



Preventing Animal-Vehicle Collisions –  
Demonstration of Best Practices targeting priority  
species in SE Europe  
Layman's report



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# The project in brief

Name: Preventing Animal-Vehicle Collisions - Demonstration of Best Practices targeting priority species in SE Europe

**Acronym: LIFE SAFE-CROSSING**

**Reference code: LIFE17NAT/IT/464**

**Duration:**

**Start date: 01/09/2018**

**End date: 31/08/2023**

**Total budget: 4.222,170€**

**Coordinating beneficiary:** Agristudio Srl

**Associated beneficiaries:**

Parco Nazionale d'Abruzzo Lazio e Molise, Italy

Parco Nazionale della Maiella, Italy

Provincia di Terni, Italy

National Institute for Research and Development in Forestry "Marin Drăcea", Romania

Fundația Carpați, Romania

CALLISTO Wildlife and Nature Conservation Society, Greece

COSMOTE Kinites Tilepikoinonies AE, Greece

Egnatia Odos S.A, Greece

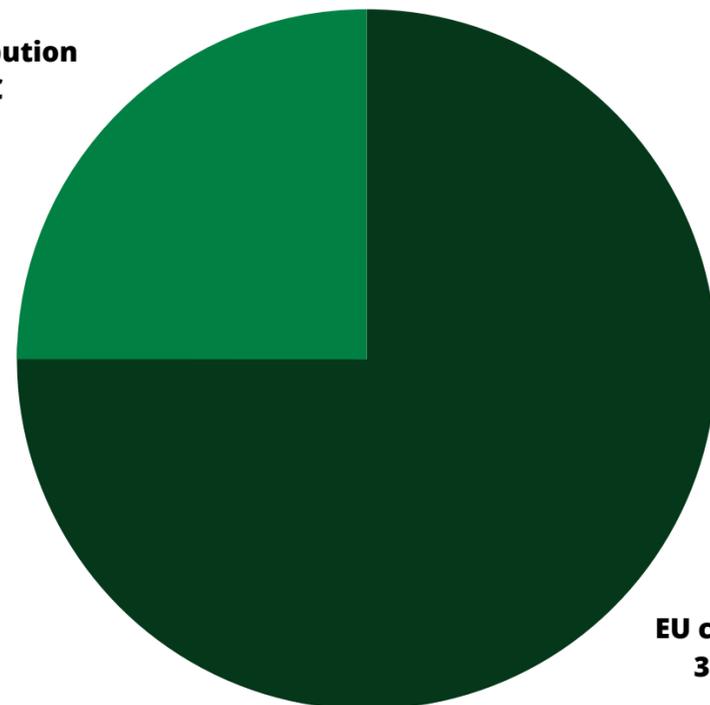
Region of Western Macedonia, Greece

Agencia de Medio Ambiente y Agua de Andalucía, Spain

Consejería de Sostenibilidad, Medio Ambiente y Economía Azul, Spain

MINUARTIA Estidis Ambientals SI, Spain

**Partner contribution**  
**1.055.806€**



**EU contribution**  
**3.166.364€**



# Introduction

Roads represent an important cause of mortality for many species and a threat for the conservation of biodiversity:

- they cause disturbance and the reduction and fragmentation of habitats;
- accidents with wildlife can have a significant impact on the survival of some species, especially the ones that are at risk of extinction;
- roads can represent an important barrier for the movements of many wildlife species, thus reducing the interchange within and between populations;

In Europe it has been estimated that between 10 and 100 million birds and mammals are killed on the roads each year.

Wildlife vehicle collisions represent also an increasing problem for human safety and have also a great economic impact related to damages of vehicles.

The LIFE SAFE-CROSSING project aimed at implementing actions to reduce the impact of roads on some priority species in four European countries: Apennine brown bear (*Ursus arctos marsicanus*) and wolf (*Canis lupus*) in Italy, Iberian lynx (*Lynx pardinus*) in Spain, and Brown bear (*Ursus arctos*) in Greece and Romania.

These species are severely threatened by road infrastructures, both by direct mortality as well as by the barrier effect. In order to mitigate these the objectives of the LIFE SAFE-CROSSING project were:

- to demonstrate the use of innovative Animal-Vehicle Collision (AVC) prevention tools
- to reduce the risk of traffic collisions with the target species
- to improve connectivity and favour movements for the target populations
- to increase the attention of drivers about the risk of collisions with the target species

The project included 29 Natura 2000 sites and it involved 13 partners, among which NGOs, private companies and public bodies.

