



LIFE Project Number
LIFE17NAT/IT/000464

Final Report
Covering the project activities from 01/09/2018 to 31/08/2023

Reporting Date
31/08/2023

LIFE SAFE-CROSSING
**Preventing Animal-Vehicle Collisions – Demonstration of
Best Practices targeting priority species in SE Europe**

Data Project

Project location:	Italy, Romania, Greece, Spain
Project start date:	01/09/2018
Project end date:	31/08/2023
Total budget:	€ 4.224.070
EU contribution:	€ 3.166.364
(%) of eligible costs:	74,99 %

Data Beneficiary

Name Beneficiary:	Agristudio S.r.l.
Contact person:	Annette Mertens
Postal address:	Via Frusa 3, 50131 Firenze, Italy
Telephone:	+39 348 2290286; +39 055 575175
E-mail:	Mertens.annette@gmail.com
Project Website:	https://life.safe-crossing.eu/

1. Table of contents	
2. List of key-words and abbreviations	3
3. Executive Summary	4
4. Introduction	7
5. Administrative part	9
6. Technical part	12
6.1. Technical progress, per Action	12
6.2. Main deviations, problems and corrective actions implemented	54
6.3. Evaluation of Project Implementation	55
6.4. Analysis of benefits	68
7. Key Project-level Indicators	76

2. List of key-words and abbreviations

AMAyA - Agencia de Medio Ambiente y Agua de Andalucia

AMT – Advanced Media Technologies

ANAS – National Roads and Highways Administration

AUC – Area Under the Curve

AVC – Animal-Vehicle Collisions

AVC PS – Animal-Vehicle Collision Prevention System

CAGPYDS – Consejeria de Agricultura Ganaderia, Pesca y Desarrollo Sostenible

CNAIR – Compania Nationala de Administrare a Infrastructurii Rutiere (National Road Administration Company)

EO SA – EGNATIA ODOS S.A.

FC – Fundatia Carpati

IENE – Infrastructure Ecology Network Europe

INCDS – Institute for Research and Development in Forestry

KDE+ – Kernel Density Estimation

KPI – Key Performance Indicators

MTR – Mid Term Report

PATOM – Piano d’Azione per la Tutela dell’Orso Bruno Marsicano

PNALM – Parco Nazionale d’Abruzzo Lazio e Molise

PNGSL – Parco Nazionae del Gran Sasso e Monti della Laga

PNM – Parco Nazionale della Maiella

RWM – Region of Western Macedonia

3. Executive Summary

The LIFE SAFE-CROSSING project aimed at reducing the impact of roads on three target species: Brown bears, Iberian lynx and Wolf. It has taken place in Italy, Romania, Greece and Spain.

Specifically, the foreseen objectives were:

- To reduce road mortality of the target species;
- To reduce the level of habitat fragmentation and improve ecological connectivity;
- To increase the awareness of the general public about the phenomenon of animal vehicle collisions in order to encourage a more responsible driving behaviour.

This was done through the following steps:

- Monitoring the impact of roads on the target species;
- Mapping and characterization of the crossing structures;
- Installation of Animal-Vehicle Collision Prevention Systems (AVC PS) (developed in the frame of the LIFE STRADE project – LIFE11BIO/IT/072) and active wildlife roadside reflectors;
- Adaptation of already existing crossing structures to favour the passage of animals;
- Installation of specifically designed road information panels and implementation of other awareness raising activities.

All in all the project has been concluded successfully, although in some actions there have been some delays. After the initial kick-off and training meeting the representatives of Agristudio have carried out a row of field visits in the target areas in order to provide an initial training to the field staff on how to apply the foreseen concrete interventions (A1). In order to evaluate the impact of roads, in the frame of Action A3 all the partners provided already existing AVC data and data related to animal movements (telemetry data). All this data was analysed with the KDE+ method for the first identification of risk areas. In Action A4 over 400 crossing structures have been described and analysed, on the basis of guidelines provided by the associated beneficiary Minuartia. In Greece, an end-to-end prototype “Wildlife Monitoring, Species Classification and Visualization Solution” has been developed exclusively for the needs of the project, and was used for the monitoring and evaluation of usage by wildlife of 45 out of 149 crossing structures. On the basis of the results of Action A3, in Action A5 over 500 km of roads were regularly monitored to analyse the number and distribution of carcasses of animals involved in AVCs, the wildlife crossing trails along roadsides, the permeability (presence of barriers to animal movements) of the target road segments was analysed, and seasonal measurements of traffic intensity and speed were made. This data was then used to identify the final locations for the implementation of the concrete interventions.

All the gathered data were stored in a geodatabase, which has been produced in the frame of Action A6, along with an App that aims to involve the public in the collection of information about AVCs. The data have also been used to produce risk maps, which can be an important planning and decision-making tool also after the end of the project. The data pooling from different Apps and databases has shown to be too demanding from the technical and administrative (usage agreements) point of view.

In Action C1 26 AVC PS have been installed, one less than foreseen because in Romania one AVC PS was replaced with 2 km of virtual fence in an area that appeared to be critical and

where the virtual fence was the most suitable solution. In Romania, Spain and Greece the installation of the AVC PS has been delayed due to a row of administrative and financial problems, but eventually they are all in place and being monitored. 36,5 km of virtual fence have been installed, 2 km more than foreseen due to the up-mentioned change in Romania.

In the frame of Action C2, 98 crossing structures have been re-adapted, involving mainly the cleaning of debris, construction of escape ramps and dry ledges, planting of vegetation, installation of fences. Moreover, fences have been installed on 4,8 km length on road sides in order to discourage animals from crossing the roads.

In the frame of Action C3, 167 road information panels have been installed, 20 more than initially planned.

The monitoring of the effectiveness of these interventions (D1) has started in January 2021, basically with the counting of AVCs, activations of the AVC PS, use of camera traps, monitoring of the passages of animals in the crossing structure and submission of questionnaires in order to evaluate the effectiveness of the road information panels. In Action D2 a questionnaire to evaluate the appreciation of the project by stakeholders was submitted to a set of target persons, and the results have shown a general appreciation, although also some additional recommendations were provided. Actions D3 and D4 were developed together. An expert company was subcontracted, which made an accurate evaluation of the impacts of the project.

These activities were accompanied by a set of communication and dissemination activities. In addition to a set of awareness raising materials (leaflet, poster, gadgets, video spot) (E1) a video game has been produced (E2) which was used to raise awareness of young people and future drivers. Besides the project website a Facebook and an Instagram page were kept constantly alive and updated (E3) and the project has been mentioned in 162 media activities. In Action E4, despite the COVID-19 limitations until mid 2022, 178 public events have been made, and the awareness raising activities reached 400.000 persons. In the meantime, the project activities have been strongly disseminated through 39 networking activities (E5), in the presentation at 17 conferences (E6) and through 32 dissemination activities, which have been very successful and led to 18 replications of the project interventions (E7).

Table 1. Main outputs achieved in the LIFE SAFE-CROSSING project

Action	Output	Achieved result
A3	Identification of risk areas	Risk areas identified through KDE+ analysis, summarized in a report
A4	Identification of crossing structures to adapt	Guidelines for crossing structures analysis produced. 404 crossing structures mapped and characterized.
A5	Selection of sites of implementation of C actions	500 km roads monitored and described.
C1	Installation of 27 AVC PS and 34 km of virtual fence	26 AVC PS + 36,5 km of virtual fence installed
C2	Adaptation of over 100 crossing structures	98 crossing structures adapted to favour their use by wildlife
C3	Installation of 119 road information panels	167 road information panels installed
E actions	Info materials, video spot, gadgets, video game, documentary produced and disseminated	Leaflets, posters, gadgets produced in all project languages. Video spot available on you tube channel of the project. Video game available on App Store and Play Store. Awareness raising activities reached 400.000 persons.

		Project resented in 39 networking activities and 18 conferences and workshops. 32 dissemination activities led to 18 replications.
--	--	---

The preparatory actions have been very important to plan the interventions, in fact they have clearly indicated which are the most risky road segments and the most important crossing structures to be adapted. This, coupled with specific field surveys, has allowed to accurately identify the locations for the interventions.

The effects of the concrete interventions of the project can be considered as very significant. During the monitoring activities we have recorded a decrease of animal-vehicle collisions up to 100% on the road segments where AVC PS and virtual fences were installed. Moreover, the adaptation of the crossing structures has been very successful, with a registered increase of the use of the structures by wildlife. This is particularly significant in Greece, where we have recorded an increase of over 100% of the use of the adapted underpasses. The monitoring with camera and video traps has also shown extremely interesting footage of the behaviour of wildlife and target species using the adapted structures.

Also the results of the evaluation of the road information panels are very encouraging, with the majority of the respondents indicating that they have considered the panels positively and that their driving behaviour has changed after seeing the panels.

Another important effect of the project is that a large number of key stakeholders have been involved in the networking and replication activities, and now have an increased knowledge of potential instruments they can use to reduce the impact of linear infrastructures on wildlife. The interest of the stakeholders and authorities is demonstrated also by the big number of replications that were already recorded.

In the LIFE SAFE-CROSSING project there have not been major deviations. In Romania one AVC PS has been replaced with 2 km of virtual fence, in order to put in safety a road segment that has become problematic in the past years.

In Romania, Greece and Spain the tendering for the installation of the AVC PS has suffered a delay due to two main problems: the complex bureaucratic procedures for the tenders, coupled with a strong increase of costs of the basic materials as a consequence of the COVID-19 pandemic and the war in Ukraine. All the devices have finally been installed and, even though in Greece and Spain the monitoring activity lasted less than expected, the positive results achieved in Italy and Romania provide sufficient insight in the effectiveness of the AVC PSs. The COVID-19 pandemic has also caused some changes in the development of the E actions. During 2020, 2021 and the first half of 2022 only online activities have been possible. This has strongly delayed the development of public events (Action E4), which could not be done online. However, in the last year of the project a strong effort was made to recover this delay and finally the objective of the action has been achieved successfully.

Considering the achieved results and the problems incurred it can be said that under the given circumstances (the COVID-19 pandemic, the increase of costs of materials, the bureaucratic problems) the project has been carried out successfully and has a positive benefit in terms of reduction of the impact of roads on the target species and wildlife.

4. Introduction

Roads represent an important cause of mortality for many species and a threat for the conservation of biodiversity. This phenomenon is constantly increasing in recent years, and must not be underestimated due to the following reasons:

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

Moreover, animal vehicle collisions (AVC) represent a serious problem for drivers safety, and have a significant economic impact due to damages caused to vehicles, which have to be compensated by the public authorities where this is foreseen by the national/regional law.

In the United States the wildlife mortality due to collisions with vehicles has been estimated around one million vertebrates per day (Laslo, 1987) and the data available about Europe seem to confirm an alarming situation. In fact, in Europe it has been estimated that between 10 and 100 million birds and mammals are killed on the roads each year. According to a new computational procedure developed in Sweden, for each 10.000 km travelled by a vehicle one bird is killed. On a road with a traffic of 300 vehicles per hour, an amphibian has a probability of 18% to be killed, and a micromammal of 10% (in Guccione et al. 2008).

All the target species are affected in one way or another by the problem of increasing road infrastructure and traffic. For some the presence of roads represents more a cause of fragmentation between different areas, whereas in other areas road mortality is the most impacting factor.

The present project aimed at implementing actions to reduce the impact of roads on some priority species in four European countries: Apennine brown bear and wolf in Italy, Iberian lynx in Spain, Brown bear in Greece and Romania.

The target species are severely threatened by road infrastructure, both by direct mortality as well as by the barrier effect.

In Italy the mortality on roads of Apennine Brown bears is estimated at round 13% of all the mortality causes, representing one of the most important threats to counter, especially considering the low number of bears surviving (about 50) and the importance of ecological connectivity to favour their range expansion.

The presence of roads and vehicular traffic represents an extremely important threat for the species, and reducing its impact is one of the priority action pointed out by the PATOM (National Action Plan for the Apennine brown bear conservation) for species conservation.

In Spain the Iberian lynx has greatly benefitted from the IBERLINCE project (LIFE10NAT/ES/570), but one of the major threats for the species remains road kills. In 2014, 64% of the lynx found dead were killed on roads.

In Greece important core bear areas are interrupted by the alignment of the Egnatia Highway and of national roads, with the consequent mortality of a considerable number of specimens. Barrier effect and road kills are estimated to affect ~30% of the local bear sub-population.

In Romania in the past 5 years 20 bears have been killed only on 40 km of the main road between Brasov and Bucharest. In this country, which is planning the construction of a new motorway, the demonstration of activities to prevent the impact of infrastructures is extremely important.

It was also seen that one of the main causes of road kills is the low level of awareness and attention of drivers regarding the risk of collisions with wildlife.

The project therefore aimed at the following objectives:

- Demonstration of the use of the innovative Animal-Vehicle Collision Prevention Systems (AVC PS), which have been developed in the frame of the LIFE STRADE project (LIFE11BIO/IT/072, www.lifestrade.it) in new project areas
- Reduction of the risk of traffic collisions with the target species
- Improve connectivity and favour movements for the target populations
- Increase the attention of drivers in the project areas about the risk of collisions with the target species

The project was developed in the following areas:

Italy: Abruzzo Lazio e Molise National Park, Maiella National Park and Terni Province

Romania: Central Carpathians

Greece: Western Macedonia

Spain: Sierra Morena and Doñana National Park (Andalucía)

The core of the project was the implementation of tools for the prevention of Animal-Vehicle Collisions to new areas. This was accompanied by best practices to adapt the already existing crossing structures in order to favour the movements of animals across roads and therefore improve connectivity of the territory. The implementation of communication activities for drivers also strongly contributed to reduce the danger of road kills. Finally, in the scope of a demonstration project, a specific action was devoted to replicate the implemented activities, mainly the innovative ones in other areas. For this reason the involvement, as associated beneficiaries, of the authorities responsible for road management (EO SA, RWM, Terni province) was really important, as well as the strong relationship and collaboration with the local road authorities developed by the other associated beneficiaries not directly involved in this task.

The concrete conservation actions and the information campaigns for drivers have a significant impact not only on the target species but for the overall biodiversity of the project areas, and this is an important added value of the present project.

As was seen in the LIFE STRADE project the effectiveness of the AVC Prevention Systems is very high, reducing fatalities up to 100%. It was therefore expected that in the sites where these devices were planned to be installed the mortality of the target species would be reduced almost to zero.

But the project was also expected to impact longer road segments, by providing consistent data about risk areas, installation of the virtual fence, the adaptation of crossing structures and the installation of road information panels.

We therefore estimated that the project would have a direct impact on over 500 km in terms of reduction of the mortality of the target species on roads and of the improvement of ecological connectivity.

The strong demonstration character, including the big efforts for dissemination to other interested parties and the activities to increase replicability, has been extremely important at national level for each country to introduce important and effective management and road kill prevention tools.

Moreover, the fact that the actions were implemented in the previously identified wildlife corridors, was extremely important to guarantee connectivity between different populations.

5. Administrative part

The LIFE SAFE-CROSSING Project involved thirteen beneficiaries. Since the project covered different fields of responsibility (wildlife management, road management, infrastructures) it is logical that different types of private and public bodies were involved.

In each country public bodies were included in the partnership, which main role was to ensure the permits for the interventions on the roads as well as the long-term maintenance of the implemented actions on the ground.

In Italy two National Parks were involved (PNM and PNALM), in the other countries NGOs were part of the consortium. These organizations also ensured technical-scientific supervision at national level as well as an important contribution to the communication activities. In Italy PNM and PNALM are core areas for the conservation of Apennine brown bears and were therefore the most suitable organizations also to assure the maintenance of the interventions after the project. The Province of Terni had mainly the role of building a link with the previous LIFE STRADE Project, in order to transfer expertise acquired in the frame of that project. In Romania INCDS was involved for the great expertise in brown bear management, and this public body is responsible for the wildlife management in the country. This organization has historically cooperated with Fundatia Carpati, which also is experienced in the development of LIFE projects.

