoabsorbent asphalt when mantaining and renewing the lanes in La Estrella neighbourhood, Arnedo and Villamediana de Iregua.

Similarly, it is being executed the installation of noise barriers in Villamediana de Iregua.

With these measures it is planned to halve the noise impact in Arnedo from 4.9 to 2.5% of population affected, and from 5.2 to 3.51% in Villamediana de Iregua.

In summary, it is expected to reduce the people exposed to traffic noise from 1644 to 1129 (31%) with a budget of 2.18 million €.

Source of Information: La Rioja Regional Government.

### **Studies of wildlife mortality in roads of the Montgó Natural Park**

The Natural Park is a karstic massif of 2117 Ha placed in the coast of Alicante, and shared by the villages of Dénia and Xàbia. The massif is surrounded by urban areas and transport infrastructures of different entity, which prevent proper ecological connectivity with the surrounding habitats (see picture below).



In 2008 and 2009 several reports, maps and reviews were made in order to evaluate wildlife mortality in the roads that surround and cross the Park (see Puche et al. 2009: *Incidencia de la infraestructura viaria sobre la fauna en tres parques naturales de la Red Natura 2000 en la Comunidad Valenciana. Comunidad Valenciana: Centro de Interpretación del Parque Natural del Macizo del Montgó*).

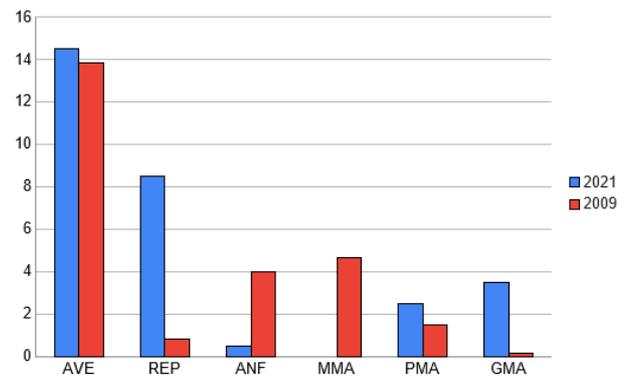
These studies serve to find mortality hotspots and implement some mitigation measures such as annual clearing of drainages along road CV-735 to facilitate their use as wildlife crossing, and speed reduction to 50 km/h in the road section belonging to Xàbia.

In 2021 Adriana Noelia Cosmai, as diploma student of the degree of Higher Technician in Forest and Natural Environment Management, gathered information to evaluate the effectiveness of the above mentioned mitigating measures and suggest new measures in case they were needed.

To get homogenous information, she followed the same methods used previously, which consisted in visiting the road CV-735 in the section between Toscamar Xàbia neighborhood (kilimeter 5-4), and Benimaquía curve (kilometer 8-9), and recording all wildlife carcasses along with information on the physical conditions of road section.

Interestingly, the section with less mortality correspond to kilometers 4-5 belonging to Xàbia, where mitigation measures were applied because it constitute a roadkill hotspot in 2009. This result may support the effectiveness of the implemented measures.

Regarding the animal groups that were road killed, small birds were predominant followed by reptiles. Carcasses of this group have increased significantly when compared with previous studies, encouraging further efforts to properly evaluate this source of mortality for this group. On the other hand, mortality of small mammals (MMA in the figure) have decreased, being less affected than before. As found in other studies, mortality of amphibians is dependent on the weather conditions before the sampling, being higher when conditions are more humid.



Because of the apparent effectiveness of mitigation measures applied in the Xabia section, the following mitigating measures to be applied in highest mortality sections are suggested:

- 1.- Speed reduction and appropriate road signs.
- 2.- Habilitation of wildlife crossings.
- 3.- Vegetation management in road verges.

Source of Information: Parc Natural Montgó.