# Map of the project area



# The target species

## The Apennine Brown Bear

*(Ursus arctos marsicanus)*



The Apennine brown bear population was once spread along all the Apennines but its range progressively decreased, mainly due to the land use change and persecution by humans. The establishment of the Abruzzo National Park in 1923 helped the preservation of this subspecies and today there are evidences of re-colonization. The total range of the Apennine brown bear is now estimated in 5000 km<sup>2</sup> with the area occupied by reproducing females coinciding mainly with the Abruzzo, Lazio e Molise National Park and the immediate surrounding mountains. Roads represent a threat on the one hand because bears get killed on them, but also because the roads limit the range expansion of the species.

# The target species

## The European Brown Bear

(*Ursus Arctos*)

In *Greece* over the last 15 years the bear population showed a constant geographical positive trend, with the recolonization of the western range of the former distribution area. The permanent and recolonized range covers ~ 34.868 km<sup>2</sup>. In this country bears are frequently killed in accidents on national roads but also on the Egnatia Highway. Besides this, the motorway represents a severe cause of fragmentation of the habitats and the population.

In *Romania* the brown bear population is distributed across the whole forested area of the Romanian Carpathian Mountains, occupying a surface of approximatively 69.000 km<sup>2</sup> and the last estimates were of round 6.450-7.200 individuals. The species enjoys a favourable conservation status, but the presence of linear infrastructures (both roads and railroads) represents a severe threat both in terms of direct mortality and of loss of connectivity.



# The target species

## The Iberian Lynx

*(Lynx pardinus)*



The Iberian lynx is considered to be one of the most endangered cat species of the world according to the IUCN red list. The evolution of the species in the 20th century has been clearly downward, from an estimated population in 1988 of between 880 and 1150 individuals, or 350 adult females to an estimated 160 individuals in 2002. Thanks to intensive conservation efforts, the population of the species has increased considerably to over 1600 individuals in the Iberian Peninsula according to the census carried out in 2022 at life Lynxconnect. Despite all the actions undertaken in the last two decades, the main cause of non-natural mortality is roadkill, with an annual mortality rate of 6%.

# The target species

## The Wolf

*(Canis Lupus)*



In Italy the wolf is distributed all along the Apennines and since 1990 recolonized the alpine arch. The most recent estimate of the wolf population, based on the national monitoring program carried out between October 2020 and April 2021, is about 3307 individuals (95% CIs = 2.945 - 3.608). The species is now in a favourable increasing conservation status, but killing on roads is still representing one of the main threats for the conservation of the species. In Umbria region the official statistics report 16 wolves found dead along roads in recent years, but this is a clear underestimate of the phenomenon.

# The project activities

To reduce the impact of linear infrastructures on biodiversity it is fundamental to monitor the phenomenon, to identify the most risky road segments, to implement technical solutions to prevent wildlife road mortality and to favor habitat connectivity, and last but not least to promote a responsible driving behavior and to involve road management authorities in order to apply the lessons learned in the future outside the project area.

Therefore, the main activities developed in the frame of the project were:

- monitoring of wildlife road mortality;
- characterization of the existing crossing structures and monitoring of their use by wildlife;
- installation of innovative electronic devices to reduce animal-vehicle collisions;
- implementation of concrete interventions to improve habitat connectivity;
- raising awareness of general public and key stakeholder about the impact of roads on biodiversity.





# Monitoring

The monitoring activities of the LIFE SAFE-CROSSING project were divided into three main sections:

- 1** Quantification and characterization of wildlife mortality on roads
- 2** Characterization and use of the crossing structures
- 3** Geodatabase

# Monitoring

**Quantification and characterization of wildlife mortality on roads**, specifically in order to identify the locations where to install the AVC prevention tools and to evaluate their effectiveness:

- Identification of the most risky road segments (AVC clusters) and the most used crossing points (Crossing points clusters) through the KDE+ method developed by Bil et al 2013, using historical data of AVC and telemetry data
- Classification of the road segments according to the main following parameters: number of lanes, speed limits, number of wildlife crossing signs, habitat types crossed by the road, barriers for animal movements
- Regular patrolling of selected road segments to record animals found dead
- Camera trapping to specifically identify the paths and trails used by the animals to approach the road
- Measurement of numbers of vehicles and their speed through the installation of a traffic counter