In Spain CAGPYDS is responsible of wildlife conservation in Andalucía and has been the coordinating beneficiary of three LIFE Projects targeting Iberian lynx conservation. AMAyA is a specifically dedicated Regional Agency competent for environmental protection, which has also been involved in previous lynx projects.

In Greece, CALLISTO has long experience in bear conservation and has successfully developed and implemented several LIFE projects targeting bears. Egnatia Odos S.A. (a public company responsible for motorway management) was involved because it was responsible for interventions for the adaptation of the crossing structures. The company COSMOTE S.A. provided its expertise/knowhow on state-of-the-art technologies/solutions/services and their deployment in the field, by developing an innovative end-to-end prototype solution for effective monitoring of the crossing structures and evaluation of a huge amount of photos and videos collected by the cameras, while supporting cloud-based high (automated) storage, processing and visualization capabilities and innovative tools. RWM was responsible for road management and will assure the long-term maintenance of the interventions on its roads.

Minuartia has a long curriculum in research and management works regarding the impact of roads on biodiversity, and therefore had an important function of guidance.

The project was managed by a steering group composed by the following persons:

- A general Project Manager (Annette Mertens), contracted by Agristudio, who was responsible for ascertaining that the project activities were carried out in line with all the LIFE regulations and conditions. The project manager was responsible also for communication with the external monitoring team and with EASME/CINEA and for the coordination of all reporting activities.
- A technical coordinator (Simone Ricci), who supervised and coordinated the implementation of all the technical activities between the 13 involved partners and the 4 countries, and guaranteed that these were developed in a coherent manner.
- A Financial Manager (Gloriana Aloisio), who was in charge of coordinating and supervising the administrative management of the project.

In the first year the project staff has met in a kick-off meeting and two follow-up staff meetings. After the start of the COVID-19 emergency, until summer 2022, the meetings were held online, involving the i) entire consortium, ii) only the partners of a single country, iii) single partners

according to a specific issue. These meetings were necessary to assess the development of the project, to exchange information between beneficiaries about procedures, methods and obtained results, to discuss potential problems and to plan upcoming activities until the next steering group meeting.

The main communication with EASME/CINEA was assured by the Project Manager through the representative of the External Monitoring Team, first Mr. Riccardo Scalera and then Ms. Sara Luchetti. In some specific cases where direct communication with the EASME/CINEA was needed the Project Manager communicated directly with the Project Advisor, always upon recommendation of the monitor.

As requested by the external monitoring team, the project delivered quarterly reports to the external monitor.

The financial manager of the project kept track of the project expenses with the use of a specially designed “financial monitoring tool”. This was a set of Excel sheets that provided a periodic update of the expenses for each beneficiary, broken down to separate actions, in comparison with the foreseen budget.

All changes in the technical and administrative implementation of the project were evaluated by all the members of the steering group, following a precisely elaborated communication and evaluation procedure.

A dedicated “Task Manager” (a dedicated software) was developed by Agristudio, which could be accessed by all the beneficiaries with own access codes. It was used to store all the administrative/financial and technical documentation produced and to share it with the management team.

No changes to the grant agreement have been made.

The beneficiary CMAyOT was renamed twice:

In 2019 renamed to CAGPYDS - Consejería de Agricultura Ganadería, Pesca y Desarrollo Sostenible.

In 2023 renamed CSMAEA- Consejería de Sostenibilidad, Medio Ambiente y Economía Azul. Only the name changed, no changes were made in address, bank account etc.

In 2021 The Majella National Park was renamed as Maiella National Park. Only the name changed, no changes were made in address, bank account, status etc.

Since until the MTR the partner was always called CAGPYDS, we have maintained this, and therefore this acronym is used throughout the report.

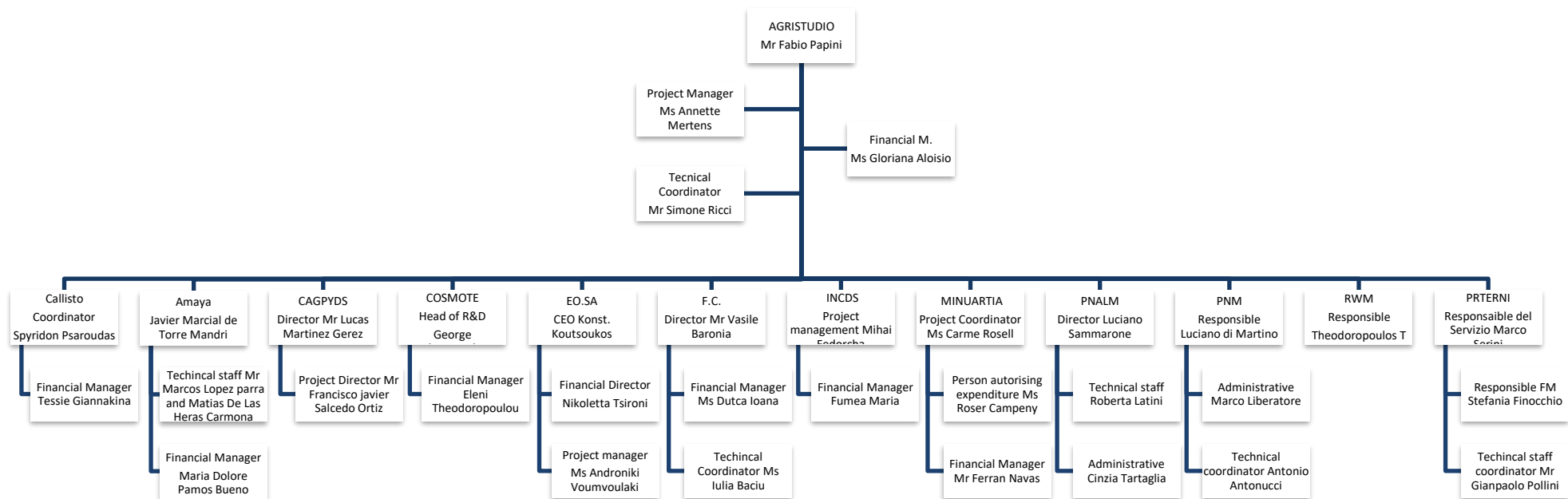


Figure 1. Organigram of the staff of the LIFE SAFE-CROSSING project

6. Technical part

6.1. Technical progress, per Action

Action A1. Kick-off meeting and initial training

Objective of the action:

The action aimed at the development of a kick-off meeting for the initial training of the technical and administrative staff of the project about the rules of implementation of LIFE Projects + training of the technical staff in the use and management of AVC PS.

Foreseen start date: 01.10.2018	Actual start date: 01.10.2018
Foreseen end date: 30.06.2019	Actual (or anticipated) end date: 15.11.2019

Progress

In November 2018 the 2-day kick-off meeting has been made in Orvieto (Terni province) as was planned, and as foreseen the technical training about project management was provided and the detailed planning of the actions was done. A half-day visit was also made to the AVC PS already installed in the Province of Terni, therefore the partners saw how they are installed, the spatial distribution of the components, the environmental/landscape features etc.

After this, due to a slight rearrangement of the action (described and justified below) the following visits to the project countries were made.

03-06.12.2018 – Greece

28-31.05.2019 – Romania

11-13.11.2019 – Spain

During the field visits the selected road segments were surveyed in the view of the implementation of actions C1 (installation of AVC PS and virtual fences) and C2 (adaptation of crossing structures). A series of important features for the implementation of both actions were analysed and discussed (e.g. size and shape of roads, surroundings, presence of barriers, size, shape and location of crossing structures etc.).

During these visits the pros and cons of all the locations for the different interventions were analysed and highlighted, and potential alternative have been discussed. It was also analysed in which locations AVC PS or virtual fences were more suitable to be installed, whether these should be combined, and what components for each AVC PS should be chosen (especially for animal detection).

Problems/changes/delays:

During the initial months of the project we realized that field visits to the single project areas would have been more productive than doing all the training in the Terni province. This was the case because the partners did have in mind some locations for the installation of the AVC PS devices and virtual fences in their project areas, but since they did not have expertise with the functioning of these devices their planning was not always fitting with the technical requirements and potentialities of the systems. Therefore, it was considered much more productive that the persons who already had experience in the work with the AVC PS would visit the project areas and help the local teams to understand how to select the intervention sites in the most suitable way.

Action A2. Preparation of the administrative basis of the project

Objective of the action:

The action aimed at preparing all the administrative procedures necessary for the implementation of the activities. Also, it foresaw the implementation of all the necessary steps (meetings, official requests, technical descriptions etc.) for achieving the permits for the interventions developed in Actions C1, C2 and C3.

Foreseen start date: 01.09.2018	Actual start date: 01.09.2018
Foreseen end date: 31.12.2022	Actual (or anticipated) end date: 31.12.2022

Progress

Initial administrative procedures:

The main coordination staff that was contracted was:

- Project manager – Annette Mertens
- Financial manager – Gloriana Aloisio
- Technical coordinator – Simone Ricci

Also other beneficiaries have finalized the contracts for the specifically dedicated staff.

As requested by EASME, the regulations for travel reimbursement and subcontracting have been gathered and analysed in order to make sure that all procedures are done regularly.

Partnership agreements have been signed between Agristudio and all the associated beneficiaries. Each beneficiary has nominated a working group.

Authorizations to implement the concrete conservation actions:

Since the beginning of the project, in each country the road management authorities have been contacted to present the project, the concrete conservation actions, and the details of the devices (AVC PS and virtual fence) to be installed on the roads.

We organized specific meetings with the local authorities in order to establish a strong collaboration with them and to understand the procedures needed to carry out the different interventions.

For this reason, we prepared a technical document in which we summarized the functioning and the technical characteristics of the AVC PS.

Action A3. Assessment of the amount and distribution of road accidents and of core areas of the target species that are interrupted by roads

Objective of the action:

The actions foresaw the analysis of animal-vehicle collisions (AVC) data and telemetry data in order to identify the most critical road segments where to plan the concrete conservation actions (Action C1, C2, C3). This action was also a preparatory action for the implementation of Action A4 and A5.

Foreseen start date: 01.10.2018	Actual start date: 01.10.2018
Foreseen end date: 31.03.2020	Actual (or anticipated) end date: 30.06.2020

Progress

The action was carried out in all project areas except Terni province, because AVC data analysis was already carried out in the frame of LIFE STRADE project.

In the first phase of the action, we collected AVC data already recorded from 1975 to 2018, and telemetry data of radiocollared bears from 2005 to 2019. Lynx telemetry data were not

analysed, because a specific analysis has already been made in the frame of a previous life project (LIFE IBERLINCE - LIFE10NAT/ES/570) (Illanas et al 2017).

Overall, we collected 722 AVC data regarding all the different wildlife species, but we included in the analysis 515 AVC data because we excluded the data registered before 2009 and the ones including birds, reptiles, rodents, insectivores, and unknown species. We also excluded those points located more than 50 m from the roads.

AVC data and road crossing points were analysed using KDE+ method (Bill et al 2013). This method allowed us to identify AVC clusters (hotspots of road mortality) and crossing point clusters (hotspots where crossing points are mainly concentrated).

Totally 46 AVC significant clusters (hotspots) were identified in the 4 project countries; 16 out of these 46 were 'high reliability clusters'.

From the analysis of telemetry data, 141 significant road crossing points 'high reliability clusters' of target species were identified (all of them described as significant with high reliability).

In the frame of this action, we also carried out a specific analysis to identify the area most used by the radio-collared bears. This was another useful tool to identify the priority areas where to apply the mitigation measures.

This action was very important because we used a standard approach to select the area where to apply the mitigation measures, and this approach can be used in other areas also beyond the end of the project.

The results of the action A3 were also stored in the geodatabase developed in the Action A6.

All these data are explained in major detail in the technical report (available on the project website).

Action A4. Analysis and mapping of existing crossing structures for potential use by the target species, and other interventions on the roads

Objective of the action:

The action aimed at identifying, characterizing and monitoring the existing crossing structures in the target areas, in order to select the ones to be adapted in the frame of Action C2 to favour their use by the target species. The production of specific guidelines on how to carry out the characterization of the existing crossing structures and the selection of the interventions to be undertaken to adapt them as wildlife crossing was also realized.

Foreseen start date: 01.01.2019	Actual start date: 01.01.2019
Foreseen end date: 30.06.2020	Actual (or anticipated) end date: 31.12.2020

Progress

The first phase of the action was devoted to the production, by the partner MINUARTIA, of a specific field form to characterize the already existing crossing structures. A specific database was also created to store all the data collected. This first step guaranteed the standardization of the approach in each project country. The field form and the data base were then included in a guidance manual, which also includes recommendations for the adaptation of crossing structures.

Overall, in the project area 404 crossing structures were mapped and characterized: 149 in Greece, 127 in Romania, 87 in Majella National Park, and 41 in Abruzzo Lazio e Molise National Park. 387 out of the total 404 crossing structures were included in the database, because the remaining 17 had to be reviewed with respect to some parameters.

A sample of the crossing structures characterized was monitored through the use of the camera traps to evaluate their use by the target species and by the other wildlife species. This monitoring activity in Greece was carried out through the use of the prototype developed by COSMOTE. This prototype allowed not only to monitor the use of the underpasses but also to store and process automatically the videos and photos collected by the installed cameras and extract -practically in no time- statistics (graphs) on a per species and/or on a per underpass basis. It is worth noting that during the course of the project over 100.000 videos and photos were collected and processed.

On the basis of the results obtained, we were able to define the crossing structures and interventions needed to favour their use by the target species, and therefore we set the basis for the implementation of C2 action. The selection process was based following the guidelines produced by Minuartia in the frame of this action.

For the selection of the structures to be adapted in the frame of Action C2 the evaluation of the results of Action A3 was fundamental. We first considered the distribution of AVC clusters (hotspots of road mortality) and crossing points clusters (hotspots of road crossing) as well as the analysis of the area used by the target species. We focused on those structures that were located around these critical areas for the target species because favouring their use could enhance habitat connectivity and reduce road mortality.

Problems/changes/delays:

The end of the action was postponed by 6 months in order to ensure a whole year of monitoring of the crossing structures and to overcome the interruption of the field activity due to Covid 19 restrictions.

Action A5. Description of target road segments, identification of crossing points used by animals and analysis of traffic volume and speed

Objective of the action:

The aim of the action was to characterize, monitor wildlife road mortality and traffic volume along selected road segments in the project area. The results obtained represented the basis to define the sites for the installation of the AVC PS and virtual fence (Action C1).

Foreseen start date: 01.01.2019	Actual start date: 01.03.2019
Foreseen end date: 30.06.2020	Actual (or anticipated) end date: 30.12.2020

Progress

In each project area we selected specific road segments to be monitored in order to evaluate:

- Presence and distribution of barriers to animal movements
- Road mortality
- Crossing points used by wildlife
- Traffic volume and vehicle speed

The selection of the road segments to be monitored were based on the results of action A3, (inclusion of the AVC clusters and crossing points clusters), but also on the basis of previous knowledge of the target species (e.g inclusion of ecological corridors)

Overall, we monitored 504,19 km of roads around 100 km more than was originally foreseen in the project proposal.

The length of the selected road segments in in each project area is the following:

- Greece: 37 km

- Italy: 185,3 km Majella National Park; 49,2 km Abruzzo Lazio e Molise National Park, 21,29 km Terni Province
- Romania: 120 km
- Spain: 91,4 km

The field activity started in March 2019 and lasted until September 2020.

The analysis and the integration of the results of all the activities carried out in the frame of this action were the basis to select the sites for the installation of the AVC PS and virtual fence devices, because, starting from the results of Action A3, we were able to define, at a very detailed scale the most suitable location for the mitigation measures. The results obtained were compared with the ones obtained after the installation of the prevention devices to measure their effectiveness.