### **Aranda irrigation canal as lineal infrastructure contributing to habitat fragmentation and source of wildlife mortality**

Irrigation canals constitute barriers for wildlife movements and cause habitat fragmentation and wildlife mortality (see Editorial). In recent years, mortality rates of wildlife have increased, particularly regarding roe deer, which dies when trying to cross, drink, or when escaping from hunters. This constitutes a serious environmental, economic and health problem of high social concern. Other game species are sensitive to this source of mortality, but also species included in the List of Wildlife Species of Special Conservation Concern and in the Spanish Catalogue of Endangered Species.

The Aranda irrigation canal (South of Burgos Province) belong to the Duero river catchment authority (CHD) and it was first operated in 1948. It has a flow of 3.750 l/s and a length of 29.5km, 23 of them in U-shape, 6.2 km in trapezoidal shape, and 0.3 km of siphon tubes. Depth varied from 1 to 1.3m, and wideness from 1.4 to 2m. It is made of concrete, and it works from April to October, when crops are watered. The U-shape section is the most dangerous, because vertical wet walls prevent animals to climb the wall and escape from the canal. Half of the length of the canal surrounds by the south the public forest 651 (La Calabaza), which is home of a numerous roe deer population. The canal constitute an important source of non-natural mortality of this population.



To try to mitigate this impact, several escaping ramps were built. However, they did not diminish the number of roe deer found death in the canal (see picture). This is mainly because: a) the number of escapes is not enough. By instinct, animals try to swim upstream and this makes difficult to find the nearest ramp; b) once they get exhausted, they swim downstream, finding the ramps, but being not able of use them, especially if the ramp is not placed before siphons or bridges, or water level is not enough to get access to the ramp; c) guiding structures that should help animals to find the ramps are either broken or have been stolen; d) the majority of escapes were placed in forested areas, but they should be also placed in the agricultural area.

According to Castilla y León Regional Law 4/2015 (of the Regional Natural Heritage), when points of high mortality for the wildlife due to infrastructures are reported, the corresponding authority within the Regional Government (*Consejería de Fomento y Medio Ambiente*) should inform the infrastructure's owner about this situation to adopt the required correction measures. During the last years, the Regional Government has informed the CHD on this topic, but, according to CHD web page there is not any planned

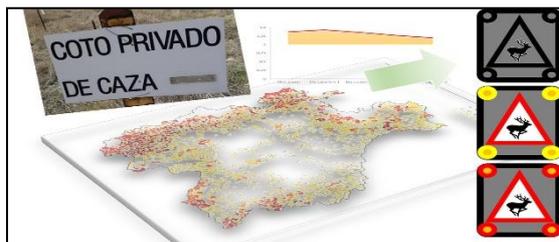
action “because recently, the farmer’s community installed pipelines (in association with SEIASA) in all pending irrigation ditches”.

Source of information: Servicio Territorial de Medio Ambiente de Burgos. Junta de Castilla y León.

### **Hunting and vehicle wildlife collisions. A new variable in temporal models feeding the smart signaling prototype of the Regional Road Network of Castilla y León**

Using 5-years information from collective hunting in Castilla y León, it was studied whether vehicle-wildlife collisions (VWC) increased the day or days after these events were celebrated. In general terms, the data analyzed indicated this, but showing a high variation between hunting grounds. While the VWC risk significantly increased in some grounds, in others the effect was negligible. This study was part of the project of smart signaling that is being developed by the Regional Roads and Infrastructures Directorate, together with the Department of Animal Biology of the University of Salamanca (see [bulletin 19](#)). The final aim is to incorporate this factor to the model governing the smart signaling system, therefore considering not only patterns of daily and seasonal variation in VWC risk, but also the spatial variability determined by the presence of hunting activity near the signal.

Despite hunting has been considered as explaining factor of VWC, there are still few studies that deeply considered this (but see [Neumann et al. 2020](#)). It is known that hunting bags are correlated with VWC, but it was not tested whether collective hunting events may determine higher probabilities of VWC. Radio-tracked game species showed that driven hunts may either increase or decrease animal movements depending on habitat type, and shelter availability. Therefore, the impact of driven hunting on VWC is not as straightforward as expected.