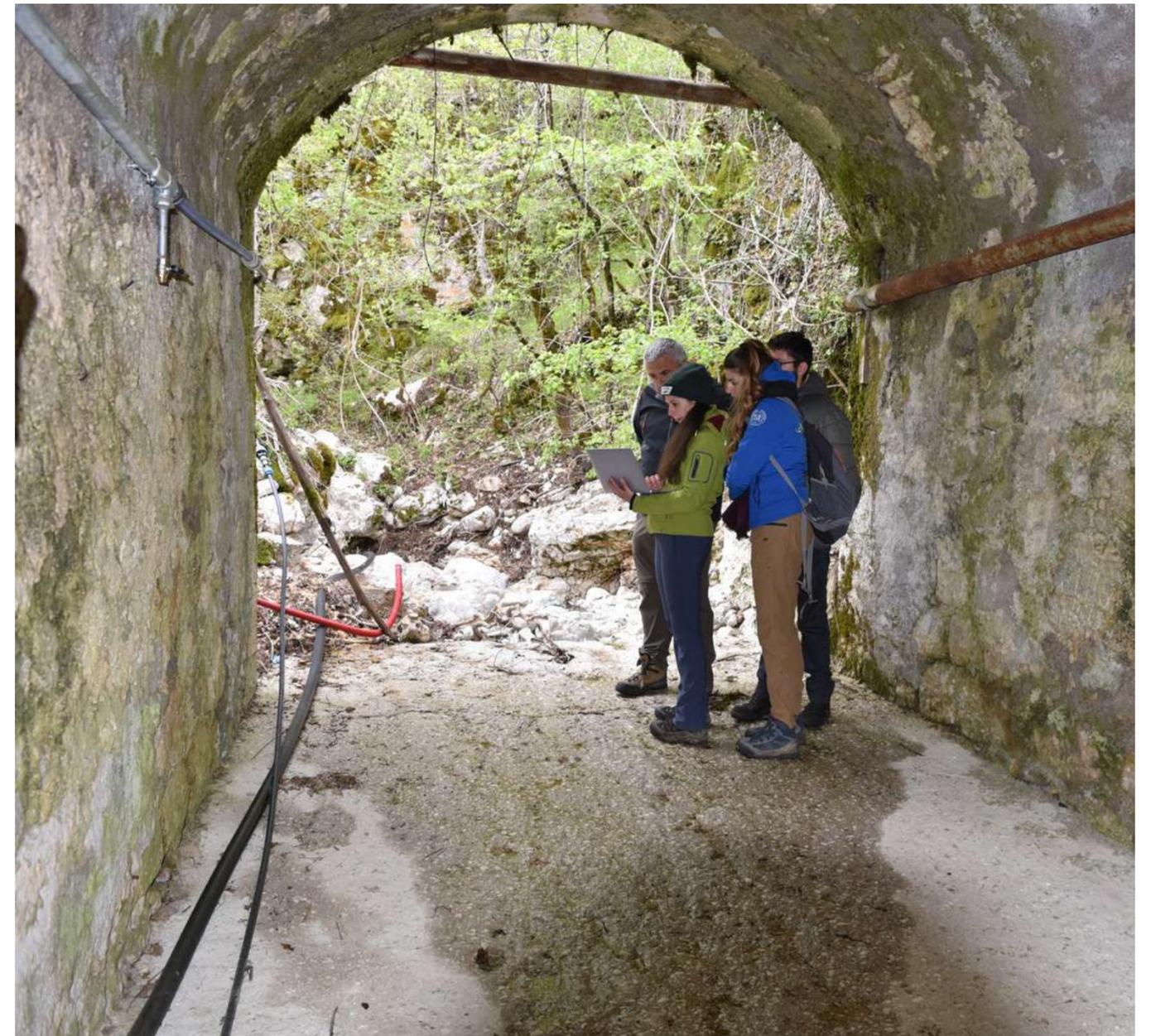


# Monitoring

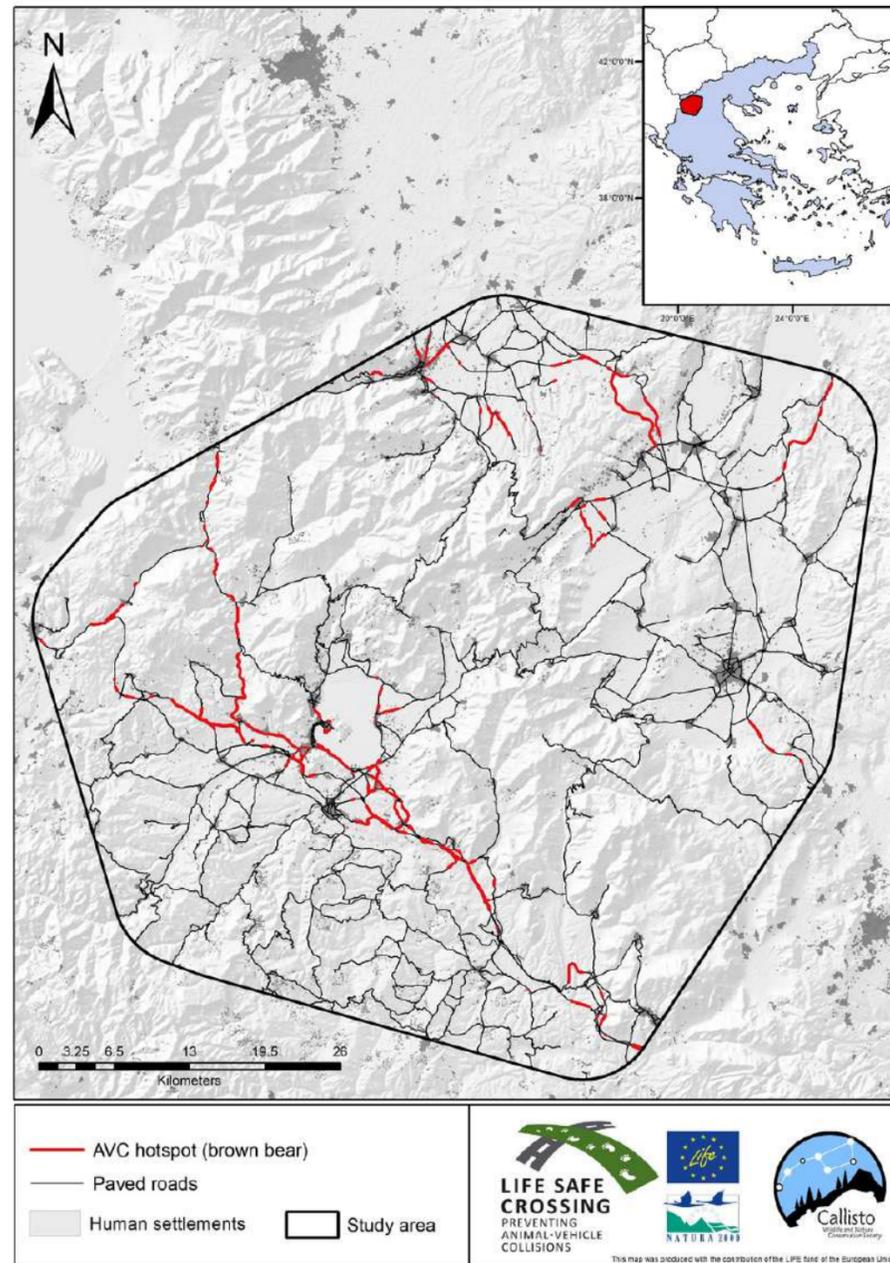
**Characterization and use of the crossing structures, to select the ones to be improved in order to favor their use by wildlife.**

All the existing crossing structures were described regarding different parameters (size, shape, use, surrounding habitat) and their use by wildlife was monitored with camera traps and by recording animal tracks. In Greece a prototype was developed to optimize data collection.

A guidance manual was also produced, which includes recommendations for the monitoring and the interventions to be made to favour the use of the crossing structures by wildlife.