Action A6. Set-up of a geographic database of the road kills and development of a hybrid app that provides real-time feedback to users

Objective of the action:

This action aimed at developing a geodatabase about wildlife road mortality, a road mortality risk model to elaborate risk maps, and an App to collect data about AVCs from the general public.

Foreseen start date:	01.04.2019	Actual start date:	01.04.2019
Foreseen end date:	30.06.2023	Actual (or anticipated) end date:	31.08.2023

Progress

1) Geodatabase

The development of the geodatabase started in June 2019 with the definition of the general structure and the types of data to be stored in it. The second phase was the import of data collected by the project partners.

The sections of the database are the following: Animals found dead on the roads; AVC Clusters; Crossing structures; Crossing points; Crossing points clusters, the location and components of the installed AVC-PS, the location of the virtual fence, the location of road panels and the adapted crossing structures. For Greece we added a section dedicated to the results collected through the use of the prototype developed by COSMOTE.

This database is a useful management tool because all the data is immediately visualizable in a map, and the database can be easily updated.

2) App

The App is a user-friendly application to record the animals found dead on the road as well the ones observed near them. The aim of this tool is to raise awareness of the general public toward the impact of vehicular traffic on biodiversity, through the involvement in the monitoring activity. The App is available in Play Store and App Store at the following addresses:

Android: <https://play.google.com/store/apps/details?id=com.amtitalia.lifesafecrossing>

iOS: <https://apps.apple.com/it/app/life-safe-crossing/id1488478071>

Until now the App has reached 180 downloads.

3) Road mortality risk model and risk maps.

The AVC data collected and the telemetry data (the same ones used in Action A3) were used to produce a “road mortality risk model” and a “crossing point probability model”.

4) Regarding the planned attempt to encourage the pooling of data coming from other Apps and databases, initially we have made a search of the potential initiatives that could be involved in this attempt. We have come up with a list of 21 Apps and databases from all over the world. The contact persons have been contacted twice with specific communications, in which we explained the aim of the project and this initiative and asked for demonstrations of interest in sharing the data into a common data set. Unfortunately, through exchanges with some of these persons, as well as with the subcontractor AMT, it appeared clear that pooling the data was too demanding from the technical point of view, and besides this there would be complicated implications of data ownership, which would have required complex data use agreements. It appeared evident that the initiatives we contacted were unwilling to face lengthy and demanding technical and administrative procedures, even if they recognized the importance of our aim and they agreed to share their data even if the pooling was not possible. Therefore, the attempt of a common data set has finally not been successful. This does however not decrease the importance of the App developed in the frame of the LIFE SAFE-CROSSING project, because its main goal was to involve and to raise awareness of people about the impact of linear infrastructures on biodiversity.

This replies to Issue 9 of the CINEA letter of 20.05.2022.

Action A7. Development, with use of an innovative technique, of road panels to raise the attention of drivers on the risks of vehicle collisions with animals

Objective of the action:

This action foresaw the development of effective road information panels that should invite drivers to adapt their driving behaviour to the local conditions. This was done with the use of the Neuromarketing technique, in which draft panels were tested with a selected number of test persons.

Foreseen start date: 01.01.2019	Actual start date: 01.01.2019
Foreseen end date: 30.06.2020	Actual (or anticipated) end date: 30.06.2020

Progress

In an initial phase of the action the subcontractor Carsa Edizioni has prepared 4 different proposals of images for the panels, with four different slogans. Each version was produced for bear, lynx and wolf, and in all four project languages: Romanian, Greek, Italian, Spanish. In Total, 36 versions were prepared.

In November 2019 the prototypes were tested on 32 test persons, belonging to the four nationalities of the target countries were identified: 8 Romanian, 8 Greek, 8 Spanish, 8 Italian. The test consisted in showing the different panels to the test persons while applying specific neuroscience tests, which provided information regarding the emotional reaction of the persons as well as on how the different graphic features of the panels had to be modified or improved in order to optimize the message.

Finally, for all the project areas it was chosen to install two different versions of the panels in order to have two different messages that complement each other.

A technical report, available on the project website, explains how the road panels were developed and selected by the project beneficiaries and describes in detail the methods used for testing them and the results.

Action C1. Installation of innovative AVC prevention systems and accompanying measures

Objective of the action:

The action foresaw the installation of 27 AVC PS and 34 km of virtual fences in the four project countries:

Italy: 10 AVC PS + 25 km virtual fence

Romania: 6 AVC PS + 5 km virtual fence

Greece: 6 AVC PS

Spain: 5 AVC PS + 4 km virtual fence

Foreseen start date: 01.01.2020	Actual start date: 01.10.2019
Foreseen end date: 30.06.2023	Actual end date: 31.08.2023

Progress

The selection of the sites where to install these prevention tools was based on the results of Actions A3 and A5. The AVC PS and the virtual fence were installed in the most risky areas (hotspots) considering the road mortality data, the crossing points used by the target species, the characterization of the road segments, and last but not least the ecological importance of the areas for the target species.

Installation of AVC PS

The installation of AVC PS was one of the core actions of the project. This task needed a huge amount of work not only from a technical point of view but also from the administrative one. On all the countries detailed public tenders had to be made in which, for each system, we had to specify the necessary components on the basis of specific environmental characteristics of the site.

For each site several field surveys were carried out prior to the installation of the AVC PS, to identify the paths used by wildlife to approach the road and to define the exact position of the central unit as well as the flashing light panels for drivers. These surveys were made also with the personnel of the road management authorities to confirm that the selected positions respected the national legislation.

Totally 26 systems were installed in the frame of the project: 10 in Italy (3 in PNALM, 5 in PNM and 2 in Terni Province), 5 in Romania, 5 in Spain and 6 in Greece. In Romania, with respect to what was foreseen in the project proposal 1 AVC-PS was replaced by 2 Km of virtual fence (see below), because during the project implementation a new critical area was identified, where the virtual fence was the most suitable solution to prevent wildlife road kills there (for more detailed information see section “Changes”).

On the pole of the central unit an explanatory panel, with LIFE and Natura 2000 logos, was installed also to avoid potential vandalism actions. This panel explained that the system is a tool to prevent wildlife vehicle collisions and not to make fines to charge the drivers with fines.

The composition of the different AVC PS was adapted to the local conditions of the singles installation sites, therefore depending on the characteristics of the site we included PIR sensors or thermal cameras, or both of them. The type and the number of the above-mentioned components were chosen to maximize the detection area used by animals to approach the road.

Check and adjustments of the AVC PS functionality

Once the installation of the systems was finalized the monitoring of their functioning was made remotely

- with the use of a dedicated App, which was specifically produced for the monitoring of the systems,
- through systematic field surveys, during which we defined the setup of the components as well as the detection area of the PIR sensors and of the thermal camera.

Important tests were made in Maiella National Park where the AVC PS were firstly installed. To test the detection area of the PIR sensors we used camera traps and we also used a dog of around 10 Kg to define the height above the ground the devices had to be placed in order to detect smaller animals. Similar trials were made where thermal cameras were installed to check if the detection area effectively covered all the potential areas used by wildlife to approach the road. The experience gained in Maiella National Park was then used in the other project areas where the installation of AVC PS occurred later.

Adjustments in the number/position of the PIR sensors as well as in the use of thermal cameras were made throughout the action implementation basing on the knowledge acquired during this “testing phase” as well as on the results of the monitoring activity implemented with Action D1. This “adaptive” approach was a key factor in maximizing the effectiveness of the devices.

The remote control done using the specific App allowed to download videos, to check in real time the proper functioning of the system and to intervene in case of a problem (e.g. low battery charge of the central unit, communication between the central unit and the flashing light panels, internet connection for data transmission).

The technical problems were solved replacing the batteries, and installing more performant antennas where there were problems in the transmission of the signal between the components of the system. Regarding data transmission, in Italy we had problems, especially in one AVC-PS in PNALM where the internet coverage is very poor, and in one AVC-PS in Terni province related to the national switch to 5G network. This meant that we had no data about the activations of the AVC-PS for some periods, but, overall, we were able to monitor the functioning and the effectiveness of the systems.

The data collected in all project areas, through the analysis of the activations of the systems, as well as the snapshots and videos of the thermal cameras and the videos of the camera traps showed the effectiveness of the AVC-PS, in fact we had a significant decrease of up 100% of the road kills after the installation of these prevention tools (see Action D1).

The AVC-PS were able to detect smaller animals (like hare and mustelids and also small rodents) as well as larger ones (like ungulates and large carnivores).

Some of the videos filmed by the thermal camera of the AVC-PS were uploaded in the Youtube channel (https://www.youtube.com/channel/UC2X_eM5uRV0OcY2_9Jn0Rtg) of the project, as well as the Instagram page.

2) Installation of Virtual fence

The action started in October 2019 when the staff of the coordinating beneficiary and the representatives of PNM, PNALM, INCDS and FC went to Vienna for a two-days meeting (1-2 October 2019) with iPTE an Austrian company that produces the virtual fence.

During this visit we made a field survey to see the functioning of the devices installed on the road. This was particularly useful in order to understand how this mitigation measures had to be installed in the frame of the project.

In the project area 36,5 Km of virtual fence were installed: 25 Km in Italy (5 in PNALM and 20 in PNM) , 7 Km in Romania, and 4,5 Km in Spain. The installation of the virtual fence was authorized by the local management authorities.

The details of the installation in each country are the following:

PNALM: The total length of the virtual fence installed, as was foreseen in the project proposal, was 5 Km. The installation started the 11/05/2021 on the SP 17, and the following days on two road segments of the road SS 83. In March 2023 all the devices were moved from SS83 to SP 17, because on the SS 83 some devices were damaged and some were stolen, for this reason it was decided that was more useful and effective to concentrate all of them in one single area. The devices were all mounted on the posts already present on the road sides.

PNM: The total length of the virtual fence, in line with the project proposal, is ~20 Km. The preparatory phase of this intervention was particularly demanding as all the barriers of the selected road stretches (guard rails, poles, walls etc.) needed to be checked meter by meter in order to purchase the correct supports for the devices to be installed.

After a thoughtful evaluation of the needed materials and the finalization of the purchasing procedure, the Virtual Fence (VF) installation started on June 2022 when about 9.5 Km of wireless/regular VF were installed along the SS487 and the SS17 in two of the most critical road stretches identified through actions A5-A3 where 1 AVC cluster and 3 (out of 8) AVC “high sureness” clusters had been identified and where 1 AVC PS was also already installed (Majella 2). By October 2022, 3 additional Km of wireless/regular VF were installed along the SS487 and SS17, again two critical road stretches identified through actions A5-A3 where 2 AVC “high sureness” clusters had been identified and where the 3 AVC PSs named Majella 1 and Majella 4 were already installed as well. At the end of 2022 12.5 Km out of the 20 Km foreseen (~ 60%) of VF were installed in all the most critical road stretches identified with Actions A3-A5 also complementing 4 out of the 5 AVC PSs installed.

The remaining ~7.5 Km were supposed to be installed along the SS5 and along the “Altopiano delle Cinquemiglia” on the SS17 in order to also complement the AVC PS Majella 3. Due to problems explained in the following section, the location of the remaining VF had to be partially changed. In spring 2023, about 3 Km of VF were installed along the same road (SS17) but in another critical area where also one “high sureness” AVC cluster had been individuated with Action A3 while the remaining 5 Km of VF (wireless/regular) were installed along the SS5 as foreseen. PNM is the only project partner that installed the wireless connected devices, special chains of VF units where only the first (or the last) device needs to be activated by the car lights while the devices in the middle are triggered through the wireless connection. These special chains are specifically designed to maximize the VF activation and functioning in curvy road segments where the activation of the regular devices is affected by non-optimal angles between the device and the car lights.

Romania

The total length of the virtual fence installed was 7 Km respect to 5 foreseen in the project proposal.

The first 2 Km of virtual fence was installed on DN1 road, in the municipality of Timisul de Jos (sector Romania 1), the 20/07/2020, and another 1 Km was installed the 13/06/2022 to increase the area covered by this prevention tool.

In the municipality of Persani, on the E68, DN1 Brasov-Vladeni road (sector Romania 5) 2 Km of virtual fence was installed on 24/03/2022. T.

In relation to the number of road kills registered on the DN 11 road in the municipality of Prejmer, 30 roe deer and 5 bears road killed from 1/01/2022 to 1/01/2023, we decided to install there, on the 27/07/2023, an additional 2 km of virtual fence. These 2 Km of virtual fence replaced 1 AVC-PS originally foreseen in the project proposal. This choice was communicated during the last monitoring visit in Romania (28-29/03/2023). For further explanation see below, in section “Changes”.

In Romania the installation of the devices requested the installation of specific poles, because on the roads there weren't posts where to attach the unit. At the beginning and at the end of the road section where the virtual fence was installed, two panels explaining the intervention were placed on the device posts.

Spain: The total length of the virtual fence installed was 4,5 Km with respect to 4 foreseen in the project proposal. The installation was made on 9/09/2022 on A 312 road in the municipality of Vilches. The devices were all mounted on the posts already present on the road sides.

The installation of virtual fence was not foreseen in Greece, where the virtual fence was installed in the frame of LIFE AMYBEAR PROJECT, and in Terni Province where, on the basis of the experience gained during LIFE STRADE project, they decided to install only AVC-PS.

Check and adjustment of the virtual fence functionality

The degree of functioning of the devices was good, and during our checks only a minor percentage (5-10%) of the devices showed problems.

The main problems that occurred were related to some devices stolen or they were damaged during cleaning of the road, especially in spring when vegetation cutting was carried out, and in winter after the snowfalls.

After the first installation of the devices, checks have been implemented travelling the road segments at night in order to see if the devices were correctly triggered by the headlight of the approaching vehicles and to check if all of them were actually working. In case of recorded problems, daylight checks of the units were implemented, verifying if the battery was charging, evaluating the position of the devices, and replacing the units if not working.

The degree of functioning of the devices was good, and during our checks only a minor percentage (5-10%) of the devices showed problems.

The only problems that occurred were related to some devices stolen or damaged during cleaning of the road, especially in spring when vegetation cutting was carried out, and in winter after the snowfalls.

Problems/changes/delays:

1) Thefts of the components of the AVC-PS were very limited (3 sensors in an AVC-PS in PNM, where the system was in place for around 3 years, and 1 in Spain) and didn't affect the action implementation. In the case of the thefts of the units of virtual fence, these were also limited and the devices were promptly replaced.

2) In Romania one of the 6 foreseen AVC-PS was replaced with 2 km of virtual fence in the area of Prejmer (SCI ROSCI 0170). This was decided because it was recorded that from 1/01/2022 to 1/01/2023, 30 roe deer and 5 bears were killed on that road segment. The road

segment crosses a piece of forest of 350 ha, where the presence of bears has increased only lately. This forested area is located on the plain north of the town of Brasov, which is surrounded by mountain areas. It can be considered as a sort of stepping stone between the different forested areas where the foreseen intervention areas are located.

The area is particularly important for bears because this species has re-appeared in this area only in 2019, and now it is a site of significant importance for bears due to the up-mentioned reason.

Therefore, this area is of great importance for the local bear population, and considering the number of bears killed on that road segment it appeared evident that an intervention was urgently needed. The installation of an AVC PS was not adequate in that area because the road segment is too long to be covered by such a tool.

The virtual fence was installed on 27.07.2023. Taking into consideration the fact that in other areas where we had installed the virtual fence previously, we did not have any accidents, we consider this as a valuable thing to take into consideration.

Action C2. Activities to enhance connectivity between core areas through readaptation of underpasses and interventions on roadsides

Objective of the action:

The aim of the action was the adaptation of existing crossing structures to reduce habitat fragmentation in order to improve ecological connectivity for the target species. In Spain, where the interventions on crossing structures were already made in the frame of a previous life project, LIFE IBERLINCE, the aim of the action was the management of road verges to increase drivers’ visibility, in order to reduce the road kills of Iberian lynx. This action was not implemented in the province of Terni, where there are no crossing structures along the selected road segments.

