

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
- > Number 21

EDITORIAL

Past June 22nd, the European Commission published the proposal for the so-called "Nature Restoration Law" with binding targets and direct applications in all European state members. It aims at restoring degraded terrestrial and aquatic ecosystems in Europe, constituting an historic event similar to the adoption of the Habitats Directive (1992), which forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments.

Despite this law proposal still needs to be discussed and endorsed in the European Parliament and the European Council, it already adds a new level of legal strength to conservation and restoration efforts across Europe. It actually enumerates detailed restoration targets regarding terrestrial (including forests, coastal, agricultural and urban) freshwater and marine ecosystems, river connectivity, and pollinators, among others.

The Commission set an overarching target to restore 20% of EU's land and sea area by 2030 and all ecosystems in need of restoration by 2050. It also aims at stopping any kind of further degradation in the conservation status of both species and habitats and getting at least 30% of them in favourable or improved conservation status. It will urge state members to build National Restoration Plans including the identification of target areas, restoration measures proposals, monitoring and evaluation protocols and corresponding timetables, as well as funding and other requirements and participation processes.

Ecosystem restoring is also a key issue well beyond the European Union. The United Nation (UN) Vision 2050 to combat desertification and drought, The UN Agenda 2030 for Sustainable Development, and the UN Decade on Ecosystem Restoration, support the protection and restoration of ecosystems. At the end of this year, the Conference of the Parties of the Convention on Biological Diversity will build a new global biodiversity framework, including ambitious targets regarding restoration ecology.

In this context, but especially because of the international commitments posed by the future European law, National Restoration Plans should include actions such as the recovery and creation of hedgerows and field margins in agricultural landscapes, the enlargement of free-flowing rivers by the removal of dams and other barriers, the restoration of margins in transportation infrastructures or the construction of wildlife crossings. Likewise, further efforts regarding habitat defragmentation should be also implemented in our country.

Nonetheless, many of these ambitious targets are already considered within the Spanish National Strategy on Green Infrastructure and Connectivity and Ecological Restoration, which is being developed since July 2021. In fact, one of the main pillars of this strategy is ecological restoration. This document of strategic planning that runs until 2050 should be the legislative framework that allows the integration of all future actions regarding ecological restoration in Spain, including the European Natural Restoration Law that has been proposed.



Picture: Manuel Oñorbe.

WORKING GROUP

The Working Group on Habitat Fragmentation due to Transport Infrastructures met on March 2nd to inform on the activities and news developed during the last months by the different assisting authorities and organizations. Among them, the Spanish Traffic Authority (DGT) informed on vehicle-animal collisions during 2021 (see news); the Castilla y León Regional Government informed on further developments regarding the variable signaling prototype that is being developed in collaboration with the University of Salamanca (see Colino et al. 2021 in Publications); the Tenerife island Council informed on Carbon footprints calculations that are being conducted in the island, see news; Minuartia Inc. informed on the update of the IENE handbook, see Publications, as well as on the progress of the Bison project. In addition, the new coordination team of the General Sub Directorate of terrestrial and marine biodiversity was introduced together with its progress in the development of the National Plan for Infrastructure defragmentation that belongs to the National Strategy of Green Infrastructure and Connectivity and Restoration Ecology. Likewise, the working group was informed on the state of the art of the ongoing document on Technical Prescriptions regarding animal mortality on transportation infrastructures (number 9 of the series) linked to SAFE project (see [bulletin 20](#)), led by the Ministry for the Ecological Transition and the Demographic Challenge (MITECO). To answer questions and clarify methods regarding this project, Marcello D'Amico, from the Doñana Biological Station (CSIC) was invited to the meeting.

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

Tenerife island Council conducted a pioneer study on Carbon Balance in the vicinity of high traffic roads.

The technical service on roads, landscape and mobility of the Tenerife Island Council (CIT), in agreement with Eulen Environment Inc. has estimated and recorded the carbon footprint of its activities, the development of a greenhouse gases reduction plan, and the study of the Carbon Balance regarding roads managed by the CIT. This constitutes a commitment in the contribution to combat climate change, trying to move its activities toward sustainability and fulfilment of Sustainable Development Goals of the United Nations, namely number 13 (climate action), number 15 (life on land) and number 17 (partnership of the goals), which belong to the CIT's Sustainability Agenda.

The estimation of Carbon Balance is a pioneer study in Spain in the framework of sustainability and continuous improvement in the management of high traffic roads, aiming to build new strategies for climate neutrality in the roads network.