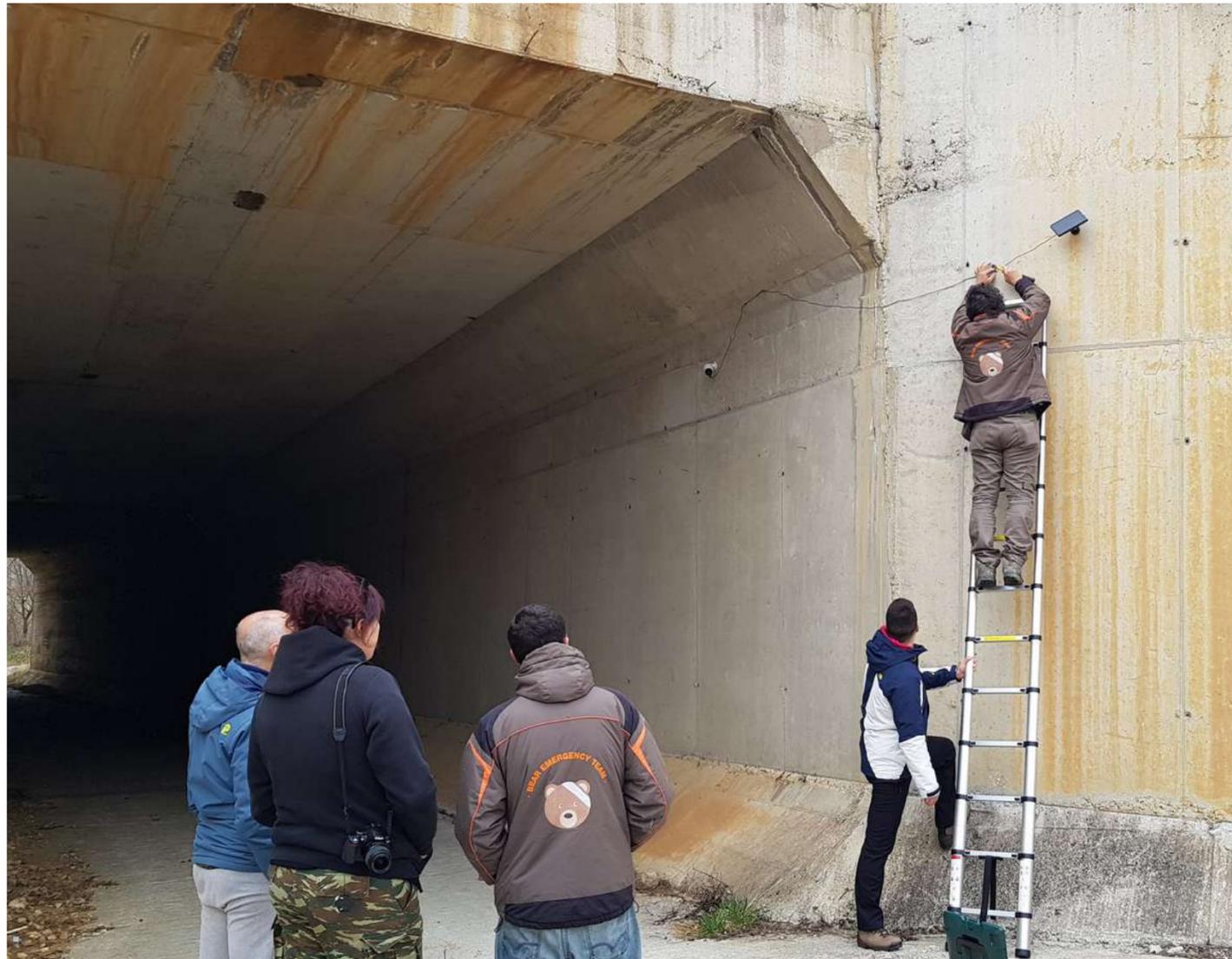
# Monitoring



## Geodatabase

All the data collected during the monitoring activities as well as the locations of the concrete interventions were stored in an online database. This geodatabase can be easily updated, therefore it represents a very useful management tool that can be used also after the project.

# Monitoring



The Greek partner COSMOTE's R&D Dept. developed an innovative end-to-end wildlife monitoring solution, which monitors the use of underpasses by wildlife, and assesses effectively the collected information (photos, videos).

This solution has been installed and validated at 45 underpasses along the Egnatia Odos in NE Greece. Since Aug 2019 more than 100.000 photos and videos have been collected and processed, and on this basis a software for real-time species detection and categorization using AI techniques has been developed.