The interventions foresaw in the project proposal were the followings:

Italy: 7 crossing structures adapted on the SS 83 road (PNALM); 12 fences on SS17 road and 3 crossing structures cleaned on the SS 487 road (PNM)

Romania: 30 crossing structures adapted

Greece: 50 crossing structures adapted

Spain: Vegetation clearance on most critical road segments

Foreseen start date:	01.01.2020	Actual start date:	01.06.2019
Foreseen end date:	30.06.2023	Actual end date:	31.08.2023

Progress

The selection of the crossing structures to be adapted to favour the use by the target species was based on the results gathered in Actions A3 and A4, while the interventions to be made followed the criteria indicated in the guidelines, always produced in the frame of A4 Action.

Romania

The Action started earlier than was foreseen in Romania where the interventions on the crossing structures began in June 2019. The 30 crossing structures, selected to favour their use by the brown bears as well as the other wildlife species, were located 5 in the road segment D13 Pandurea bogatii (Romania 4), 15 in DN 1 National road Brasov-Comarnic (Romania 1), 5 in, DN1A Cheia-Brasov road (Romania 3) and 5 in E68, DN1 Brasov-Vladeni road (Romania 5).

The main Interventions carried out for each crossing structure were: cutting and managing vegetation in order to guide the animal toward the entrances of the structure, removal of

debriefs brought by water and removal of garbage in order to allow animal's passages. Each intervention was carried out by a team of 20 people and lasted around 5-7 days.

The interventions on the 30 crossing structures are carried out on a seasonal basis and a total of 60 interventions were made for the selected crossing structures. Most of the interventions consist of collecting the garbage, 30 of them were carried out in the busiest sector of the project, Romania 1 (DN 1 National road Brasov-Comarnic), where people coming from Bucharest on the weekends, use the road as a garbage bin. In the other 3 sectors (Romania 3, 4, and 5), most of the interventions were carried out twice per year and consisted of cutting the vegetation that was blocking the entrances and also the removal of objects that were carried by the high waters, after a heavy rain, usually at the start and the end of summer.

During the interventions all animal tracks were recorded in order to evaluate the effectiveness of the action implementation. As was foreseen in the project proposal the use of 20 out of 30 adapted crossing structures were monitored through camera trapping. In a first phase we used basic camera traps while in March 2022 we installed Reolink cameras that send videos through a SIM card and can be checked remotely. A lot of interesting videos were collected demonstrating the effectiveness of the interventions carried out.

In order to ensure the continuity of this action after the end of the project an agreement was made between INCDS and the road authority, in this way the 30 adapted structures will keep cleaned thus ensuring the ecological connectivity in the long term.

Greece

The crossing structures to be readapted, located along the Vertical Axis A29 of the Egnatia Highway, were 55, in respect of the 50 foreseen in the project proposal. This increase was possible due to a precise definition and planning of the necessary interventions to be carried out, occurring in the frame of Action A4.

On 24/10/2020 EOSA organized a meeting with the authorities from the Prefecture of Kastoria, concerning the permits for the interventions.

The authorities involved with the interventions that were asked for their approval, were:

- Region of Western Macedonia, Dept of Roads
- Region of Western Macedonia, Dept of Roads of Kozani Prefecture
- Region of Western Macedonia, Dept of Roads of Kastoria Prefecture
- Municipality of Argos Orestiko (Prefecture of Kastoria)
- Municipality of Voio (Prefecture of Kozani)
- Municipality of Kastoria (Prefecture of Kastoria)

The official approval for the interventions were sent by all authorities between November and December 2020.

The works to adapt the crossing structures started in September 2021 and were finalized in spring 2022. From an administrative point of view EOSA included these works in a bigger pre-existing contract for maintenance works, instead of making a new tender which would request a lot of time with the possible delay of the action implementation.

The interventions realized were the following:

- Planting: basic interventions for the provision of natural conditions and increase attractiveness around the entrances of the structures. A total of about 7.000 native plants were planted in 41 crossing structures; the intervention included the construction of an irrigation system, as well as the construction of a protective fence, in areas with livestock around. The plants used were *Cotinus* and *Spartium*.
- Pruning: to improve approachability of the structures; this intervention was made in 14 crossing structures.

- Cleaning/Debris removal: to improve openness index and approachability of the structures. This intervention, in many cases, required the use of mechanised vehicles and excavators to remove soil and all obstacles that prevented or hindered access to the structure. Overall, this kind of intervention was made in 29 structures.
- Construction of stairs/ramps: to allow/improve the use of the structures by bears and other wildlife. This intervention was realized in 8 structures (12 stairs/ramps), where the presence of a wall impeded the passage of wildlife.
- Construction of dry ledges: to improve the structure use, especially by small mammals, in case of water flow. Dry ledges were built in 4 structures (5 ledges), the length of the ledges was between 50 and 90 meters, while the width was 1 meter.
- Correction of existing high fence: to improve the structure entrance approachability, in order to guide the animals directly into the structure. Fence improvements were made in 12 structures, and a total of around 300 meters of fence were installed.
- Installation of light screens: in 10 structures, light screens, made of thick plastic used in playgrounds, were installed to create a safer perception of the structure entrance for wildlife.
- Adding natural material: to guide the animals towards the entrances of the structures. Woods and rocks were placed near the entrances, and this was especially important for small mammals. This kind of intervention was made in 8 structures.

These interventions not only increased the use of the existing crossing structures by wildlife, but in several cases, they resulted in the creation of new safe passages to cross the highway. This was possible because the removal of debris made it possible to pass through these crossing structures that were previously completely obstructed. The same effect was achieved with the construction of stairs/ ramps that allowed the use of the crossing structures, which was previously impossible.

The effectiveness of the interventions carried out was witnessed by the videos collected through the installation of the prototype developed by COSMOTE.

The results obtained were extremely important, because they really improved the ecological connectivity for the bear and other wildlife species.

Italy:

PNALM: The interventions were carried out on 2 crossing structures along the SS83 road, 1 along the SS17 road, and the remaining one along the SP 17.

A preliminary intervention, concerning the cutting of vegetation to clear the entrances of both crossing structures along the SS83 road was carried out in 2019. In summer 2019 was also organized the removal of fruit from the road, always along SS83, in collaboration with volunteers. Unfortunately, this action could not be repeated in 2020 due to Covid-19 restrictions. The presence of fruit along the road is a big problem because it attracts bears therefore increasing the risk of a road accident.

The two structures along the SS83 road were both culverts, one at the 55,800 Km called Casone Antonucci, the other at the 54,600 Km called Crugnale.

Casone Antonucci: the intervention started in September 2021 and was finalized in July 2022. The work mainly consisted in the removal of debris around the entrances and the installation of a metal fence to guide the animals toward the structure. The fence was a rhomboidal net, stretched by spinning n. 5 transversal cables placed respectively 1 at the foot, 1 in the middle and 3 in the upper part. The galvanised tubular posts, spaced 2,5 meters between them, had a height of 2.50 m. above the ground, including the anti-burglar fold inclined at 45 degrees. The total length of the fence was around 450 meters.

The fence was checked regularly, especially the lower part to close some holes that had been created by the passage of wild boars, as the rocky terrain had prevented the net from being buried. The holes in the net were closed with natural material and the use of metal pickets.

Crugnale: the intervention started in September 2021 and was finalized in July 2022. A wood fence was installed to guide the animals toward the culvert. The wood poles had a section of 10-12 cm and were tied together. All the obstacles at the entrances of the structure were removed and natural substratum was added in order to increase the approachability of the culvert. In August 2022 a metal fence was added to the wood one in order to better guide the animals, increasing the total length of the fence.

The third intervention was the installation of a metal fence along the SS17 road (Km 146,100) where a female bear was killed on the road in December 2019, and where 1 AVC-PS was installed in April 2021.

The intervention started in July 2022, the entrances of the crossing structure were cleared of bushes and a metal fence was installed on both sides of the road. The total length of the fence was around 1200 metres. The installation of the fence was co-funded by WWF and Salviamo l'Orso, this made possible to cover a larger area. The intervention was completed in October 2022.

The fourth intervention was the removal of vegetation from the entrances of the crossing structure on the SP 17 road near the junction with SS83 road where one of the 3 AVC-PS was installed. This intervention was carried out in July 2023 in order to better secure the area.

PNM: Through the implementation of Action A4 all the existing crossing structures have been characterized and the analysis of this data together with the ones collected with the other A actions, allowed the individuation of the priority crossing structures to be adapted for use by bears. The analysis confirmed what was reported in the proposal, individuating the SS17, specifically the road stretch Pettorano S.G. –Roccaraso, as the priority area of intervention given the presence of several existing viaducts/tunnels and giving its importance in term of connectivity between the bear source population and the PNM. Along the SS487 the only necessary intervention was instead the cleaning of 1 viaduct and 1 underpass where the entrances were completely obstructed. Removal of vegetation and debris was carried out in spring 2022 by the Park personnel together with the volunteers of a National volunteering program (Servizio Civile Universale) making them accessible to wildlife. The intervention was then repeated the following year.

The intervention along the SS17 consisted in the installation of metal fences on both sides of the road to invite wildlife to use the existing crossing structures. After the implementation of the preliminary actions, 4 priority areas of interventions were identified but due to budget issues (addressed also using PNM own funds) only one of them could be actually addressed. The exact location actually chosen is the one where the maximum number of existing crossing structures could be adapted with the available budget thanks to the high density of crossing structures (7 in ~1.2 Km) and the presence of existing barriers already working as “invites” to use the crossing structures rather than crossing the road (e.g. high walls). The careful analysis developed (both at an economic and technical level) and the use of additional PNM funds allowed the installation of ~1.5 Km of fences that, together with the existing barriers, made ~3 Km of SS17 became a “safe crossing” for bears in one of the most important corridors for the bear range expansion (Ciucci et al. 2017). The intervention consisted in the installation of electro-welded, galvanized and plastic-coated wire 5x7.5 cm mesh, 2 mm wire, supported by galvanized tubular posts with a diameter of 60.00 mm, placed at a distance between centers of no more than 2.50 m. The height of the net from the ground is 2.00 m. The posts are fixed to the ground using holes 70 cm deep and pouring anti-shrink mortar. The net is anchored to the posts by three lines of 6.00 mm stranded steel cable and two lines of 2 mm intermediate edges.

Additionally, specific interventions were also implemented to impede wildlife access to some tunnels with side openings: a galvanized electro-welded mesh 10x10 cm fixed to a height of at least 2.00 m to the structural reinforced concrete. Finally, ANAS contributed to the works replacing the existing metallic fences aimed at preventing animal falling out from the top of the tunnels.

The implementation of this task required a huge preparatory work developed by PNM and ANAS that resulted in about 25 meetings/field surveys and a strong collaboration to individuate the best period to start the works in order not to overlap with ANAS extraordinary maintenance works. This last issue is the reason why works needed to be postponed from summer 2022 to spring 2023 meaning when extraordinary maintenance works were not ongoing. All the details of the intervention are available in the Deliverable “Brief Action Report”.

The budget shifts needed to implement this task of Action C2 are detailed in chapter 8 as an answer to the issue 16 of the CINEA letter of 15/05/2023

SPAIN: In Spain the management of vegetation to increase visibility of drivers started in October 2021 and was carried out on the following Road: A 481. The total length of the intervention was around 27 km: 7,6 Km on SE-MA01 road, 3,6 Km on CO-3102 road, 3,25 Km on A-481 road, and 12,3 km on N-420 road. This last intervention was carried out by the Spanish Ministry of Public work following the indications of the LIFE SAFE-CROSSING staff.

The details of the interventions carried out were the followings:

SE-MA01: All vegetation on both sides of the road were cleared (3,8 kilometers on each side). A geotextile was placed in the cleared area and covered with mineral material to prevent and/or slow down the growth of vegetation in the intervention area. The work lasted from October 2021 to December 2021.

CO-3102: The ditches on both sides of the road have been cleared (1,8 kilometer on each side). The low branches of the trees near the road have also been pruned to increase visibility. The intervention was carried out in October 2021.

A-481: Clearing and pruning of bushes was carried out on both sides of the road for a total length of 3,25 Km. Vegetation was removed from the roadside to the existing fence. The work lasted from October 2022 to December 2022.

N-420: The ditches on both sides of the road were cleared (total length of 12,3 Km). Moreover, in this road segment 3 wildlife crossings were built. The work started in October 2021 and was finalized in December 2022.

Problems/changes/delays:

The start of the action was anticipated in Romania, because during the field activities carried out in action A4 a huge amount of debris were discovered at the entrances of the crossing structures, therefore we decided to start this activity earlier than was originally foreseen. In the other countries the action started as was foreseen in the project proposal.

In Greece we were able to intervene on 55 crossing structures, 5 more than the 50 indicated in the project proposal.

In PNALM the interventions regarded 4 crossing structures and not 7 because during the analysis made in the frame of Action A4 three of the 7 initially foreseen crossing structures were considered not suitable. Instead, more emphasis was put on the other 4 crossing structures, therefore finally the length of the fences installed was almost 1800 m, with respect to 400 m foreseen in the project proposal. This increase of the length of the fences was mainly possible because in the case of the intervention on the SS 17 road the NGOs WWF and Salviamo l’Orso

co funded the installation of the fence. On the other 3 crossing structures originally foreseen in the project proposal only minor Interventions of vegetation cleaning were carried out.

In PNM, following results of A actions as well as results of field surveys aimed at assessing fine details about the crossing structure status, slight changes were made as compared to the proposal. Two crossing structures (instead of 3) were cleaned along the SS487 and 7 crossing structures were adapted instead of 12 along the SS17. In the case of SS487 this change was just due to the fact that these 2 crossing structures were the only ones where the cleaning was actually needed. In the case of SS17 budget constrains influenced the amount of interventions possible but the thoughtful choice of the best road stretch in term of cost/benefit ratio allowed the full achievement of the project objectives even if less crossing structures were adapted. Delays caused by the extraordinary maintenance works implemented by ANAS in 2022 did not significantly affect this task and the achievement of the fixed objectives, on the contrary the collaboration with ANAS and its active involvement represented an added value and allowed the installation of an extremely well designed, well realized and effective intervention.

As is explained in chapter 8 both PNM and PNALM shifted the costs for the construction of the fences, initially foreseen in Equipment, to External Assistance, because differently from what was initially planned (to make the work with internal staff) the work demonstrated to be technically too demanding and therefore needed to be outsourced to a competent company.

Action C3. Production and installation of specifically designed information road panels to improve awareness about the risk of road accidents with wildlife

Objective of the action:

The aim of the action was the installation of 119 Road panels:

91 in Italy (25 in Pnalml, 60 in PNM, 6 in Terni Province);

8 in Romania;

12 in Spain;

38 in Greece (the 30 small ones were foreseen only in the budget, not in the project text).

The graphic layout and the message included in the Road panels installed were the results of the application of the neuromarketing technique (Action A7).

Foreseen start date: 01.01.2020	Actual start date: 01.01.2020
Foreseen end date: 31.12.2022	Actual end date: 31.12.2022

Progress

The action was successfully implemented. Overall, we were able to install 167 panels, 18 more than was foreseen in the project proposal.

In each country the installation of the road panels was authorized by the local road management authority, because it was necessary that the road panels respected the national road legislations, therefore in the initial phase of the action implementation, several meetings, as well as field surveys were made to obtain the necessary permits.

The selection of the roads where to install the panels was based on the results of Action A3 and A 5, in order to cover the most risky road segments.

On the basis of the results of the neuromarketing techniques in Italy and Romania we installed both types of panels the “Crossing” and “Car” versions, while in Spain only the “Car” version was selected, and in Greece only the “Crossing” one.

