habitat fragmentation due to transportation infrastructure

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MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

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PREVIOUS NEWSLETTERS

EDITORIAL

More than 20 years ago, the European Union launched and funded the action Cost 341. It was developed by a consortium of 16 European countries, and an International Organization (Infra Eco Network Europe –IENE-). Its goal was to establish the situation with regards to habitat fragmentation caused by transport infrastructure networks in Europe, and to identify best practice guidelines, methodologies, indicators and technical designs for the avoidance, mitigation and compensation of adverse ecological effects. As a product of this action, a review on habitat fragmentation due to transport infrastructures was published in 2003, being one of the first comprehensive handbook on the impact of infrastructures on the environment, also posing solutions to be implemented in the different parts of the life cycle of infrastructure building. Spain was one of the first countries adhering to the action, and established a working group on the topic that also celebrated its 20th anniversary recently. During this time, this working group has published several technical prescriptions on different topics, as well as this bulletin that also reach its number 20. It is therefore a well-known study-system by the numerous technicians involved in writing these documents, also participating in congresses, and other disseminations events.

In spite of these achievements, there is still a long list of pending tasks regarding the improvement of the many actions devoted to reduce habitat fragmentation by linear infrastructures, and increase their permeability to wildlife, as well as new investments on high-capacity crossings. The maintenance of these structures also requires further attention to ensure their use, and improves their efficiency. Very recently, the commission on road safety of the Spanish parliament approved a law proposition with full support (18 votes in favor, none against). In this way, the Spanish government has been encouraged to identify and properly signal those road sections where vehicle-animal collisions are more frequent, especially those involving endangered species such as the Iberian lynx or the Iberian wolf.

In line with this, the Ministry for the Ecological Transition and the Demographic Challenge has signed two agreements to evaluate road mortality in the whole country, as a previous step required to reduce it (see Working Group and News sections).

This Ministry is also launching the Strategy for the permeabilization of transport infrastructures and defragmentation of related habitats. This Strategy will be built following a wide-scope participative process, and it will be completed in two years. Its main goal is to establish the knowledge and mechanisms required to get a varied set of commitments from involved institutions to effectively reduce, both qualitatively and quantitatively, the fragmentation due to transport infrastructures. It will consider all knowledge and activities developed by the above-mentioned working group and will boost social and professional awareness on this topic.

On the side of the scientific community, the so-called Road Ecology has already reached a remarkable maturity status, exemplified by several journals already creating topical collections on this discipline, or calling papers for special issues on the topic (see Publication section).

Therefore, it is timely to keep working hard and jointly from different disciplines and statements on the reduction of habitat fragmentation due to transport infrastructures.

WORKING GROUP

The Working Group met on February 16 to inform, among other topics, on the imminent startup of the project SAFE (Stop vertebrate roadkill in Spain). This project is developed by means of two agreements signed by the Ministry for the Ecological Transition and the Demographic Challenge. The first agreement involves three of the main Spanish conservationist NGO: Birdlife Spain, the Spanish Herpetological Society, and the Spanish Society of Mammalogist. These NGO will coordinate volunteers to conduct a citizen-science based National survey on roadkill. The second agreement involves the Doñana Biological Station (CSIC), as scientific advisor of the project in charge of the sampling design and data analysis. Representatives of this Institute were present in the meeting to explain the methods to be employed in the survey. Two issues of the project were especially interesting for attendants. First, the possibility of different administrations to get involved in the project by creating transects according to project's methods. This is especially relevant because of their access to protected areas. Second, the interest of road maintaining services in sharing information on managed carcasses resulted from vehicle-animal collisions. Nonetheless, the website of the project (see below) shows all required information to get involved in the project, including telephone numbers to solve questions.