This study provide us with additional environmental indexes for roads management through the evaluation of traffic emissions and artificial lighting, as well as vegetation types and the ability to absorb CO₂ of the different species planted in road margins, and other green areas managed by the technical service on roads, landscape and mobility of the CIT. This would allow designing mitigation actions to be applied under different scenarios of traffic conditions.

This method allowed to create a list of plant species ranked according to their CO₂ absorption abilities. This still requires to be supported by additional scientific studies providing further information on absorption capabilities of vegetation, especially shrubs, considering the diversity and singularity of the Canarian flora.

In addition to CO₂ measurements, the study involves a planting program to increase CO₂ absorption capacity in road margins. This program includes a total of 1492 individuals to be planted in the next 5 years, therefore contributing to ameliorate the impact of climate change. In this program, actions are hierarchically divided into different levels depending on CO₂ emissions. In this way, priority is given to these areas where emissions are higher.

This study aims at highlighting the utility and importance of vegetation in reducing the impact of CO₂ on climate warming. It also constitutes an additional criterion when selecting plant species to be used in road margins and other green areas in their vicinity, both managed by the technical service on roads, landscape and mobility of the CIT.



This study in combination with the new Island Plan for Sustainable Mobility, which imposes a change in the type and dynamic of emissions, constitute valuable tools in the fight against climate change while improving the Island's landscape.

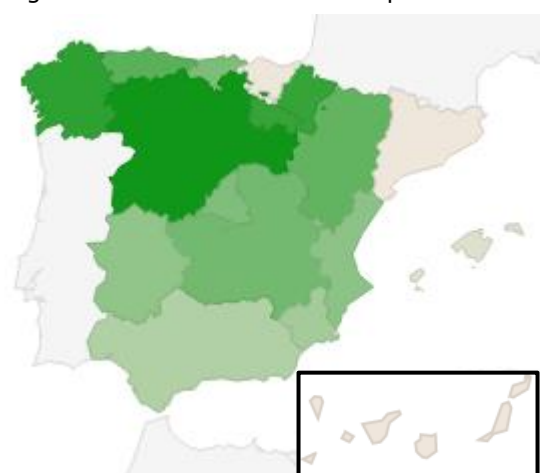
Source of information: Tenerife Island Council.

Animal vehicle collisions in Spain during 2021

Two different institutions: the Spanish Traffic Authority (DGT) and the Insurance Company AXA Spain, have recently published their statistics about wildlife-vehicle collisions (WVC) during 2021. Data from DGT belong to collisions where the traffic authority was required. Data from AXA belong to collisions reported to the company by drivers. Therefore, information highly overlaps, but not fully. During 2021, the DGT recorded 32804 collisions in all regions, except Catalonia and the Basque country because these regions have their own recording systems. According to DGT WVC constitute one third of the accidents in non-urban roads. During 2021, AXA Spain recorded 6676 WVC in the whole country although geographical distribution of drivers is not provided, potentially biasing results towards best-represented areas. In both data sets, the number of WVC increased steadily during the last years, being 2020 the exception to the rule, due to COVID-19 lockdown (see [Bulletin 18](#)).

	Total 2018	Total 2019	Total 2020	Total 2021	Wild boar 2021	Roe deer 2021	Dog 2021
DGT	28059	29889	29517	32804	39%	33%	11%
AXA	3981	4791	4159	6676	35.9%	25.7%	19.7%

As detailed in the table, wild boar is the most frequent species involved in WVC, roe deer being the second, and dog the third. Relative frequencies of other species are all below 6%. Both data sets also show differences between regions being Galicia (DGT and AXA), Castilla y León (DGT and AXA), and Cataluña (AXA) where WVC are more frequent (61% of all WVC). At the province level, WVC were more frequent in Burgos (6.7%), Ourense (5.5%) and León (4.4%). Temporal differences were also found, November showing the highest percentage (probably due to hunting), and July showing the lowest (6.4%). Nonetheless, the information provided in a regional basis is difficult to interpret because of the strong differences in surface among territories. Therefore, we calculated the number of WVC per road km using the length of state, region and province roads in each region. Because AXA did not include all regions in its report, we used data from DGT for this calculation. Results shown in figure depict no data in Catalonia and the Basque Country, and high WVC rate in Castilla y León, Galicia, La Rioja and Navarra with 35, 30, 29, and 29 WVC per 100 km, respectively. Andalusia and the Balearic and Canarian archipelagos show the lowest values with 10, 2.5, and 2.2 WVC per 100 km.