PNM: The installation of the 60 panels was made in November 2020. The panels were installed on the following Roads: 16 on SS17, 12 on SS 487, 8 SS 84, 7 on SP 12, 7 on SS5, 4 on SP 55, 4 on SP 84, and 2 on SP 54.

In the road managed by ANAS as well as in the road managed by the province of L’Aquila, both authorities put their logo in the panels, and this was clear evidence that they supported the project activities.

PNALM: The installation of the 25 panels was made in March 2021. The panels were installed on the following roads: 12 on SS 83, 2 on SS17, 6 on SP 17, 1 on SP 509 and 4 on SR 479. As was the case of PNM, also in this case ANAS and the province of L’Aquila put their logo on the panels installed in the roads under their responsibility.

Terni Province: 12 panels were installed with respect to 6 foreseen in the project proposal. The installation of the panels was made between November and December 2020. The panels were installed on the following roads: 4 on SR 205, 2 on SP 38, 4 on SP 85 and 2 on SP 8.

In Terni province we choose to use the roe deer in the road panel, and not the wolf, because we thought that the message would have been more effective. Roe deer is one of the species most involved in road accidents and therefore the road panel message would have been most easily and immediately recognisable to drivers.

ROMANIA: The installation of the 8 panels was made in August 2021. The panels were installed on the following roads: 4 on DN1, 2 on DN1A, and 2 on DN 13.

SPAIN: 24 panels were installed with respect to 12 foreseen in the project proposal. The installation of the panels was made in March 2022, 14 panels were installed in Sierra Morena while 10 in the Donana project area. The panels were installed on the following roads: 6 on A-301, 4 on A-312, 4 on CO-3102, 6 on A-481 and 4 on SE-MA-01.

GREECE: 38 panels were installed in the project area 8 big panels and 30 smaller ones. The panels were installed in July 2022 on the following Regional Unit: 14 in Kastoria, 18 in Florina and 6 in Kozani.

The success of this action was also witnessed by the replication cases that occurred in Italy, where in the Piedmont region, in the frame of LIFE WOLFALPS project, the graphic layout of the panel was taken over for the production of similar road panels. Another very important replication case was the installation of 20 panels, with the same graphic layout of the ones of the project in the petrol stations of the Autostrada dei Parchi, between Lazio and Abruzzo region, an highway travelled each year by millions of people.

Problems/changes/delays:

The increase of the numbers of road panels has been possible due to the lower final price for the production and installation of the road panels in Spain and in Terni Province.

Action D1. Monitoring the impact of the concrete conservation actions

Objective of the action:

The action aims to understand the effectiveness of the activities implemented in Actions C1, C2 and C3.

Foreseen start date: 01.07.2020	Actual start date: 01.10.2020
---------------------------------	-------------------------------

Foreseen end date: 30.06.2023	Achieved: 31.08.2023
-------------------------------	----------------------

Progress

The effectiveness of the concrete conservation actions was evaluated taking in consideration the main following parameters:

- Number of animal-vehicle collisions before and after the interventions carried out (AVC-PS and virtual fence-Action C1)
- Number of animal passages before and after the adaptation of crossing structures (Action C2)
- Replies to a questionnaire to evaluate the road signs developed using the neuromarketing technique (Action C3)

Moreover, for the AVC-PS we analyzed the data related to:

- the number of activations of the thermal camera and PIR sensors as a measure of the number of times the wildlife species were detected near the road,
- the number of activations of the acoustic scaring device to estimate the number of times there was an animal near the road and a vehicle travelling at a speed ≥ 50 km/h (i.e. AVC risky situation)
- the percentage of vehicles that reduced their speed after the flashing wildlife crossing warning signal was activated.

In the case of the virtual fence in PNM, Spain and in a first phase in PNALM we also installed camera traps to record the reaction of animals to the activations of the visual and acoustic signal emitted by the devices. In Romania several monitoring sessions were made through the use of a thermal camera, but this method was very time consuming in terms of personnel and time required.

In the frame of this action, we also continued the road mortality monitoring sessions and the measurements of traffic volume as we made in Action A5.

As was foreseen in the project proposal in Romania we analyzed the movements of radio collared bears. 9 bears (4 more than the 5 foreseen) were captured in the project area and fitted with radio collars, and we measured their behaviour in relationship to the roads with a special focus to the road segments where the concrete conservation actions were carried out.

AVC-PS and virtual fence

Overall the reduction of accidents where AVC-PS and virtual fence were installed was up to 100%. For each AVC-PS we quantified all the parameters mentioned before and the most relevant result is that out of an overall number of AVC risk situation (number of the times wildlife was detected near the roads when vehicles were also approaching at more than 50 Km/h) few AVCs actually happened and in some cases, they happened during the daylight when the system is turned off. Thanks to the camera trap monitoring and to the videos recorded by the thermal camera we could also assess that animals do react to the acoustic deterrent device (most of the times by stopping and waiting for the vehicle to pass or by going back and trying the road crossing in another moment) and that, so far, they did not habituated to it. The most informative videos collected were used in the networking and dissemination activities to show the effectiveness of this prevention system. Videos collected with the implementation of a VF camera trap monitoring were useful to complement data achieved on the reduction of animal vehicle collisions after the installation of the devices. Specifically, they gave valuable insights

on how animals behave at the road verge and how they reacted to the activation of the Virtual Fence unit.

Adapted crossing structures

The interventions on the crossing structures determined generally a significant increase of animal passages, even if their effect will be better visible in the long term.

In *Greece* according to the monitoring with the end-to-end prototype developed by COSMOTE, brown bears showed a statistically significantly higher use of the improved crossing structures. In fact after the improvements, 464 bears crossings were recorded compared to 189 before the improvements, in a comparable time span. Moreover, Brown Bear showed the best increase in numbers of the used structures, as after the improvements: 29 structures have been used by the species, instead of 22 before the improvements. One of the most important results was that in 5 structures, located in crucial area for the ecological connectivity, where, we registered clear signs of bears, unsuccessful attempts to cross through, have been used by wildlife species and especially by brown bears after the construction of special rumps with stairs which facilitate their permeability.

In *Romania*, after an initial monitoring of 11 adapted crossing structures with normal camera traps, from February 2022 to August 2023 20 crossing structures were monitored through the installation of Reolink cameras. Overall, we registered the presence of 9 mammal species and we recorded 123 bear crossings. During the action implementation the data from 7 cameras could not have been retrieved because bear individuals broke three cameras, and four were stolen. In these cases, the monitoring was made, in a more qualitative way recording animal tracks.

In *PNALM* the increase of wildlife passages was documented for both crossing structures after the interventions. On the crossing structure “Casone Antonucci” we recorded an increase of 41% of its use by bears, while on the crossing structure “Crugnale” the increase was 100% because before the intervention we never detected a bear using this crossing structure. The increase of use of both crossing structures after the interventions was recorded also for other wildlife species in particular the wolf on the crossing structure “Casone Antonucci”. On the adapted crossing structure of SS 17 road the monitoring of the effectiveness of the intervention carried out was not possible through camera trapping, due to the theft of the camera, but its use after the installation of the fence was documented by recording animal tracks.

In *PNM* the intervention carried out on the SS17 road secured 3 Km of the main principal barrier to the bear expansion, therefore it is of fundamental importance for the conservation of this extremely threatened species. The other two interventions on the SS487 road made these crossing structures available for wildlife passages.

In *Spain*, in all the road segments where the management of vegetation on roadsides were implemented no accidents were recorded.

Road information panels

We developed and submitted a questionnaire to evaluate the effectiveness of the road information panels and we obtained 1.319 replies. 77% of all respondents stated that, after having seen them, they changed their driving behaviour by slowing down and driving more attentively. The large majority of respondents indicated that installing these types of road panels would be beneficial in protecting large carnivores. Even if this survey was not based on a statistical sample design, it reflects the success of this action and the importance of improving human communication of important messages when facing the challenge of reducing large carnivore road mortality.

All the details of the data analysis are available in the technical report, available on the project website.

Problems/changes/delays:

1) Thefts of Reolink cameras, as well as the cameras damaged caused by bears were registered in Romania, but this didn't significantly affect data collection. The monitoring of the effectiveness of the adaptation of crossing structures continued by recording animal tracks.

2) In some cases in the AVC-PS installed (PNALM and Terni) we had some problems in data transmission, related to bad internet coverage, therefore we lost some data in certain months, but the information collected allowed us to analyze the systems in an exhaustive manner.

Action D2. Evaluation of project effectiveness by key actors involved in the project actions

Objective of the action:

The aim of the action was to assess the level of satisfaction of key actors (road authorities, regional/province administrations, municipalities, drivers, associations) regarding the activities carried out in the project. This was done through the submission of a simple questionnaire to the contacts gathered during the project.

Foreseen start date: 01.01.2021	Actual start date: 01.01.2022
Foreseen end date: 30.06.2023	Actual (or anticipated) end date: 30.06.2023

Progress

In the first phase of the action implementation, we developed the questionnaire for the evaluation of project effectiveness by the key stakeholders. We then prepared a list of people to be included in the survey.

The questionnaire was composed of 7 closed-ended questions, plus 2 open-ended questions.

The closed-ended questions were based on a Likert scale 1 to 5.

The questionnaire was submitted to the people during the meeting and events organized by the project as well as it was distributed online.

The survey lasted from January until June 2023. A specific google format was developed to collect the replies in order to facilitate data analysis.

The first two questions were of a general nature to assess the importance attributed by respondents to wildlife road investments and habitat fragmentation caused by roads.

The following ones were related to measure if and how much the project was considered important and effective to face the impact of linear infrastructures on biodiversity, and which of the implemented actions were considered most useful. The other points addressed by the questionnaire were related to understanding which were considered to be the main obstacles to the implementation of the project actions in one's own territory, and which other interventions, apart from the ones developed in the LIFE SAFE-CROSSING the respondents would like to implement.

Totally 97 replies were collected from ten countries (Belgium, Croatia, France, Greece, Ireland, Italy, Spain, Netherlands, Romania, and Slovakia). The people interviewed were: researchers, tourism actors, NGOs, local and road authorities, national park employees, and the staff of private companies. The survey involved also people from 6 countries outside the project area (Belgium, Croatia, France, Ireland, Netherlands, and Slovakia) in order to have a more comprehensive evaluation of the activities carried out. All the people interviewed outside project area were always persons involved in various forms in the issue of the impact of road on biodiversity.

The LIFE SAFE-CROSSING project was positively or very positively judged by the 95% of the people, and among the actions implemented we obtained the following results:

Monitoring actions reached the highest value with 89% of the replies, followed by the installation of the AVC-PS (84%) the adaptation of crossing structures (83%) and the awareness raising activities (82%).

Considering the reply to the question about which actions of the project respondents would consider useful in their own respective area, it's very interesting to underline that 72% of people selected the adaptation of existing crossing structures, 67% awareness raising activities, 62% the monitoring activities and the installation of the Animal-Vehicle Collision Prevention System, 52% the installation of road panels, and 32% indicated the installation of virtual fences to be considered in their area.

The main obstacles to implement the activities of the LIFE SAFE-CROSSING project in its own area, 50% of the respondents marked the lack of financial resources as the most relevant hindering factors, followed by lack of political willingness (23%), difficulties in permit processes (17%) and inapt staff (12%).

The other interventions considered important were the construction of overpasses, a better control of the road safety (speed limit) and the necessity of cooperation among public authorities to integrate biodiversity conservation in planning and maintenance of linear infrastructures.

The results of the survey clearly showed that the LIFE SAFE-CROSSING project was considered an important initiative to face the issue of the impact of linear infrastructures on biodiversity. It was generally recognized that the project activities covered the main important aspects of this problem, and the solution implemented have a great potentiality to be replicated outside project area.

Action D3. Assessment of the socio-economic impact of the project on the local economy and population

Objective of the action:

The aim of the action was to identify if and how the project had a socio-economic impact, e.g. through the reduction of accidents

Foreseen start date:	01.01.2022	Actual start date:	01.01.2022
Foreseen end date:	30.06.2023	Actual end date:	30.08.2023

Progress:

As was already communicated to CINEA during the 5th monitoring visit, and acknowledged in the CINEA letter of 10.05.2023, actions D3 and D4 have been carried out together and one deliverable was produced for both actions together. The description of the activities can be found in Action D4.

Action D4. Assessment of impact on the ecosystem functions

Objective of the action:

The action was to identify if and how the project would have an impact on the ecosystem functions.

Foreseen start date:	01.01.2022	Actual start date:	01.01.2022
Foreseen end date:	30.06.2023	Actual end date:	31.08.2023

Progress

A specialized company “Ecosystem Evaluation”, with a huge expertise in the development of analysis of socio-economic impact and impact on ecosystem services was contracted by Agristudio.

Several meetings were made between the staff of the contracted company and the ones of the coordinator beneficiary, as well as with all the other project partners to select the indicators to be considered and the data to be collected.

The main general meetings, involving all the project partners were made in Romania (19/01/2023), and in Greece (20/06/2023).

A combination of data collection methods was employed to gather information concerning both the socio-economic aspects (Action D3) and the impacts on ecosystem services (Action D4).

The socio-economic aspects were based on both the project’s pre-determined KPIs and additional direct and indirect socio-economic indicators (jobs created, funding opportunities, collaboration, improved capacities) the project potentially contributed to. Ecosystem services were selected according to the Common International Classification of Ecosystem Services (CICES) framework. Based on the direct project’s influence on connectivity and species populations, biodiversity and habitat provision (maintaining nursery populations and habitats) were selected as a regulation and maintenance ecosystem service. It was deduced that the project also added to certain cultural ecosystem services (more specifically, tourism, cultural heritage, educational and scientific services). Incorporating questions into a diverse set of data collection methods (surveys, secondary data collection) aimed at a broad spectrum of stakeholders ensured that the data were obtained from multiple sources, providing a comprehensive and robust conclusion.

The LIFE SAFE-CROSSING project demonstrated the potential of collaborative efforts to address the complex issues of road-related impacts on wildlife. The reduction of animal-vehicle collisions, increased awareness among drivers, improved habitats and connectivity, and the positive influence on local economies are noteworthy accomplishments. The integration of various stakeholders, combined with effective communication strategies, showcased the importance of public and stakeholder engagement in successful conservation initiatives. As the project's impact continues to unfold, its innovative measures and collaborative approach could serve as a model for future efforts in mitigating the adverse effects of road infrastructure on biodiversity and safety.

Action E1. Development of logo, graphic layout and information materials (including info panels and layman’s report)

Objective of the action:

This action aimed at the production of all the graphic/information material that was foreseen to be used for disseminating the project, raising awareness about the target issue and about the importance of an adequate driving behaviour: leaflet, poster, gadgets, adaptation of the video spot produced in LIFE STRADE etc.

Foreseen start date: 01.04.2019	Actual start date: 01.11.2018
Foreseen end date: 31.12.2022	Actual (or anticipated) end date: 31.12.2022

Progress

1. The first step of the action was the production, by CAGPYDS, of the project logo and a graphic layout, along with the templates for presentations, reports, certificates etc.

At the second project staff meeting (November 2019) the draft layouts of the gadgets were provided by CAGPYDS to the other beneficiaries: safety vests, T-shirts, Pens, USB pen drives,

teddy bears, key rings, rucksacks. They were discussed by the whole partnership, after which the final layouts and graphic specifications were provided.

2. Two versions of a leaflet and one poster have been produced. In a first moment (before the MTR) a 6-page leaflet has been produced by the graphic staff of PNALM.

The layout was then also shared with the other partners. After that, in 2022, a second, 8-page leaflet was produced by the company that was contracted by CAGPYDS (Lostipejos) on the basis of a graphic proposal by PNM. The leaflet was translated into all the project languages and adapted to the local conditions.