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

NEWS

Official kick-off of project SAFE (National roadkill survey in Spain)

On May 10 the project SAFE was officially launched in a webinar. This project is the result of two agreements of the Ministry for the Ecological Transition and the Demographic Challenge (see above) to conduct a National roadkill survey in Spain that allows quantifying this source of mortality for all vertebrates. The webinar was chaired by Jorge Marquínez and Georgina Alvarez, as representatives of the Ministry. Regarding the NGO in charge of the citizen-science based survey, Enrique Ayllón acts as representative of the Spanish Herpetological Society, Ana Carricondo as representative of Birdlife, and Francisco García as representative of the Spanish Society of Mammalogist). As representatives from the Doñana Biological Station (CSIC), in charge of the scientific planning, and data analysis of the project participated Eloy Revilla, Miguel Clavero and Jacinto Román. The full webinar (including questions) can be seen here:

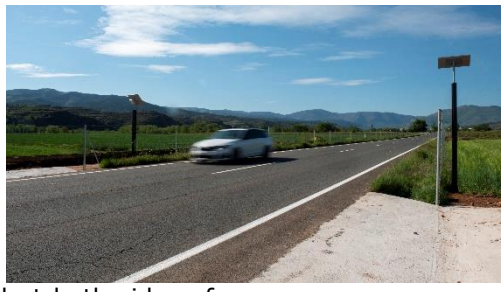
https://www.youtube.com/watch?v=outS_-jk_zY

The project is being well accepted, and currently there are 30 active transects in 17 provinces. In addition, several administrations have already contacted us to adhere the project, including the National Park Autonomous Agency, La Rioja and Navarra regional governments, and the municipality of Olérdola (Barcelona).

In the web page of the project, hosted by MITECO, it is possible to find information on the project, the links to tutorials (in pdf and video formats), and some additional material. It is possible to contribute by conducting transects at foot, by bike, and by car, recording all road killed vertebrates. The transect should be conducted at least monthly during a whole year. This effort will contribute to better evaluate roads as a source of vertebrate's mortality in Spain.

Source of information: Editorial team

La Rioja region installed its first wildlife crossing in road LR-113



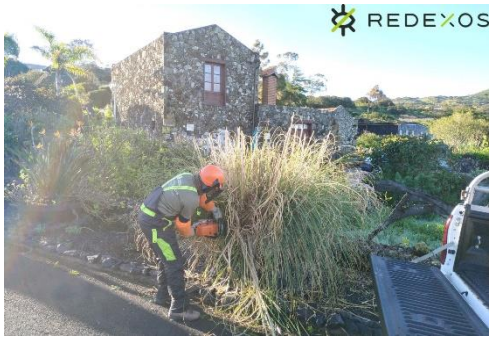
The regional government of La Rioja have recently installed this system to improve driving safety by reducing vehicle-wildlife collisions.

The system is installed in LR-113 between Mahave and Baños del Rio Tobía, and it consists in a wildlife crossing at the road level where visibility is high, and three complementary systems that leads wildlife to the crossing place. First, a fence was installed at both sides of the crossing and in both directions. Second, both repellent and attractive chemicals were sprayed along road verges. The first was used along non-fenced sections placed between the crossing and a river running nearby, where animals used the two bridge eyes to cross the road. The second was used in the first 140m at both sides of the crossing (see first picture). Third, an automatic detection system placed in the crossing is able to recognize the presence of animals in the road to trigger the light of a traffic signal installed at the end of the fence at both sides of the road. In this signal the driver could then read "animals on the road" (see second picture). The funding required was 483836 euro, and it is expected to reduce animal-vehicle collisions in this road.

Source of Information: Gobierno de La Rioja.

El Hierro insular authority involves all departments in fighting against invasive plants

The island is considered as a Biosphere reserve by the Unesco. The insular authority continues fighting against the introduction of invasive plants to avoid their negative impacts on the high biodiversity of the island.



In spring, the insular authority launched an intensive education plan that involves not only the environmental department, but also the countryside and marine department, and the department of transport infrastructures.