2019/07

LIFE SAFE CROSSING  
PREVENTING ANIMAL-VEHICLE COLLISIONS

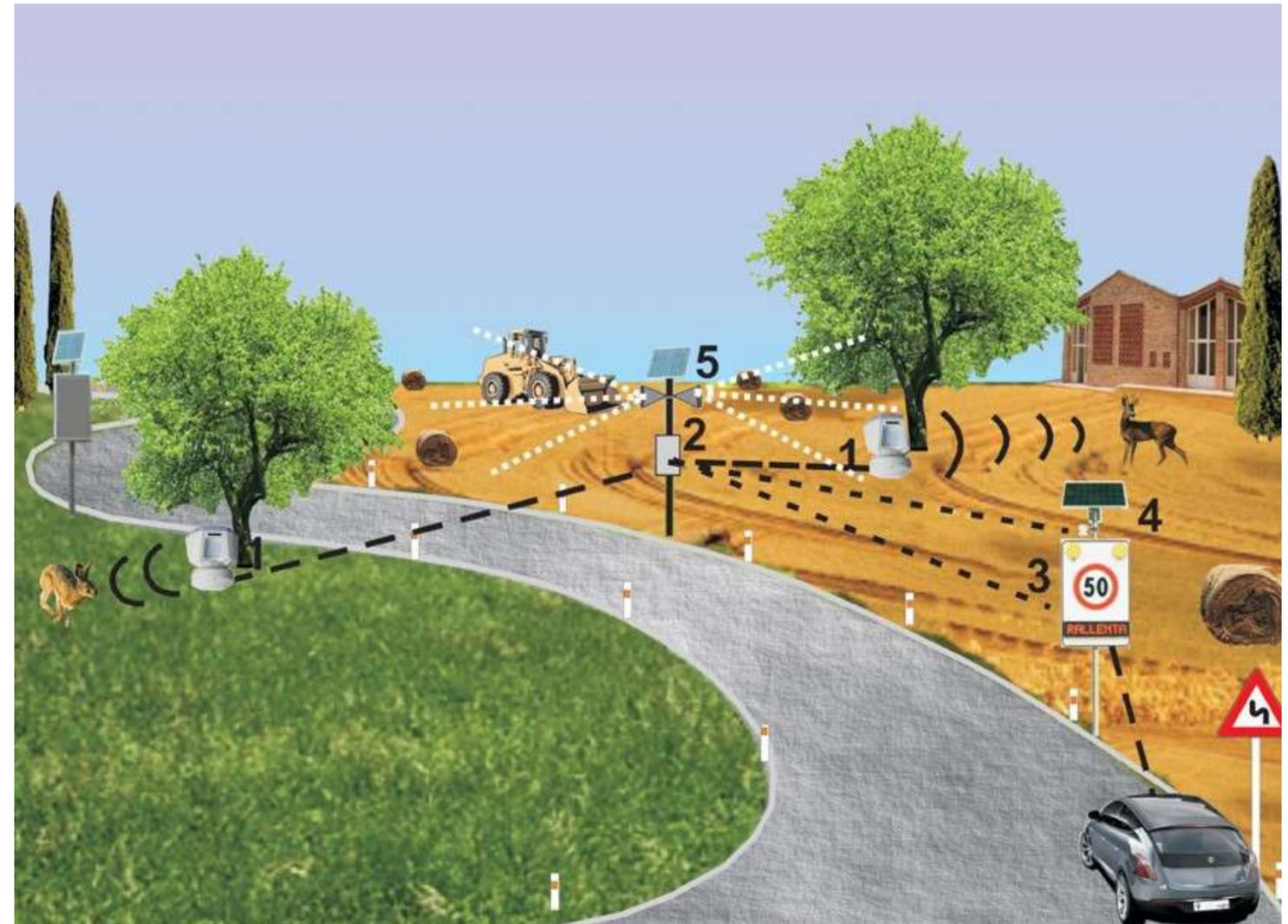
Life

NATURA 2000



# Installation of Animal-Vehicle Collision Prevention System

The AVC prevention systems that were installed have the following functioning and structure (see figure and photos): a set of Passive infrared (PIR) sensors and/or a thermic camera (1) registers the presence of an approaching animal and sends the information to the electronic control unit (2). This unit triggers an alert signal for drivers (3), inviting them to slow down. A radar doppler sensor (4) measures whether the car actually slows down to the fixed threshold speed (50 km/h). 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 (5), emitting voices from humans, dogs barking and similar, to deter the animal from further approaching the road.