The company Lostipejos has produced, upon the feedback of the beneficiaries, also the project poster.

Finally, the following leaflets and posters were produced:

PNALM - 6-page leaflet + one leaflet to be included with the newspaper “Il Centro” (see Action E3)

PNM - 8-page leaflet

Romania - 8 - pages leaflet

Spain - 8 pages leaflet

Greece - both leaflets

3. In each country the gadgets, for which the layout was proposed by CAGPYDS, were locally adapted and produced. The objects are not identical because they were purchased at local level, but the layout that was printed on them was the same for all the countries. The following number of gadgets, leaflets and posters was finally produced:

Table 2. Numbers of produced gadgets, leaflets and posters

	<i>Italy</i>			<i>Spain</i>	<i>Greece</i>	<i>Romania</i>	<i>Final Conference</i>
	<i>PNM</i>	<i>PNALM</i>	<i>TR</i>				
<i>Leaflet</i>	15.000	6.000 leaflets + 12.000 with newspaper	500	4.000	10.000	2.000	
<i>Poster</i>	1.100	3.000	100	1.000	1.000	2.000	
<i>Road safety vest</i>	300	500	20	3.000	150	150	150
<i>T-shirts</i>	300		180		700	1.350	
<i>Stickers</i>	10.000	3.000	800		6.000	5.000	
<i>Pen drives</i>	1.000	600	10		1.000	600	
<i>Pens/pencils</i>	1.000	2.000	800	5.000	3.200	2.000	150
<i>Teddies</i>	300			1.500	300	500	150
<i>Backpack</i>				1.500	350	350	
<i>Water bottle (new)</i>	300				500		
<i>Key rings (new)</i>	300	500		20.000	2.000		
<i>Labels</i>	1.000						
<i>Note block</i>							150

<i>Cotton bag</i>							150
<i>Bracelets</i>				3.000			
<i>Roll-up</i>		1					
<i>Banner</i>							1
TOTAL	30.600	27.601	2.410	39.000	25.200	13.950	751
<i>Number foreseen in the project</i>	<i>19.500</i>	<i>12.500</i>	<i>1.700</i>	<i>23.500</i>	<i>25.200</i>	<i>13.200</i>	<i>N.A.</i>

Moreover, in all areas except Greece more gadgets were produced than initially foreseen. In all cases this was because they had made some savings and when they saw that the gadgets were rapidly consumed, they reproduced as many as they could.

In PNALM also a roll-up flag was produced, which was displayed at the public events and conferences organized by the Park.

4. A package of 5 panels to form a small exhibition were produced by CAGPYDS and provided to the other countries. In Italy the panels were changed and reproduced by the two National Parks together, in order to make an exhibition that was specifically dedicated to the Apennine brown bear.

Spain: The itinerant exhibitions were installed at public events and in schools. In Spain, it was installed in the following places in Sevilla:

13/10/2022 - Casa de la Cultura – 1500 persons

14/10/2022 - Town Hall Square. Afterwards, we moved the exhibition to the multipurpose center, since the town hall was closed and we thought that in the new location it would have more visibility

27/10/2022 - Casa de la Juventud

02/11/2022 - Plaza Carlos III

03/11/2022- Plaza de la Constitución

In these places it was viewed by 3700 persons.

Moreover it was used by children of a school for making a small demonstration through the streets of Huelva.

In *Romania* it was exposed during activities with schools, and therefore seen by over 1800 students.

In *PNM* and *PNALM* the exhibition was exposed at the final conference and in the following places:

- during the final conference (17-18/05/2023) on the square in the centre of Sulmona, accessible to all people passing along the main street of the town
- 05-11/06/2023 during the “Festival Cinema” in Avezzano – viewed by 700 persons

In Greece, production of itinerant exhibition was not foreseen in the form of panels. Nevertheless, a set of nine (9) slides were printed in A3 size to be used together with already existing roll-ups and posters in all events organised by the project, including open events and national fairs.



Figure 2. Photos of the itinerant exhibition



Figure 3. Photos of the A3 size prints that were used in fairs and public events in Greece

5. Spain: A brief video of 4 minutes has been produced by the students of an audio-visual communications school in Seville, IES Néstor Almendros (<https://iesnestoralmendros.es/joomla/>):

<https://www.youtube.com/watch?v=K2PQBDn3hmw&t=12s>

This video is disseminated through the media and communication campaign of CAGPYDS. It has been disseminated through the LIFE LYNXCONNECT website and on that of the Junta de Andalucía, in the Department of Sustainability and Environment, as well as on the Project and Board networks.

The LYNXCONNECT website has 19,000 visits, whereas the Environmental Portal of the Junta de Andalucía exceeds 100,000.

Besides this, Agristudio used some savings to produce another 8-minute, in Italian and English, which presents the project activities. It was shown at the final conference and then uploaded on the YouTube channel:

English: <https://www.youtube.com/watch?v=bNCDigp4TaY&t=20s>

Italian: <https://www.youtube.com/watch?v=45LYyPdbiX4>

6. During the LIFE STRADE Project (LIFE11BIO/IT/072) an awareness raising video spot has been produced. This has been adapted also to the use in the LIFE SAFE-CROSSING project and beyond it. The company that had produced the spot (A+) has been contracted again to revise the product. The text was adapted to make it more widely usable and independently from the projects. The spot is now available in Italian, English and in English with Romanian, Greek and Spanish subtitles.

The videos can be seen at the following links:

English: <https://youtu.be/MY1Ea4Ym68Q>

Italian: <https://youtu.be/j-HD3uBV34E>

Romanian: <https://youtu.be/HFOlnrb3qQA>

Spanish: https://youtu.be/E_yoNXiqReA

Greek: <https://youtu.be/d9JuLDcsZdI>

7. Regarding the info panels, a general layout has been produced by CAGPYDS, which has then been sent to the other beneficiaries, who have adapted them to the needs of the different project areas. The following numbers of info panels have been installed in the different project areas:

PNM: 40

PNALM: 15

Terni: 6

Greece: 9

Spain: 6

Romania: 20

8. A Layman's report has been produced in electronic format in English and the four project languages, available on the project website.

Action E2. Development of a video game "avoid the animal" to be used for awareness activities

Objective of the action:

The action foresaw the development of a video game that was foreseen to be used for reaching and raising the awareness of young people/future drivers.

Foreseen start date: 01.04.2019	Actual start date: 01.04.2019
Foreseen end date: 30.06.2020	Actual (or anticipated) end date: 30.11.2020

Progress

The action has been developed as foreseen in line with the project. The company AMT, which was contracted also for the production for the project website (Action E3), the App and the geodatabase (Action A6) has also been in charge with the production of the video game.

A first draft of the game was presented to the project partnership at the second staff meeting in November 2019. Feedback was gathered from all the participants, after which a process started in which new demo versions were constantly provided and the additional revisions were made.

The final version of the video game was then ready in November 2020, and it was published on the App stores for iOS and Android under the name "Avoid it!!":

Android: <https://play.google.com/store/apps/details?id=com.AMTItalia.AvoidIt>

iOS: <https://apps.apple.com/it/app/avoid-it/id1523273703>

Dissemination of the video game has occurred through the social media and during public events. It has been downloaded from the App stores 350 times.

Besides this, it has been used by the following numbers of persons:

Romania: at least 300 children during events with schools

Italy: the following numbers of persons saw or played with the video game at the following meetings:

19.08.2022 - Public meeting in the PNALM Park Museum in Pescasseroli - 100 persons

06-07.11.2021 - Stand of the project has been installed in a public exhibition in a shopping center in Pescara. 300 persons

7-11.09.2021 - Coexistence Tour organized in PNM to promote human-bear coexistence - 50 persons

02/04/2022 - Workshop[GDD1] organized by PNM on public squares in Sulmona and San Valentino - 10 persons

01-07/08/2022 - Two info points (in Valle dell'Orfento and in locality Majelletta, PNM) installed the whole day for the entire week, to distribute information materials to tourists and hikers - 60 persons

11/08/2022 - Event "La colazione dell'orso" in the bakery "il Mattarello" in Campo di Giove, PNM - 10 persons

24/09/2022 - Workshop organized by PNM in Palena and Pescocostanzo - 10 persons

17/05/2023 - Workshop organized by PNM in Sulmona - 5 persons

17-18/05/2023 - Educational activity for children in Sulmona simultaneously to the LIFE SAFE-CROSSING Final Conference - 10 persons

Greece:

1.Participation in an event for "30 years of Natura 2000 & LIFE" - Prespes, Pyli Information Center, organised by NECCA 21/05/2022 (LIFE ARCPROM): 30 persons

2."5th Festival of Organic Agriculture and Crafts of Kastoria" - Kastoria, 27/8/2022 (LIFE Safe Crossing, E4): 70 persons

3"Earth Festival" - Vlasti Kozani, 6/7/2023 (Life Safe Crossing, E4): 30 persons

4."Earth Festival" - Vlasti Kozani, 9/7/2022 (Life Safe Crossing, E4): 15 persons

7.Seminar in Thessaloniki with executives from: Institute of Transportation and Ministry of Transportation. 9/6/2023, (Life Safe Crossing, E7): 7 persons

8.Seminar in Athens with executives from: Green Fund, NECCA Central Unit, Ministry of Environment, Ministry of Transportation etc. 12/6/2023, (Life Safe Crossing, E7): 31 persons

9.Seminar in Stavroupoli,Xanthi, with employees from NECCA Management Authority Unit.Management Unit of Nestos -Vistonida and Rhodope National Parks, 22/6/2023, (Life Safe Crossing, E7): 11 persons

10.Seminar in Aspraggeloi, Ioannina,with employees from NECCA Management Authority Unit.Management Unit of Northern Pindos National Park, 23/6/2023, (Life Safe Crossing, E7): 9 persons

11.Seminar in Lagkadas, Thessaloniki, with employees from NECCA Management Authority Unit. Management Unit of Protected Areas of Central Macedonia, 29/6/2023, (Life Safe Crossing, E7): 12 persons

In Greece one mini-documentary was produced with the collaboration of the project "Coexistence is the Road", financed by the Green Fund, with the scope to publicise the video game: <https://www.youtube.com/watch?v=-Rnz65ddlTA&t=2s>

Spain: the video game was shown to the children during activities in schools (see action E4).

In general, we can estimate that the video game was played and watched by around 1.500-2.000 persons.

Action E3. Communication through website, social media and mass media

Objective of the action:

The action foresaw the communication of the project through a dedicated project website, social media and mass media.

Foreseen start date: 01.09.2018	Actual start date: 01.09.2018
Foreseen end date: 30.06.2023	Actual (or anticipated) end date: 30.06.2023

Progress

1. The project website (E3) (<https://life.safe-crossing.eu/>) was put online on 19 February 2019. The website has been visited 17.034 times, with a total of 33.974 page views. 43 news have been made.

The project website is a more static tool than the Facebook and Instagram page although regular news were published. But as is the case in social media in general the more dynamic ones are more viewed and attract more attention by the public. This was the case also for the present project, which gained more attention through the social media than through the website.

2. Social media activities:

Facebook: instead of creating a new page the page of the LIFE STRADE project (LIFE11BIO/IT/072) was renamed and graphically adapted, in order to gain the followers of that already existing page. Posts have been made regularly, at least twice per week, and after the creation of the Instagram page (below) the Facebook has re-posted all the Instagram posts. The Facebook page is nowadays followed by 2.428 persons.

In 2022 an Instagram page has been created by the communication officer (see point 6). For this, the communication officer has created regular monthly or bi-monthly social planning calendars, which foresaw 12 posts per month. Besides this, specific posts on momentary specific issues were made, such as the killing of a bear on a road in Abruzzo, the dissemination of the final conference etc. Like this a very regular communication was conveyed through this social channel, which now is followed by 416 persons.

A YouTube channel was created and directly linked to the website. All most interesting videos have been uploaded on this channel. Currently there are 53 videos. 63 persons are regularly signed up to the channel, but the videos were viewed up to over 1.000 times.

3. Mass media activities:

Totally 187 media activities have been made during the project.

Table 3. Media activities in the frame of the LIFE SAFE-CROSSING project

Media tool	Italy	Romania	Greece	Spain
Press releases and conferences	7	2	19	1
National press	8		2	7

Regional/local press	21		32	14
Internet news	11	1	3	3
TV/Radio news/releases	15	6	7	3

Besides this:

In July 2022 an article about the LIFE SAFE-CROSSING project was published in “Platinum”, a magazine produced by Il Sole 24 ore, dedicated to green economy and sustainable development. This magazine is published in 140.000 copies in Italian and English, and available online ([PLATINUM_2022_LUGLIO_ITA \(3\).pdf \(platinum-online.com\)](#)).

PNALM has printed 12.000 copies of a simple leaflet, which on 15/05/2022 was distributed with the newspaper Il Centro, the main newspaper read in Abruzzo Region.

Similarly, on 05/05/2023, close to the 7th UN Global Road Safety Week, PNM has rented a publicity space in the newspaper IL CENTRO, where an info box about the project was included. This was printed in 200.000 copies, whereas the online version was viewed by round 250.000 persons. Additionally, versions of the same info box created *ad hoc* to be visible on PC, tablets and smartphones were inserted in the “Il Centro” webpage as flash spots for one week from May 8th to 15th 2023. Basing on the average number of unique visitors of the Il Centro webpage it was estimated that 250.000 persons saw the spot at least once.



Figure 4. The image-spot produced by PNM and published on the printed version (right) and online version (left) of “Il Centro” on May 6th 2023.

PNALM has produced a Podcast of 6 episodes, which tells a story linked to a bear that gets killed by a car. It is aimed to raise awareness of people about the issue. It is accessible on all the main podcast channels such as Spotify, Audible etc. The podcast was heard by 15.780 persons.

PNM broadcasted the the video Spot of LIFE STRADEadapted in the frame of Action E1. It has been broadcasted on the main TV channel of Abruzzo Region, Rete 8, twice per day for 30 days, in May 2023 when also the 7th UN Global Road Safety Week was celebrated. Basing on the monthly average share of Rete 8, it is estimated that it was watched by round 80.000 people.

In Summer 2021 the video was also shown in a cinema in Orvieto (Terni Province), for 5 months in a row every day. The cinema is visited by 100-150 persons per day.

In Greece an 11-minute video was produced in the frame of the “Coexistence is the road” project, financed by the Green Fund, reporting the activities carried out in the frame of the LIFE SAFE-CROSSING project: <https://www.youtube.com/watch?v=qx50CipOpG8&t=11s>

4. As was already described and justified on page 52 of the MTR Agristudio has used some savings for contracting a Communication Officer, in order to improve communication through the social media, to overcome the impossibility to make meetings in presence during 2020-2021.

This person was identified in a social media communication expert and a graphic working in the company AMT, which had already been contracted for the development of the website, the App, the geodatabase and the video game.

With the additional contract these persons carried out the following activities:

- Regular social planning for the Instagram page, which was then reposted on Facebook
- Update and animation of the website, including production of news
- Assistance in the production of the poster for driving schools
- Publicizing the App and the video game
- Assistance in media activities

Changes:

The COVID-19 emergency has been a severe roadblock for many communication activities, in particular in the frame of Actions E4 and E5, where physical activities and encounters were foreseen, but also for Actions E6 and E7, which foresaw participation at conferences, meetings, organization of workshops etc.

In order to maintain communication activities, the use of social media, media activities and online tools such as webinars has become much more important.

But such activities have to be adequately planned, organized and carried out and all messages have to be coordinated among the beneficiaries in the four countries. To do this, Agristudio has contracted a specifically dedicated communication officer, who was paid with savings that are described in chapter 8.

Action E4. Local awareness raising activities

Objective of the action:

In this action meetings at local level were made with the inhabitants of the local communities, divers, and potential tourists, in order to raise awareness about the issue of AVCs and a correct driving behaviour.