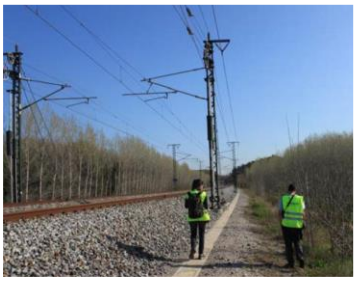
They were assisted by the early warning network of the regional government (RedExos) aimed to detect and eradicate invasive plants in the Canarian archipelago. Their technicians, together with those from the insular authority gave a training course to personnel from the departments of roads, agriculture and environment, and even for those hired for climate change purposes. The training included an informative-technical talk and a field trip to recognize the invasive species (especially the 10 of more concern because of their impact on insular ecosystems). In this trip, they visited the road HI-3 between Valverde del Puerto and the island's Airport, where several of these species could be seen and it is still possible to remove them, being replaced with local species.

Both the insular authority and the RedExos consider a key factor the attitude of local people toward invasive plants. Recognizing them is the first step to stop buying them for ornamental purposes because afterwards they disperse very easily influencing the normal development of natural vegetation in the island. Likewise, the ability of local people to recognize these species may help the task of locate them in the wild. For such purpose, they have developed a mobile app where citizens may inform on the presence of invasive plants. The app is available for Android (https://play.google.com/store/apps/details?id=org.gobiernodecanarias.redexos), and iOS (https://apps.apple.com/es/app/redexos/id1446864838)

Source of Information: RedExos and El Hierro Insular Authority.

The importance of bias control in studies on mortality due to transport infrastructures. The persistence rate of carcasses.

Studies on mortality due to transport infrastructures is influenced by several factors that bias the obtained results. One of the most important is the removal of carcasses by scavengers before the sampling is conducted, therefore reducing the number of carcasses found by observers.



ADIF Alta Velocidad (High speed trains) consider this bias for the first time when evaluating mortality in the line connecting Madrid with Valencia in 2012-2014. An experiment based on Ponce et al. (2010. *Animal Conservation*) was conducted to quantify such bias.

Thereafter, ADIF Alta Velocidad has conducted a total of 33 similar studies to control for this source of bias in their studies of mortality. These studies involve more than 800 carcasses, and they highlight the importance of this bias, not only on the mortality estimations, but also on the methods to be applied when evaluating mortality in transport infrastructures.

In the first study (line Madrid-Valencia) persistence rate ranged between 60 and 84% per week. The sampling frequency of 1 week was, therefore, appropriate, and calculated persistence rate could be applied as correction factor to mortality estimates.

However, persistence rates estimated in the line between Orense and Santiago (NW of the Country) were much lower (the majority of carcasses were removed within 2 days). This forced sampling frequency to increase up to 2 days to properly estimate this bias.

In addition, in one section of the Madrid-Valencia line, small to medium size carcasses (quails, doves and pigeons) were used to study seasonal (spring and fall) and interannual variation in carcass persistence along a 3 years study. Persistence ranged between 68 and 90%, with fluctuations of up to 22% among years.

These results highlight the importance of control for carcass persistence when evaluating mortality due to transport infrastructures, also considering the high variability this bias may show, both seasonally and yearly. Differences of up to 400% found between locations are also remarkable.

Source of information: ADIF Alta Velocidad.

Approved the building of several wildlife crossing in National Road N-420

The 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 project includes three new wildlife crossings in km 83.338, 86.309, and 90.705, made by fabric concrete that build an underpass with an entrance of 2x2m. The three crossing will be fenced at both sides. Whenever this affects current driveway entrances to properties, the budget includes the building of new entrances. It also considers grass cutting in verges and embankments, cleaning of culverts, and modification of the opening of the drainage system at Km. 82.340, and 90.350 to also serve as wildlife crossings.

The budget is approximately 1 Million Euro, and it is complementary to other actions that will be done in the same road between km 51, and 63.