The study used results from 61694 events of driven hunting celebrated in 3287 hunting grounds during 2015-2020. The General Directorate for Natural Heritage and Forest Policy from the Regional Government provided this information. During the same period, VWC data were gathered from traffic authorities. To avoid the influence of other temporal factors, comparison between VWC with and without collective hunting events only considered the hunting seasons and the hunting days (Sunday and bank holiday).

The results showed that collective hunting events increase the average probability of VWC up to 30%. This is valid not only for the hunting day, but also for the following 3-4 days. However, there were significant differences between hunting grounds. For instance, from the 34 more active grounds with at least 15 VWC during the last 5 years, only 13 showed an increased risk of VWC. In some cases, the factor of increase reached 4x. On the other hand, risk of VWC did not increase in the remaining 21 hunting grounds. Among the causes under evaluation to explain this pattern are: hunting ground management, fencing, planning of the driven hunting, number of hunters, number of driven hunts per year, hunting ground location in relation to the road network, landscape and ecological features, and the type of hunting (there are three types depending on the number of hunters, and targeted game species).

The results of this study may have important implications on temporal models feeding the smart signaling system.

Source of Information: Universidad de Salamanca and Junta de Castilla y León.

### **Erratum**

In the previous e-newsletter (July 2021), we announced that Spanish Ministry of Transports, Mobility and Urban Agenda (MITMA) has signed the agreement to launch the project *Road Safety. Mitigating actions to reduce vertebrate roadkills (Iberian Lynx). Road N-420 from Córdoba to Tarragona. Section Cardeña –Ciudad Real, Km. 81 – 93*. The text lacks important details that should be mentioned: this action is the result of a collaborative agreement between the MITMA and the Ministry for the Ecological Transition and the Demographic Challenge (MITECO). Such an agreement has the objective of developing actions that help reducing the risk of mortality derived from national transport infrastructures on species included in the Spanish Catalogue of Endangered Species, therefore increasing driving safety. The budget for these actions is shared between the two Ministries.

Source of information: Editorial team.

## PUBLICATIONS

- Ascensao, F. et al. 2021. Wildlife collisions put a dent in road safety. *Science* 374: 1208
- Barone, G. et al. 2021. Comparison of different methods to assess the distribution of alien plants along the road network and use of Google Street View panoramas interpretation in Sicily (Italy) as a case study. *Biodiversity Data Journal* 9: e66013
- Barrientos, R. et al. 2021. The lost road: do transportation networks imperil willife population persistence? *Perspectives in Ecology and Conservation* In press
- Boyle, S.P. et al. 2021. Road-effect mitigation promotes connectivity and reduces mortality at the population-level. *Biological Conservation* 261: 109230
- Claireau, F. et al. 2021. Bat overpasses help bats to cross road safely by increasing their flight height. *Acta Chiropterologica* 23: 189-198
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- Daniel-Ferreira, J. et al. 2021. Road verges are corridors and roads barriers for the movement of flower-visiting insects. *Ecography*. <https://doi.org/10.1111/ecog.05847>
- Dennehy, E. et al. 2021. Contrasting wolf responses to different paved roads and traffic volume levels. *Biodiversity and Conservation* 30: 3133-3150
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- Dominguez, J.C. et al. 2021. Lack of detectable genetic isolation in the cyclic roden *Microtus arvalis* despite large landscape fragmentation owing to transportation infrastructures. *Scientific Reports* 11: 12534
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- Levenhagen, M.J. et al. 2021. Does experimentally quieting traffic noise benefit people and birds? *Ecology and Society* 26: 32
- Neumann et al. 2020. Strength of correlation between wildlife collision data and hunting bags varies among ungulate species and with management scale. *European Journal of Wildlife Research* 66: 86
- Prist, P.R. et al. 2022. Roads and forest edges facilitate yellow fever virus dispersion. *Journal of Applied Ecology* 59: 4-17

## PAST EVENTS

### **African Conference for Linear Infrastructure & Ecology**

This year, the ACLIE Conference was fully online in August 12 - 17 2021. More [info](#).