Presentations foreseen in the following events: PNALM: 10; PNM: 5; Spain: 15; Greece: 6; Romania: 10

Foreseen start date:	01.04.2019	Actual start date:	01.09.2019
Foreseen end date:	30.06.2023	Actual (or anticipated) end date:	30.06.2023

Progress

Although in 2020 and 2021 no in-person meetings have been possible, especially during the following two years the project was greatly disseminated, mainly in in-person activities and also, to a minor degree, in online events. In fact, the number of events where the project and the issues it faces were targeted was far higher initially was planned.

1. In the frame of this action the project and the issues it faces were targeted in 103 events targeting local communities, tourists and school children (see numbers in Tables 4 and 5). Despite the problems represented by the COVID-19 limitations finally the number of planned events, at which the project was to be presented, was met everywhere except Romania. In this country the efforts were re-directed onto activities with schools, because children and were considered to be the most important persons on which to focus the efforts of awareness raising.

Table 4. Number of activities where the project was presented, per project area

Target groups	IT PNM	IT PNALM	GR	RO	ES
Local communities/public	13	7	9	1	34
Students	1	2		26	10

Table 5. Number of persons reached by dissemination actions per project area

Target groups	IT PNM	IT PNALM	GR	RO	ES
Local communities/public	1998	655	87300	20	Over 300.000
Students	93	330		1861	1461

2. Activities with driving schools:

A poster was designed to specifically address activities with driving schools. The poster includes recommendations on how to behave to prevent AVCs and how to behave in case of an encounter with an animal on the road. It was produced in all four project languages.

The following activities have been carried out with 77 driving schools, involving at least 3.437 driving schools students:

Italy:

PNM: In Spring-Summer 2022 the Park administration first contacted 44 driving schools in the Park territory and in the surrounding areas, raising a lot of interest to receive further information about the project and the road kill issue. The Park then distributed to all those schools leaflets and the poster created for driving schools, which were exposed to the students. At least 2.000 driving school students were targeted.

In PNALM in November 2022 a communication with call for participation was sent to the driving schools in the Park area, and received 9 positive replies. These driving schools were provided with leaflets and the poster, to be viewed by the students. At least 450 driving school students were targeted.

Greece: On 31.03.2021 a zoom meeting was made with the teachers of 32 driving schools in the project area. The instructors of two schools attended information meetings held in Kastoria (28/08/2023) and in Kozani (30/08/2023). Besides gathering information of best practices and dedicated posters they also received gadgets to be disseminated to students. At least 150 driving school students were targeted.

Spain: 17 driving schools in the project area were visited, the project was presented as well as recommendations of best practices, the dedicated poster was displayed and gadgets were distributed to the students. 789 students were involved.

Romania: 5 driving schools were visited, the project was presented as well as recommendations of best practices, the dedicated poster was displayed and gadgets were distributed to the students. 48 students were involved.



Figure 5. Photos of information material in driving schools

3. The materials produced in Action E1 were disseminated.

The leaflets, posters and all the gadgets were distributed

- at the stands at public events
- in schools
- in PNALM and PNM: at the park's visitors centers
- in the frame of public presentations and training activities
- In petrol stations along the monitored road segments and in the commercial activities in the municipalities inside the project area

Action E5. Networking with other projects and experience exchanges among partners

Objective of the action:

The action aimed to exchange knowledge, best practices, experiences, with other projects targeting similar issues.

Foreseen start date:	01.01.2020	Actual start date:	01.04.2019
Foreseen end date:	30.06.2023	Actual (or anticipated) end date:	30.06.2023

Progress

1) Regardless of the COVID-19 limitations in 2020-2021 the project has gained a lot of visibility and in all the occasions very positive feedback was obtained by the participants of the events.

Totally 39 networking activities have been carried out in the frame of the project, involving over 2.500 professionals from other projects and conservation organizations.

The main projects and initiatives with which networking activities have taken place are:

LIFE Dinalp Bear (LIFE15NAT/SI/550); LIFE Lynx (LIFE16NAT/SI/634); LIFE AmyBear (LIFE15NAT/GR/1108); LIFE “ForOpenForests” (LIFE11NAT/GR/1014); LIFE “Primed” (LIFE17NAT/GR/511), LIFE ARCPROM (LIFE18NAT/GR/768); LIFE Bear Smart Corridors (LIFE20NAT/NL/1107); LIFE IP4Natura (LIFE16 IPE/GR/000002); LIFE for Bear (LIFE13NAT/RO/1154); LIFE LYNXCONNECT (LIFE 19NAT/ES001055); LIFEstockPROTECT (LIFE19 NAT/AT/000889); LIFE WOLFALPS EU (LIFE18 NAT/IT/000972); LIFE with BISON (101114088).

LIFE Projects represented at Platform Meetings and Initiatives of NCPs: Polish national LIFE info day in Warsaw; Platform Meeting on Connectivity; Green Mobility Platform; Workshop “Progetti LIFE d’Abruzzo”

Two partners of the LIFE SAFE-CROSSING project (Agristudio and Minuartia) were also involved as partners in the HORIZON BISON project (101006661) and therefore there has been a constant and intense exchange between these two initiatives.

The LIFE SAFE-CROSSING project was presented in several initiatives of the IENE framework (Infra Eco Network Europe)

Horizon Bearconnect

Interreg projects: Interreg EnVeRos Project; SaveGREEN

Greek Ministry of Defense; Romanian Ministry of Environment;

Grupo Trabajo Fragmentación Hábitas por vías de Transporte, working on “Estrategia de Desfragmentación de Infraestructuras Lineales”

Three Universities: Bologna, Bristol, Goettingen

During these activities the main benefits for the project staff as well as for their initiatives have been:

- The project and its results have been disseminated widely to similar initiatives at international level, thus providing information about best practices and lessons learned to other conservationists.
- The exchange with several other LIFE (and non-LIFE projects) that face the same issue, as well as the participation at conferences, has provided a lot of important insights into issues concerning monitoring activities as well as ideas for the improvement of the project actions.
- Information and assistance for planning activities for the reduction of the impact of infrastructures has been provided to decision makers.
- The discussion and exchanges about awareness raising aspects, which are usually underestimated and not sufficiently carried out, has been increased.
- Cooperation in communication/dissemination activities, such as the dissemination of the App, the common use of an itinerant exhibition, common communication and awareness raising activities (e.g. with project “Conservation is the Road, ArcProm, LYNXCONNECT)
- Technical information and assistance were provided to other projects and conservation initiatives that want to carry out similar activities (contributing to replication, Action E7).

- Technical information (also about costs) was provided to the staff preparing other LIFE project proposals, thus contributing to further replicate the activities.

The exchanges have been important to identify persons/entities/projects who could potentially be interested in replicating the project activities.

2) The following experience exchange trips have been made:

23-25/11/2021: The Spanish team of the project (Javier Salcedo, Marcos Lopez-Parra, Matias de las Heras, Maria Navarro) visited the intervention areas of Maiella National Park (PNM) and Abruzzo Lazio and Molise National Park (PNALM) from the 23 until the 25 of November 2021. The aim of the visit was to gain information about the installation and the functioning of the AVC-PS and the virtual fence.

17-18/02/2022: Two staff members of Minuartia (Carme Rosell and Luis Fernandez) visited the two Italian National Parks, in order to learn more about the technical interventions implemented, which best practices they want to transfer to other projects in their area.

01-03/03/2023: Two staff members of CALLISTO (Maria Psaralexí and Yannis Tsaknakis) visited the two Italian National Parks. The main aim was to get a better insight in the installation, handling and maintenance of AVC PS devices, but also on all other interventions carried out.

17-18/04/2023: One staff member of PNALM (Roberta Latini) and one of PNM (Giovanna di Domenico) travelled to the Spanish Pyrenees for an exchange with researchers, managers, and technicians from organizations working with the two populations inhabiting in Spain, the Cantabrian population (Fundación Oso Pardo) and the Pyrenean population, both from Spain (Generalitat de Catalunya, SDG Biodiversity and Cos d'Agents Rurals), Conselh Generau d'Aran) and France (Office Français de la Biodiversité).

30-31/03/2023: After the Monitoring Visit to the project (28-29/03/2023) in Romania, a group of persons stayed in the project area for visiting the interventions by the Romanian team. For the staff member of Terni province (Gian Paolo Pollini) this was considered to be an experience exchange, because he learned more about the installation of the virtual fence and the new experiences with the set-up of the AVC PS, whereas he contributed with his own experience with the AVC PS in Terni Province.

21-23/06/2023: After the meeting for the discussion of the After-LIFE Plan (on 20/06/2023) in Greece, a part of the staff remained in the project area in order to visit the interventions carried out, with a main focus on the interventions on the underpasses under the Egnatia Highway, which were a particularly specific part of the project and of great interest for the participants from the other countries. The following staff members have participated: Romania: Mihai Fedorca, Ioana Negrea (INCDS), Iulia Baciú and Vasile Boronia (FC).

Italy: Annette Mertens, Simone Ricci (Agristudio), Giovanna Di Domenico, Antonio Antonucci (PNM), Gian Paolo Pollini (Terni Province).

Spain: Javier Salcedo, Maria Navarro (CAGPYDS), Marcos Lopez-Parra, Lola Pamos Bueno (AMAYA).

The staff of COSMOTE (Elina Theodoropoulou and George Lyberopoulos) and of Egnatia Odos (Niki Voumvoulaki) has participated in the field visit of the staff meeting held in Romania in January 2023 and therefore has benefited from this exchange.

Finally, almost from each beneficiary at least one experience exchange trip has been made and totally 28 persons have been involved.

28-31/08/2023: One staff member of INCDS (Mihai Fedorca) participated in the IUGB (International Union of Game Biologists) conference, in Poland. IUGB is an international, non-profit organization whose aims are to promote the improvement of knowledge about game biology and any other skill related to wildlife, as well as improving wildlife population

management and wildlife habitat conservation. The team presented several subjects related to the LIFE SAFEE-CROSSING project.

Action E6. National and international conference and workshops

Objective of the action:

The action foresaw the development of a final conference where the project results was presented, and the participation of the beneficiaries at external conferences, workshops etc.

Foreseen start date: 01.07.2019	Actual start date: 01.11.2018
Foreseen end date: 30.06.2023	Actual (or anticipated) end date: 30.06.2023

Progress

1) The opening events have been made on the following dates:

Italy: 26.01.2019

Romania: 31.01.2019

Spain: 27.02.2020

Greece: 25.02.2020

At all four events the mainly interested stakeholders have been invited to a presentation of the project, where the faced problems and activities as well the expected results were presented.

These have been important occasions also to make first contacts with the crucial decision makers such as ANAS in Italy, the Romanian road authority, the local communities etc.

In Spain and Greece the events have been made later than foreseen due to the initial delays in CAGPYDS and RWM, explained in chapter 6.2 of the MTR.

2) The international final conference of the project was held on 17-18 May 2023 in Sulmona, Italy. For its organization an event-organization company was contracted (I'MEETALY) following a call for cost offers and a cost comparison. The company has assisted in all logistic aspects such as the booking of trips for the invited speakers, organizing accommodation, the catering, organization of the venue, proving all technical assistance, and translation service. Two days with presentations of the project results as well as presentations from experts from 9 European Countries and North America, regarding all different aspects concerning the impact of linear infrastructures on biodiversity.

The conference divided in the following sessions:

17 May:

Introductory session, including greetings and keynote speech

Animal-Vehicle Collision monitoring and prevention

Improving connectivity

18 May:

Awareness raising and information

Stakeholder involvement

18 May afternoon: Field visit to the interventions in the project area

We enjoyed over 120 participants from all over Europe. Participation was mainly in person, but also round 20 persons joined the conference remotely.

An important aspect of the conference has been a final round table that saw the participation of some key authorities such as ANAS, the Abruzzo Region and Prefecture, the Greek partner EO SA, the Terni Province as well as the PNM and PNALM.

3) The project has been presented at the 18 conferences/workshops listed below.

26-27.11.2018 – **Italy**: Presentation of the project at Workshop “Human-nature interactions and conflict management in mountain environments”, Bolzano (Italy) – 50 participants – Programme and photos attached

03-04/12/2018 – **Italy**: Project presentation at a public conference organized by ISPRA and the Ministry of Environment – 400 participants – Programme and photos attached

11.04.2019 – **Italy**: the LIFE SAFE-CROSSING project was presented at the national congress organized by WWF “Insieme per il futuro dell’orso bruno marsicano in Appennino” (Bioparco, Roma) – 200 participants – Webnews attached

14.12.2019 – **Italy**: Presentation at conference “Orsi senza confini” of Salviamo l’Orso, Pescara – 60 participants – Programme and photos attached

15-16/11/2021 – **Greece**: Two presentations of the project were made at the Final Conference of the LIFE AMYBEAR – 120 participants – Programme and photos attached

6-7.06.2019 – **Romania**: Presentation of the project at the Ministerial Environment Conference "Large Carnivore Management - Challenges and Solutions, which took place at the Romanian Parliament – 70 participants – Programme and photos attached

16-17/10/2020 – **Romania**: 9th International Symposium Forest and Sustainable Development – 40 participants – Programme and photos attached

14-15/10/2022 – **Romania**: 10th International Symposium Forest and Sustainable Development – 30 participants – Programme and photos attached

18-22/09/2022 – **Romania**: 9th International Beaver Symposium – 100 participants- Programme and photos attached

16-17/08/2022 – **Romania**: E-cost Workshop of genetic WG. Testing Genetic Indicators for the Convention on Biological Diversity – 60 participants – Programme and photos attached

24-25/08/2023 – **Romania**: Final National Conference of the LIFE SAFE-CROSSING project – 120 persons – Programme and photos attached

24-25.10.2019 – **Spain**: presentation of the LIFE SAFE-CROSSING project by introducing the methodological approach of analysis developed in Action A3 “Jornadas del Grupo de trabajo de fragmentation de habitats causada por infraestructuras de transporte”, Barcelona – 98 participants – Programme and photos attached

06-08/04/2022 – **Spain**: The Junta de Andalucia had a thematic stand where it presented the LIFE SAFE-CROSSING during the Fifth Anadalusian Road Congress (Granada 6-8 April) – 820 participants - Programme and photos attached

31/05/2023 – **Spain**: 6 presentations of the project at the seminar organised in the framework of the Spanish National Defragmentation Technical sessions 'Ecological restoration and transport infrastructure', which took place on 31/05-02/06/2023 – 185 participants – Programme and photos attached

24.09.2019 – **All**: The Project was presented at the International Conference on Ecology and Transportation (ICOET) in California – 500 participants – Programme and photos attached

12-14-01.2021 – **All**: two presentations of the project were made at the international IENE2020 conference, which enjoyed the participation of 354 persons – 354 participants – Programme and screenshots attached

Mertens: LIFE SAFE-CROSSING: A new international project for preventing large carnivore road mortality in Europe

Psaralexi: Mapping and monitoring large mammal underpasses on motorway A29

The presentations were followed by a round tables at which several questions were answered.

06-07/06/2022 – **All**: Two presentations of the project were made during the international conference of the Interreg Dinalpconnect project, which took place on 6-7 June 2022 in Velenje, Slovenia – 50 participants – Programme and photos attached

04-08/06/2023 – **All**: The Project implementation in Greece was virtually presented at the ICOET conference in Burlington, USA (<https://www.youtube.com/watch?v=NSdoj->

[ZFZJk&list=PLn646vGvIH10BdRTNCONAMlvIDc75TPN5&index=33](#)) – 489 participants .
Programme and screenshots attached

The project has been presented at more events than was initially foreseen, also if some presentations were done remotely. The presentations were greatly appreciated, and a lot of questions were usually made regarding the implemented activities. This interest will be very important for the further dissemination of the activities for favouring replication.