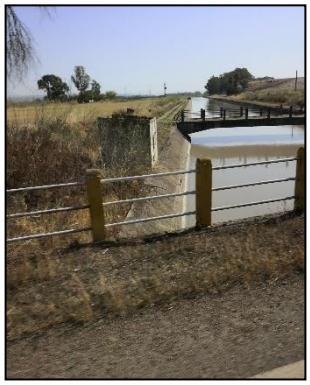
These actions aim at reducing mortality in the Iberian Lynx that currently high in this area (3 road-killed individuals in Ciudad Real Province in 2021). Nonetheless, these relatively big crossings will also contribute to increase the permeability of this road for the whole vertebrate community.

Source of Information: Editorial team.

Irrigation channels as habitat fragmentation infrastructures, and sources of mortality of wildlife

Several regional associations of hunters and other institutions related to this activity have reported the mortality associated to different irrigation channels in Spain: Lliría (Valencia), Paradilla de la Sobarriba (León), Tajo-Segura diversion channel (Castilla La Mancha), etc. In fact, they estimate that 5000-8000 animals die annually in these structures.

Irrigation channels are crucial for the development of irrigation crops, which currently constitute a 20% of the agriculture developed in Spain, but contributes up to 35% of the agrarian gross product. The majority of these infrastructures were built decades ago without any environmental impact assessment. Therefore, both their location and



building have no consideration of habitat fragmentation or permeability and their impacts on wildlife. Frequently, they are also aged and not properly maintained, being very inefficient in water transportation despite the enormous importance of this resource in Mediterranean-climate countries. In the current scenario of climate change, population increase of several ungulate species, and reported mortality in these infrastructures, it is necessary to evaluate the habitat fragmentation caused by irrigation channels, their maintenance status, and utility. Such an assessment may constitute the core of a handbook that illustrates the topic, also gathering the mitigating actions that should be conducted to both reduce the habitat fragmentation caused by these infrastructures and to mitigate direct mortality by drowning. Some of these actions have been already implemented in different parts of the country by managers and NGO with variable success, but up to our knowledge, a compilation of the methods and their efficiency that could serve as guideline is still required. Because of the contribution of irrigation channels to the dispersal of invasive plant species, their impact on biodiversity and on the channels themselves, gates and weirs should be also considered in such a handbook.

Source of information: Editorial team

Plan Itinere. Improvement of country roads in Andalusia

Under this funding framework, the Andalusian Regional Government will assume the cost of works between 75.000 and 300.000 € made in country roads that give access to agrarian plots from existing roads, urban areas or agro-industrial facilities.

In spite of being small and having low traffic, these roads may also contribute to wildlife mortality. Because of the frequent participation of the Andalusian Government in events and meetings organized by the working group on habitat fragmentation due to transport infrastructures, it is expected that they consider all recommendations and guidelines published by the group (see Documents of the Working Group). In this way, this plan may contribute not only to increase competitiveness of the Andalusian agro-industry, but also to minimize the impact of this transport infrastructures on the surrounding habitats. This is frequently the case when this funding is used to clean culverts and other related structures that are also modified to increase the permeability of the road and reduce road kills.

Source of information: Editorial team

Defragmentation actions as part of the Catalonian Green Infrastructure Program

The first analyses and identification of actions and their execution to improve the Catalonian green infrastructure started in 2014. In this starting phase, several actions were grouped in form of a plan. This allowed to be funded by FEDER European funds. Afterwards, the General Directorate for Environmental Policies (DGPAMN) made the Catalonian Green Infrastructure Program (PIVC), planned to be executed in the 2017-2021 period. The program was officially approved on November 2018 and it was incorporated as a major issue into the Catalonian Strategy of Natural Heritage and Biodiversity 2030, approved on July 17 2018 by the Catalonian Government. The Strategy plans to restore and improve the green infrastructure functioning to reduce habitat fragmentation and ecosystems deterioration. This fact constituted a boost for the development of the PIVC.