### **International Conference on Ecology and Transportation (ICOET) 2021**

Focused on "Transforming Transportation Ecology in the Global Village", it was a fully online event from 21 to 30 September 2021. More [info](#).



## Global Congress for Linear Infrastructure and Environment (GCLIE)

This meeting was intended to complement the continental conferences on transportation ecology through providing a platform that allows focus on broader, higher-level, global issues and policies that can influence national and international knowledge



sharing and bring about positive change. Periodically the continental conferences and the GCLIE will work together developing interest in, and awareness of linear infrastructure and the environment at the global scale. The Congress was chaired by Wendy Collinson and Fraser Shilling, which were assisted by an Organizing Committee composed of representatives of the major continental conferences on linear infrastructure impacts. It was a virtual meeting between on 20-21 September 2021. More [info](#).

## IUCN World Conservation Congress

The IUCN and the French government held this event from 3 to 11 September 2021 in Marseille (France). More [info](#)



## COMING EVENTS

### National Congress on Environmental Impact Assessment

The Spanish association of Environmental Impact Assessment will organize its biennial congress on *Environmental Impact Assessment in Changing Times*, in Cáceres from 23 to 25 March 2022. More [info](#).



### 6th European Congress of Conservation Biology

The Society for Conservation Biology organize this Congress on the *Biodiversity crisis in a changing world*, in Prague (Czech Republic) from 22 to 26 August 2022. More [info](#)



### IENE 2022 International Conference

The IENE network will organize its congress on Napoca, Romania (below) on 19-24, September 2022. More [info](#).

### Transport Research Arena 2022

The largest European research and technology conference on transport and mobility, themed *Moving together – reimagining mobility worldwide*, will be held in Lisbon from 14 to 17 November 2022. Among other topics, theme 4: *Policies and Economics for a Competitive Europe*, will consider the impact of transport corridors on biodiversity. More [info](#)



As part of the European project COST 341 on Habitat fragmentation due to transportation infrastructure and its continuity by the Working Group actions, various resources have been created to contribute to the knowledge and mitigation of impacts of habitat fragmentation caused by transport infrastructures.

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 transportation 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). Published 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 of this document 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.
  - **N 1. Technical prescriptions for wildlife crossing and fence design. (Second edition, revised and expanded)** (5.5 MB). English version of the previous document. Published in 2016.
  - **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.
  - **Nº5. Desfragmentación de hábitats. Orientaciones para reducir los efectos de las carreteras y ferrocarriles en funcionamiento** (53 MB) (Habitat defragmentation. Guidelines to reduce the effects of operating road and railway networks). Published in 2013.
  - **Nº 6. Identificación de áreas a desfragmentar para reducir los impactos de las infraestructuras lineales de transporte en la biodiversidad** (12.4 MB) (Identification of areas to defragment to reduce the impacts of linear transport infrastructure on biodiversity). Published in 2014.
  - **Nº 7. Efectos de borde y efectos en el margen de las infraestructuras de transporte y atenuación de su impacto sobre la biodiversidad** (3.23MB) (Edge and barrier effects in transport infrastructures. Minimizing their impact on Biodiversity). Published in 2019
  - **Nº 7. Edge and verge effects of transport infrastructure. Mitigating their impact on biodiversity** (2,8 MB) Published in 2021.
  - **Nº 8. Prescripciones técnicas para hacer efectivos los seguimientos de las medidas de mitigación del efecto barrera de las infraestructuras de transporte (diseño, documentación y archivo del seguimiento ambiental)** (7.19 MB) (Technical prescriptions to make effective the mitigating measures of the barrier effect of transport infrastructures. Design of environmental monitoring, documentation, and archive). Published in 2020.

For further information, see the [MITECO](#) and [IENE](#) sites.

■ This publication is part of the project 'Habitat fragmentation due to Transportation Infrastructure', which is promoted by the Sub-Directorate General for the Terrestrial and Marine Biodiversity, Directorate General of Biodiversity, Forests, and Desertification, and carried on in collaboration with EBD-CSIC.

Any information for publication can be sent [here](#).

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