In the report from DGT, they show that 98% of WVC only caused car damages. However, the remaining 2% means 612 WVC per year resulting in injured or dead people. In fact, during the last 5 years, they reported 29 fatal victims, 288 severely injured people, and 3879 slightly injured people. These numbers should be taken into consideration to always drive responsibly.

Source of Information: DGT, AXA Spain and Editorial team.

The Ministry for Transport, Mobility and Urban Agenda (MITMA) promote the reinforcement of wildlife fencing in several national roads in Cantabria

The MITMA signed a contract of 209.062 euros to reinforce longitudinal fencing of roads A-8, A-67, and N-634 in the Region of Cantabria. This measure aims to prevent wildlife from accessing the road. The road sectors where these actions are planned correspond to areas where recorded wildlife-vehicle collisions are high, mainly involving wild boars and roe deer, but also badgers and other carnivores.

In these selected sectors the fencing will be replaced or reinforced, also using repellents in the most critic points.



This action belongs to the Recovery, Transformation and Resilience Plan (component 6) regarding wildlife protection from mortality caused by the National Road Network.

Source of Information: MITMA.

Galicia Regional Government improves preventing measures to avoid wildlife-vehicle collisions

In the road CG 2.2, in the so-called Nadela-Sarria corridor, close to the village of Maceda, the Galician Regional Government has replaced the conventional fencing by a high breaking strength fence of 1.5 m of height to prevent wild boars from accessing the road. The fence is attached to the ground resulting in 1000 kg of breaking strength. Because of the extended height, the regional government also built several escaping paths to allow wildlife that accessed the road to go back to the nature.

Because wildlife often access highways through the network nodes, the Regional Government have installed cattle guards at these points. Cattle guard consists of a depression in the road of around 30 cm. covered by a transverse grid of beams, bars or tubes placed at ground level, and perpendicular to the movement. The gaps between the beams are wide enough for an animal's feet to enter, but sufficiently narrow to allow wheeled vehicles to cross safely. Animals, especially ungulates that has relatively thin legs and poor depth perception refuse to cross by these guards. For more agile animals, mobile beams (rotating cylinders) are used. These cylinders rotate when touched, discouraging animals from moving across. In these nodes, the Regional Government has also installed speed reductions of 30 and 50 km/h with alert markings in the pavement to notify drivers.

Similar measures were undertaken in the highway Ferrol-Villalba (AG-64), close to the village of Narón. Both actions had a total cost of 353000 euros. Depending on their effectiveness, they could be applied in other road sections within the region.

Source of Information: La Voz de Galicia.

5 road killed lynxes during 2022 in roads close to Doñana

Despite the Iberian lynx population has shown its highest numbers in two decades, with more than 1300 individuals counted (last report of the lynx working group coordinated by the MITECO), their main mortality causes are still operating. During 2021, 56 lynxes were road killed in Spain. Considering only the Doñana-Aljarafe population, 5 road killed individuals have been already found this year. The last report was in road A-481 from Hinojos to Villamanrique de la Condesa, where a female and her cub were road killed. The remaining three were found in roads A-483 from Almonte to Matalascañas, A-486 from Lucena del Puerto to Bonares, and A-8077 from Salteras to Sevilla.



Fortunately, a new LIFE project (Lynx Connect) is running until 2025 with a budget of 18 million euro. Among other measures, this project will implement mitigation measures to reduce this important source of mortality that may jeopardize the species population recovery

Source of information: Editorial Team. Picture: Jacinto Román

Preliminary results from project LIFE SAFE-CROSSING: "Preventing Animal-Vehicle collisions: demonstration of best practices targeting priority species in SE Europe"

This LIFE project with a budget of more than 5 million euro until 2023 focuses on a handful of endangered species, including the Iberian lynx (see [bulletin 17](#)). It already has some preliminary results on the efficiency of different devices installed to reduce animal-vehicle collisions. It is the case of smart devices installed in several roads of Europe. They work as follows: a set of Passive infrared (PIR) sensors and/or a thermic camera registers the presence of an approaching animal and sends the information to the electronic control unit. This unit triggers an alert signal for drivers, inviting them to slow down to an acceptable speed. A radar Doppler sensor measures whether the car actually slows down. If it does, the system stops to act. Otherwise, the radar sends a signal back to the control unit. This activates an acoustic scaring device, which shall drive the animal to escape. These devices were active during 2000 days resulting in

more than 7000 animals detected. From them, more than 4000 corresponded with danger situations (car approaching). In spite of this, only 7 road killed animals were found, 6 of them corresponding to periods of system malfunctioning.