One of the strategic goals of the PIVC focus on re-establish the ecological connectivity by developing defragmentation actions in habitats fragmented by transport and other linear infrastructures, and the restoration the functioning of ecological connectors, both riparian and terrestrial. In this first period, about 40 of these action types were identified, which can be defined as belonging to one or more of these situations:

• Road sections of high concentration of vehicle-ungulate collisions, as reported by the General Directorate for Infrastructures and Mobility.

• Main or secondary terrestrial ecological connectors, and key points for the ecological connectivity as identified in ecological connectivity maps developed by the DGPAMN.

• Very fragmented areas at the regional level, according to the document "Identificación de áreas de desfragmentar para reducir los impactos de las infraestructuras lineales de transporte en la biodiversidad" (2014; see Documents of the Working Group).

In general, actions were developed by first conducting a study that analyse and define actions to improve the ecological connectivity between involved natural spaces (frequently Natura 2000 sites). These actions aim at improving permeability of existing transport infrastructures: Highways, 4-lane roads, conventional roads, and conventional railways (high-speed railways already have appropriate wildlife crossing structures). Actions were also conducted to reinforce the habitat connectivity provided by riparian ecosystems. In summary, the study includes:

An inventory of both over and under passes that may serve as wildlife crossings (culverts, unpaved roads, etc.).

A specific study on wildlife aiming to identify those road sectors where wildlife may cross more likely (sometimes this incorporates camera-trapping sessions to identify which crossing are being used by the wildlife).

The establishment of the actions required to modify existing passing structures to serve as wildlife crossings, as well as the required restoration or rehabilitation workings that should be made in riparian habitats, and other interesting elements of the landscape.

An inventory of those elements that may serve to connect habitat patches, especially those belonging to the administration.

The analysis of foreseen instruments of urban planning, and other territory developments (e.g. wind or solar farms) that may negatively interact with the development of the green infrastructure.

The writing of a building project if actions are clearly defined. To make any modification on exiting structures that may serve as wildlife crossing, it is required the previous authorization of the owner (Ministry of Transports, Mobility and Urban Agenda), and contributions from the building company (in this case Abertis Inc.). Building on the executed project report, allows that defragmentation actions comply with the current laws on road building and maintenance.

Both the public call and the assignment of studies and building projects have been made through the public company Infraestructures.cat, which has the technical, and administrative requirements to conduct these tasks streamline. Some calls and studies were directly made by the DGPAMN, as well as the execution of minor buildings.

In the coming months, 6 of these studies and a building project will be complete. Once finished, a study on the effectivity of these measures will be conducted.

Source of information: Servicio de Proyectos DGPAMN. Generalitat de Cataluña.

PUBLICATIONS

In addition to the references cited below, in this newsletter we are highlighting the increasing importance of Road Ecology in the scientific literature. As a result, the journal Nature Conservation has created the collection "Linear Infrastructure Networks with Ecological Solutions, edited by Sara Santos, Clara Grilo, Fraser Shilling, Manisha Bhardwaj and Cristian Remus Joining to the initiative Following a similar approach already performed by the European Journal of Wildlife Research that also has a topical collection edited by Marcello D'Amico. Similarly, the journal Diversity is calling papers for a special issue entitled Transportation Infrastructure Impacts on Biodiversity in Emerging Economies. The journal Frontiers in Ecology and evolution is also calling for papers for a special issue entitled Ecological Impacts of Transportation Networks at Large Extents.

Henry, D. A. W., Collinson-Jonker, W. J., Davies-Mostert, H. T., Nicholson, S. K., Roxburgh, L., & Parker, D. M. (2021). Optimising the cost of roadkill surveys based on an analysis of carcass persistence. Journal of Environmental Management, 291, 112664. https://doi.org/10.1016/j.jenvman.2021.112664 .

Nieszala, A. y Klich, D. 2021. How far from the road should land cover be assessed? A case study on mesopredator mortality on roads. European Journal of Wildlife Research 67, 23.