# Installation of Animal-Vehicle Collision Prevention System

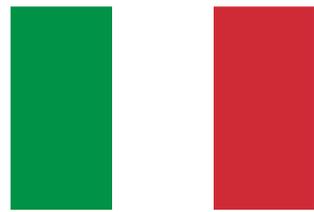
All the parts of the system are connected through a Wi-Fi network and a modem sends out an email each time a component is triggered. A specific software has been developed in order to store and classify all this type of information, and a dedicated App allows to control the system remotely in real time.

The added value of this system is that it intervenes only in risk situations, when there is the simultaneous presence of an animal on the road side and the approach of a car that proceeds at too high speed. This shall help to reduce habituation both of wildlife and the drivers, and it also does not represent an obstacle for environmental connectivity.



# Installation of Animal-Vehicle Collision Prevention System

The following AVC PS were installed:



3 in Parco Nazionale  
d'Abruzzo Lazio e Molise  
5 in Parco Nazionale della  
Maiella  
2 in Provincia di Terni



5 in Spain



6 in Greece



5 in Romania



## Installation of “Virtual Fence”

The virtual fence consists of a series of sound and light emitters, attached to posts on the road sides, and it is designed to prevent wildlife vehicle collisions. These devices are activated by the headlights of vehicles and upon activation start producing a sound and light signal, discouraging animals from crossing the road. The devices are placed on both sides of the lanes and are spaced 50 meters from each other. The simultaneous activation of the devices on a road segment actually forms a sort of virtual fence. The devices are powered by a solar panel.



# Installation of “Virtual Fence”

The following segments of virtual fence were installed:



5 km in Parco Nazionale  
d’Abruzzo Lazio e Molise  
20 km in Parco Nazionale  
della Maiella



4,5 km



7 km



# Adaption of crossing structures

Following the characterization and monitoring of over 400 existing crossing structures, interventions have been made on over 100 underpasses in order to favour their use by wildlife.

The interventions consisted in:

- Removal of garbage and debris that hinder the access of animals
- Planting of vegetation to encourage the approach of animals
- Fencing of areas near underpasses, in order to drive the animals towards the structures
- Construction of exit ramps to ease the use of structures with steep slopes
- Construction of dry ledges to better allow small and medium-sized mammals to safely cross under roads while avoiding the water inside of the culverts
- Placement of light barriers at the entrance of structures, to create a safer perception of passages
- Placement of natural materials at the entrance of structures, to create a more natural environment, especially for smaller animals



# Adaption of crossing structures



- Italy – Parco Nazionale d’Abruzzo Lazio e Molise: cleaning and construction of fences near 4 underpasses (a total of around 2 Km)
- Italy – Parco Nazionale della Maiella: cleaning of 2 underpasses and construction of fences on 2,8 km of a national road between 4 viaducts and 3 overpasses

In Spain no interventions have been made on underpasses, because this has already been made in other projects. However, in this area the road verges have been cleaned off encroaching vegetation on 27 km, in order to improve the visibility of the roadsides and therefore reduce the risk of collisions.

# Adaption of crossing structures



Greece: adaptation of 55 underpasses under the Egnatia Highway



Romania: cleaning of 30 underpasses



# Installation of Road Awareness Raising Panels

One important objective of the project was to raise the awareness of drivers about the risk of incurring in accidents with wildlife, with the scope to encourage them to drive carefully. To do this we developed specific panels that were tested with a specific “neuromarketing” technique and then installed them on the most risky road segments.

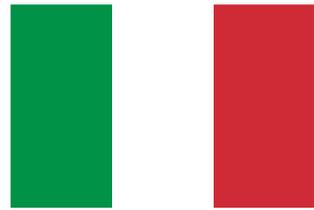
Neuromarketing is a new field of marketing which uses neuroscience technologies to study consumers' sensorimotor, cognitive, and affective response responses to visual stimuli. In a first step we produced four prototypes of road panels, which were then submitted to 36 test persons in a virtual reality setting. Specific neurological methods were used to monitor the emotional response of the test persons as well as the movement of the eyes while looking at the prototype images. These tests allowed us to identify the most effective images and to understand which graphic elements had to be changed or improved in order to optimize the visual message.

Two panels were finally chosen to be installed on the roads, conveying two distinct messages: a positive message of the presence of animals, and a negative message of the danger of accidents with wildlife not only for animals but also for drivers.