Neuromarketing techniques were also used to help designing more effective road signs able of capturing attention from drivers, therefore informing them on the risk of animal-vehicle collisions (see figure).



Source of Information: LIFE project SAFE-CROSSING (LIFE17 NAT/IT/000464).

PUBLICATIONS

In addition to the set of publications listed below, the journal Nature Conservation has published an especial issue edited by Sara Santos, Clara Grilo, Fraser Shilling, Manisha Bhardwaj and Cristian Remus. It focused on ecological solutions applied to transportation infrastructure networks, as resulted from the last IENE meeting. More [info](#)

AHE. 2022. La AHE colabora en el plan SAFE. Boletín del comité español de la UICN. Invierno: 30-31

Ascensao, F. et al. 2022. Road encroachment mediates species occupancy, trait filtering and dissimilarity of passerine communities. *Biological Conservation* 270: 109590.

Blackburn, A. et al. 2022. If you build it, will they come? A comparative landscape analysis of ocelot roadkill locations and crossing structures. *PLoS ONE* 17(5): e0267630

Cabezas-Díaz, S. 2022. SAFE: un plan para conocer y frenar los atropellos de fauna en en España. *Aves y Naturaleza* 36: 24-25

Colino et al. 2021. Bringing science and technology together: Real-time road signs based on temporal AVC models. *International Conference on Ecology and Transportation*. <https://icoet.net/2021/program/presentations/15>

Fernández-López, J., Blanco-Aguilar, J.A., Vicente, J. and Acevedo, P. (2022), Can we model distribution of population abundance from wildlife-vehicles collision data? *Ecography*, 2022: e06113. <https://doi.org/10.1111/ecog.06113>

Galatinho, A. et al. 2022. Effects of roads on small-mammal movement opportunities and risks of vegetation management on roadsides. *Journal of Environmental Management* 316: 115272.

Hallisey, N. et al. 2022. Estimating road mortality hotspots while accounting for imperfect detection: a case study with amphibians and reptiles. *Land* 11: 739

Hsu, C-H y Lin, T-E. 2021. Exploring the participation motivations of ongoing and former citizen scientists in Taiwan Roadkill Observation Network. *Journal for Nature Conservation* 64: 126055

Luell, B. 2003. Updated with a new chapter (10) on Maintenance of ecological asset. Glossary is also updated. More [info](#)

Megía-Palma, R., Merino, S. y Barrientos, R. 2022. Longitudinal effects of habitat quality, body condition, and parasites on colour patches of a multiornamented lizard. *Behavioral Ecology and Sociobiology* 76: 73

Rodríguez, C., Cabezas, S., García, F.J., Caballero, C. y Oñorbe, M. 2022. En un año se detectaron casi 3000 animales atropellados. Primeros resultados del proyecto SAFE sobre mortandad de fauna en las carreteras españolas. *Quercus* 424

Sacramento, E. Rodríguez, B. y Rodríguez, A. 2022. Roadkill mortality decreases after road inauguration. *European Journal of Wildlife Research* 68: 31.

Secem, 2022. ¿Qué nos estamos encontrando en nuestras carreteras participando en el proyecto SAFE -Stop Atropellos de Fauna en España? [Secem.es](https://www.secem.es)

Valerio, F. Basile, M. y Balestrieri, R. 2021. The identification of wildlife-vehicle collision hotspots: Citizen-science reveals spatial and temporal patterns. *Ecological Processes* 10: 6.

PAST EVENTS

National Congress on Environmental Impact assessment

The Spanish association of environmental impact assessment held its biennial congress in Caceres between 23th and 25th

of March. This year, the motto of the congress was "environmental impact assessment in changing times. Ecosystem, social and global health implications.

More [info](#).



V Andalusian Congress on Roads

Held by the Spanish Association of Roads (AEC) and the Regional Administration for infrastructures and territory management in Granada Congress Palace between 6th and 8th April 2022. More [info](#).

WIRE. Women on International Road Ecology

Held by the Panthera Association (Costa Rica) on February 28th, this was an online event where many of the most renowned women in Road Ecology shared their research. This included Carme Rosell and Georgina Alvarez.



COMING EVENTS

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 + GCLIE 2022 International Conference

Under the motto Connecting people, connecting landscapes, The IENE and GCLIE networks will organize this hybrid meeting (online and in-person) in Cluj-Napoca, Romania on 15-16, September 2022 (Global Connections Among Linear Infrastructure, Communities and Environment), and on 19-23 september 2022 (Integrated Approach for Mainstreaming Biodiversity into Transport Networks). 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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