Noonan, M.J. et al. 2021. Roads as ecological traps for gian anteaters. bioRxiv. Doi: https://doi.org/10.1101/2021.04.02.438243

Raynor, J. L., Grainger, C. A., & Parker, D. P. (2021). Wolves make roadways safer, generating large economic returns to predator conservation. Proceedings of the National Academy of Sciences, 118(22). https://doi.org/10.1073/pnas.2023251118

Ruiz-Capillas, P. et al. 2021. Do roads alter the trophic behavior of the mesocarnivore community living close to them? Diversity 13, 173.

PAST EVENTS

IAIA 2021 International Conference.

Smartening Impact Assessment: Science, technology and governance advancements towards efficiency and effectiveness. The Spanish Association of Environmental Impact Assessment organized this conference fully online on May 18-21 2021. More info.

Asphalt 4.0 for future mobility 2021

The Eurasphalt and Eurobitumine association organized this virtual meeting on June 15 - 17 2021. More info.

COMING EVENTS

African Conference for Linear Infrastructure & Ecology

This year, the ACLIE Conference will be fully online in August 12 - 17 2021. More info.

IUCN World Conservation Congress

The IUCN and the French government have agreed to hold this event from 3 to 11 September 2021 in Marseille (France). More info

International Conference on Ecology and Transportation (ICOET) 2021

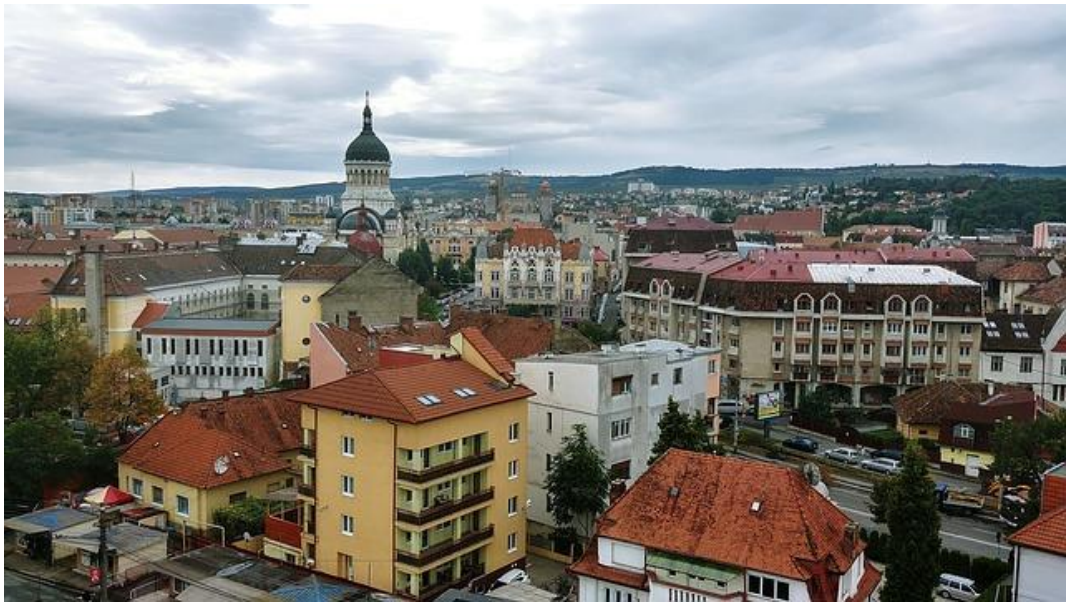
Focused on "Transforming Transportation Ecology in the Global Village", it will be a fully online event from 21 to 30 September 2021. More info.

Global Congress for Linear Infrastructure and Environment (GCLIE)

This meeting is 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 is chaired by Wendy Collinson and Fraser Shilling, which are assisted by an Organizing Committee composed of representatives of the major continental conferences on linear infrastructure impacts. It will be a virtual meeting between on 20-21 September 2021. More info.

IENE 2022 International Conference

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



DOCUMENTS OF THE WORKING GROUP

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 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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