# Installation of Road Awareness Raising Panels

We installed 166 panels in the project areas, with the aim to repeatedly convey the messages and therefore raise the attention of drivers:



Parco Nazionale d'Abruzzo  
Lazio e Molise: 25;  
Parco Nazionale della  
Maiella: 60;  
Provincia di Terni: 12

24

38

8



# Awareness raising and communication activities

Communication activities have played a key role in the LIFE SAFE-CROSSING project. We have provided information and raised awareness through a vast range of activities and initiatives, including:

- Development and running of a project website as well as Facebook and Instagram pages
- Production and distribution of leaflets and posters
- Production and circulation of an itinerant exhibition
- Production and distribution of gadgets during public events and school activities
- The development and circulation of a video game
- Development of an app for the collection of data on road kills by the public
- Presentations and information during public events
- Involvement of driving schools
- Development and circulation of a short video spot and of a project video
- Media activities: press releases, articles on national and local media, presentation of the project in TV and radio programmes
- Broadcasting of a video on local TV and diffusion of a leaflet/spot with local newspapers

Besides this, emphasis was put on the dissemination of the project activities among other professionals and interest groups, and also among other public and private authorities that deal with the management of roads and the prevention of road kills, such as the Italian and Romanian road authorities ANAS and CNAIR, the international road association PIARC, the Italian Motorway Company Strada dei Parchi, Regional and Province administrations, other protected areas etc.





# The project in numbers

- 🐾 We monitored over 500 km of roads
- 🐾 We characterized over 400 crossing structures.
- 🐾 We designed 4 prototype road awareness panels and tested them on 36 test persons.
- 🐾 We installed 26 Animal-Vehicle Collision Prevention Systems
- 🐾 We installed 36,5 km of virtual fence
- 🐾 We adapted 98 underpasses and installed round 5 km of fences
- 🐾 We installed 167 road awareness raising panels
- 🐾 The project was presented in 28 TV or radio news and programmes
- 🐾 The project was reported by 100 national and local media articles
- 🐾 We disseminated the project to 400.000 persons in public events
- 🐾 The project activities were replicated in at least 12 cases
- 🐾 The final conference of the project was attended by over 100 persons from 10 countries and from North America
- 🐾 The project was presented at 16 national and international conferences





# AUTOGRILL

**RALLENTA  
LA VELOCITÀ UCCIDE**



**LIFE SAFE-CROSSING**

Il Parco Nazionale d'Autunno è un'area di protezione in tutta il mondo nel sistema di gestione del territorio. Una delle maggiori minacce per la fauna è l'habitat frammentato per cause antropiche (agricoltura e sviluppo) e, tra queste, l'insediamento di abitazioni è una delle principali.

Se in una delle regioni più selvagge d'Italia, quella del nord, si può con un'attenzione particolare, nel nostro paese, sempre attenzione è da parte per la sua sicurezza e per quella degli animali selvatici.

Gli studi di progetto vengono LIFE SAFE-CROSSING il Parco Nazionale d'Autunno e il Parco Nazionale della Maremma sono interventi più sicuri, per animali e per l'uomo, anche grazie all'esperienza.

Conoscete l'importanza e una serie di dispositivi tecnologici in grado di prevenire gli incidenti della fauna?

Vuoi saperne di più? Scansiona il QR code!



Parco Nazionale d'Autunno  
Civita Nord



# What we achieved

The activities implemented in the project have had a significant impact: the reduction of wildlife mortality on roads up to 100%, the availability of crossing structures never used before by wildlife and the increase of up to 50% of the adapted ones.

The collaboration established with road management authorities in all project countries will allow the implementation of the solutions carried out in other areas, as witnessed by the many already achieved replication cases.

The effectiveness of the 167 road panels installed was evaluated through a specific questionnaire and more than 70% of the people interviewed replied that they changed their driving behaviour after seeing the road panels, and they consider them a useful tool to reduce the risk of wildlife vehicle collisions.

In conclusion the LIFE SAFE-CROSSING project can be considered a successful project that implemented concrete interventions to improve the conservation status of the target species and the biodiversity in general, as well as the safety of drivers.



Thermal







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With the contribution of the Green Fund



Photo credits: Valentino Mastrella/PNALM, Archive LIFE IBERLINCE, Archive CALLISTO, Ramon Jurj, Angelina Iannarelli/PNALM, Mihai Fedorca