In Romania the LIFE SAFE-CROSSING project was mentioned in 2 scientific papers:
Fedorca, A.; Fedorca, M.; Ionescu, O.; Jurj, R.; Ionescu, G.; Popa, M. Sustainable Landscape Planning to Mitigate Wildlife–Vehicle Collisions. *Land* 2021, 10, 737.
<https://doi.org/10.3390/land10070737>

Fedorca, M.; Ionescu, G.; Voda, F.; Voda, G.; Fedorca, A. First Virtual Fence System Installed in Romania for Reducing Wildlife—Vehicle Collisions; *Revista de Silvicultura si Cinegetica*: Brasov, Romania, 2020; Volume 47, pp. 77–80.

The Spanish partner CAPPYDS has been invited to write an article about safe crossing for the magazine of the Spanish Road Association. A draft was already written but the article was not published yet.

Action E7. Activities to involve potential stakeholders and to ensure replicability and transferability of the implemented activities

Objective of the action:

The action aimed at identifying (and potentially implementing) replication cases of the activities that were developed during the project: the use of AVC PS, virtual fence, adaptation of crossing structures and use of neuromarketing sciences for communication to drivers.

Foreseen number of seminars: 35 (PNALM: 3; PNM: 3; Italy general: 3; Spain: 8; Greece: 8; Romania: 10)

Foreseen start date: 01.07.2019	Actual start date: 01.07.2019
Foreseen end date: 30.06.2023	Actual (or anticipated) end date: 30.06.2023

Progress

1) A document “Guidelines to reduce large mammal and traffic conflicts” has been produced. It includes information and recommendations from previous and other initiatives, as well as insights and lessons learned in the frame of the LIFE SAFE-CROSSING project.

The guidelines are available on the project website ([ACTION E7 - GUIDELINES | LIFE SAFE-CROSSING](#)), and they will be an important tool also for the after-LIFE period.

2) Throughout the project great efforts have been put into disseminating the activities developed in the project towards persons and entities that could have been interested to implement one or more of the activities. During these meetings the interventions developed in the project were explained in detail and information regarding technical and financial aspects were provided. Moreover, every time the project team was contacted by external initiatives to ask for technical information and assistance, we offered to organize online or in-person meetings and field visits in order to explain in detail the activities, methods and techniques used, and offered assistance in case others wanted to implement the activities they were interested in.

In total 32 initiatives have been developed to promote replication (3 less than the foreseen 35). 580 persons have been reached by these meetings.

Like this, we have disseminated the information to several different interested parties such as:

- National authorities: the French Ministry of Environment, the Spanish Ministry of Ecological Transition, the Greek Institute of Transportation and Ministry of Transportation
- Regional authorities: Province Road administrations of Granada, Spain; Brasov County, Romania; Lazio Region, Italy; Parma Province, Italy; Vercelli Province, Italy; the Catalan department of Territorial and Sustainability, Catalan Road Management Authority, Spain.
- the World Road Association PIARC
- the tyre construction company Michelin
- the Italian road management authority ANAS
- the Spanish Grupo Trabajo Fragmentación Habitats por vías de Transporte
- the Prefecture of L'Aquila, in Abruzzo, Italy
- the NECCA Management Authority Unit, Greece
- the Worldwide Railway Organization (UIC)
- other LIFE projects that now implement the techniques
- at least 6 National Parks
- WWF Italy
- The Gran Sasso e Monti della Laga National Park, Italy.

3) On 12 January 2021 the workshop “Innovative techniques to mitigate transportation infrastructure impact on large carnivores” was held, as a side event of the IENE2020 international conference. The workshop lasted from 14.45 to 19.00 and enjoyed the participation of 79 persons from 20 countries. The event was structured in two parts:

- An introductory plenary part, in which an introductory talk was given by Prof. Djuro Huber, followed by a round of presentations of the different components of the LIFE SAFE-CROSSING project.
- A thematic workshop session, in which the participants were divided into 4 participatory discussion groups. At these discussion rounds the four thematic aspects of the project were discussed and the participants were consulted on a series of questions that were posed by the organizers. The replies to all the questions were summarized in a final report.

This event had a twofold benefit:

- The project has been presented in detail to a big number of persons, illustrating the technical approaches and the innovative aspects. This aimed at the identification of persons interested in potential replication activities.
- Feedback and recommendations for the future development of the project activities have been collected.

During the workshop the LIFE SAFE-CROSSING project partners offered the possibility to provide assistance in replicating the activities/approaches, by sharing expertise, documents and technical assistance.

4) A Replication plan has been developed, which sets out the main means to achieve further replication of the project activities. Specifically, for each technical aspect of the project the plan describes:

- Technical specifications and methods
- Advantages
- Assumptions: permits, resources, capacities, environmental characteristics
- Replication potential
- Costs

Results of the activities to achieve replication:

The developed activities have produced some very significant replication cases:

Italy:

1. During April 2021 it was reported several times that the female bear Amarena with her four cubs has crossed the motorway A25 in the area of the village of Carrito (between Pescina and Cocullo). Following this, in order to prevent accidents, PNALM has decided to install 2.200 metres of electric fence near the road sides in order to prevent the entry of animals (because the existing fence was inadequate). These 2.200 meters of fence have been reported as expenses under LIFE SAFE-CROSSING. Following this, under the technical supervision of PNALM the Motorway Company "Strada dei Parchi" has installed a fence of 4 km on the side of the motorway lane in a critical area where bears have entered the motorway in the past. This construction was done with own funds of Strada dei Parchi.
2. New AVC PS have been installed independently from the project: 1 in Genova Province, 4 in Province of Perugia; 1 installed in Alpi Bergamasche; price for AVC PS in Provinces of Trento, Pordenone, Salerno.
3. The graphic layout of the road info panels (Action C3) have been provided to the LIFE Wolfalps EU project (LIFE18 NAT/IT/000972), which is reproducing them to be installed in the Val di Susa.
4. Following the installation of the road information panels in PNALM and PNM the Motorway Company "Strada dei Parchi" has installed 20 similar panels with their own funds in petrol stations along the motorway between Rome and Pescara.
5. The Ministry of Environment and Energetic Safety financed a 25.000 Euros intervention developed by PNM and to be implemented in cooperation with the Carabinieri Biodiversity Department (belonging to the Carabinieri Forestale, former Forestry Service of Italy) of Pescara for the installation of a segment of virtual fence on the state road SS5, which separates the PNM from the Gran Sasso e Monti della Laga National Park.
6. Two road information panels were installed, using the graphic layout of the "crossing" C3 panel, by the Municipality of Lettopalena, in the territory of PNM in collaboration with PNM itself using internal funds of the Municipality.
7. The PNALM has produced information panels recalling the killing on a road of one of the most symbolic and well-known bears in the area, which has gained big public attention. Three of these panels are being installed in Park Municipalities.
8. WWF Italy abandoned the use of Swareflex devices and started the purchasing of the virtual fence to be installed in the areas outside the National Parks of Abruzzo to enhance ecological connectivity for the Apennine brown bear in other portions of its range.

Greece:

9. EO SA, Greece: The partner EO SA has performed a characterization of 100 underpasses with own internal funds. This was paid by EO SA, which has provided funds to a contracting company for paying an expert who did the analysis. EO SA is now applying to the Green Fund for implement interventions on underpasses in other areas of the motorway between Grevena and Kozani.

Spain:

10. The Government of Castilla y Leon installed 5 Km of virtual fence.
11. The Government of Castilla la Mancha have planned to install virtual fence and maybe an AVC PS.

12. Ministry of public work has replicated the roadside cleaning on another road segment (N420).
13. A308 Road, Granada, in the lynx reintroduction area, purchase of virtual fence for 5-10 km
14. Cooperation to promote replicability of mitigation techniques to prevent Brown bear (*Ursus arctos*) roadkill risk in the Pyrenees: the Generalitat de Catalunya and Conselh Generau d'Aran, which developed the Piroslife project, have installed 15 camera trap devices near roads identified as crossing points in the Piroslife Project. The methodology was tested under the supervision and with the cooperation of the COSMOTE staff. The result of this analysis is now used to assess the need of mitigation interventions.

Romania:

15. LIFE with BISON will install Virtual Fence and road info panels in the project area.
16. The Romanian road company expressed interest in the installation of Virtual Fence.

General:

17. The tyre production company Michelin, has installed the virtual fence on a car testing parcour in the USA
18. Meetings with at least other 5 projects and initiatives to provide information about AVC PS, virtual fence and road info panels.

Besides these cases, the staff of the project will continue providing information and technical assistance to whatever other professionals or initiatives that will show the interest in implementing technical interventions also after the end of the project.

Action F1. General project structure and management

Objective of the action:

The action identified the project management structure and partnership.

Foreseen start date: 01.09.2018	Actual start date: 01.09.2018
Foreseen end date: 31.08.2023	Actual (or anticipated) end date: 31.08.2023

Progress

The action has been carried out throughout the project, with no major problems.

Both the Project Manager and the Financial Manager have cooperated tightly with the staff of the coordinating beneficiary as well as with the associated beneficiaries.

The following monitoring visits have been made to the project: 7 February 2019, 18 March 2020, 26 January 2021; 3 March 2022, 28-29 March 2023. Due to the COVID-19 limitations the meetings in 2020, 2021 and 2022 had to be held online.

A Task Manager has been produced by the company AMT at the beginning of the project. All the beneficiaries had a specific account for accessing the tool, and it is used for the exchange of documentation, especially for the storage of the entire administrative documentation.

The Financial manager and the Project manager have been in constant contact with all the beneficiaries throughout the project for providing guidance and assistance with all technical and administrative issues.

The technical progress was monitored against the detailed contents of the project applications, with special regard to the expected results, deliverables, milestones and time plan.

The progress of the expenditures was monitored as follows: every three months all the beneficiaries sent to the Financial Manager the updated Financial Reporting Tool, as well as a “Financial Management Tool”, which was specifically produced to have a constant and real-time picture of the expenditures as well as of the budget changes. Every three months copies of all administrative documentation were provided to the coordinating beneficiary, which was then immediately checked by the Financial Manager.

No substantial changes have been made to the budget, only minor adjustments that have always remained within the limits Article II.22 of the General Conditions.

Action F2. Monitoring of the project progress and the project performance indicators

Objective of the action:

The action aimed at guaranteeing a correct coordination of the actions, in order to maintain the planned activities, the deadlines and to respect all administrative standards.

Foreseen start date: 01.09.2018	Actual start date: 01.09.2018
Foreseen end date: 31.08.2023	Actual (or anticipated) end date: 31.08.2023

Progress

After the kick-off meeting (Action A1), four in-person meetings of the entire project staff have been made:

6 February 2019 Florence, Italy

13-14 November 2019 Sevilla, Spain

18-19 January 2023 Brasov, Romania

20 June 2023 Amyntaio, Greece (in correspondence with meeting on After-LIFE Plan, F3)

At these meetings the progress of the project was presented and discussed and the activities for the following months were programmed.

In 2020, 2021 and 2022 due to the COVID-19 limitations no more physical meetings have been possible, therefore meetings were held online.

The following meetings were made by the project staff, including the staff of the Associated Beneficiaries:

General online staff meetings:

25.06.2020, 10.11.2020, 27.11.2020, 09.02.2022

Besides this, regular meetings with representatives of the beneficiaries of the four project countries are organized, and which all open issues are discussed in detail:

Italy: 13.05.2020, 22.09.2020, 17.03.2021, 28.01.2022, 08.11.2022, 27.04.2023

Romania: 10.05.2020, 14.05.2020, 03.07.2020, 18.06.2020, 09.09.2020, 15.09.2020, 03.12.2020, 20.01.2021, 28.04.2021, 05.08.2021, 14.01.2022, 03.05.2022, 13.10.2022, 24.10.2022, 20.03.2023

Spain: 18.02.2020, 03.06.2020, 05.07.2020, 16.07.2020, 17.09.2020, 02.12.2020, 04.01.2020, 20.01.2021, 11.03.2021, 20.01.2022, 17.02.2022, 18.10.2022, 22.03.2023

Greece: 08.05.2020, 15.05.2020, 21.05.2020, 18.06.2020, 08.07.2020, 18.08.2020, 09.09.2020, 01.12.2020, 08.12.2020, 22.01.2020, 11.03.2021, 26.04.2021, 29.07.2021, 24.02.2022, 31.03.2022, 18.10.2022, 17.02.2023, 21.03.2023

Two in-person specific update meetings were made in Spain and Greece after the COVID-19 limitations:

05-08.10.2021 – Update meeting Spain

13-16.12.2021 – Update meeting Greece

Besides this, some thematic virtual meetings have been made:

06.05.2021 – Virtual fence

21.07.2021; 23.07.2021, 20.10.2022 – Communication officer, 28.11.2022

23.07.2021 – Communication plenary

27.07.2021 – Communication Italy

02.10.2020 – Organization IENE workshop

07.07.2020, 25.09.2020, 19.10.2020 – Meetings with iPTE for virtual fences:

05.06.2020, 22.10.2020, 09.12.2021 – Meetings with AMT for Website, video game, App database

08.06.2020 – Meeting with ANAS for permits:

02.11.2022, 19.01.2023, 08.02.2023 – Meetings with consultants for Actions D3/D4

The production of the quarterly reports has been very useful for the constant monitoring of the project progress.

The KPI online database has been filled in the first time in Spring 2019, it was then updated for the MTR and for the FR.

Action F3. After-LIFE conservation plan

Objective of the action:

The After-LIFE plan aims to provide guidance to the project partners for their future activities in order to guarantee sustainability to the project actions.

Foreseen start date: 01.10.2022	Actual start date: 01.10.2022
Foreseen end date: 31.08.2023	Actual (or anticipated) end date: 31.08.2023

Progress:

On 20 June 2023 a half-day workshop was held in Amyntaio, Greece, with the presence of almost of the project partners, for discussing the contents of the After-LIFE plan. All the partners had to provide their input on how they plan to proceed to provide sustainability to the implemented activities. A template of a table was provided to the partners, which they were invited to fill in, where for each action under their responsibility they had to describe their future steps, the means with which they will carry on the activities, the time plan etc.

On the basis of this the After-LIFE conservation plan written and then reviewed by the partners. A detailed description of the implementing bodies and funding was further included in the analysis so that clear responsibilities are set. A SWOT analysis was developed and therefore the action frame was supported with main starting points and opportunities to be taken into consideration when the plan is put into action.

6.2 Main deviations, problems and corrective actions implemented

Romania: replacement of one AVC PS with 2 km of virtual fence

The decision to install the 2 km of virtual fence in the area of Prejmer (SCI ROSCI 0170) was taken because it was recorded that from 1/01/2022 to 1/01/2023, 30 roe deer and 5 bears were killed on that road segment. The road segment crosses a piece of forest of 350 ha, where the presence of bears has increased only lately. This forested area is located on the plain north of the town of Brasov, which is surrounded by mountain areas. It can be considered as a sort of stepping stone between the different forested areas where the foreseen intervention areas are located.

The area is particularly important for bears because this species has re-appeared in this area only in 2019, and now it is a site of significant importance for bears due to the up-mentioned reason.

Therefore this area is of big importance for the local bear population, and considering the number of bears killed on that road segment it appeared evident that an intervention was urgently needed. The installation of an AVC PS was not adequate in that area because the road segment is too long to be covered by such a tool.

The virtual fence was installed on 27.07.2023 and since then no accidents were registered in the areas. Taking into consideration the fact that in other areas where we have installed the virtual fence previously, we did not have any accidents, we consider this as a valuable thing to take into consideration.

Changes in interventions in Action C2

In PNALM the interventions regarded 4 crossing structures and not 7 because during the analysis made in the frame of Action A4 three of the 7 initially foreseen crossing structures were considered not suitable. Instead, more emphasis was put to adapt the other crossing structures, therefore finally the length of the fences installed was almost 1800 m, respect to 400 m foreseen in the project proposal. This increase of the length of the fences was mainly possible because in the case of the intervention on the SS 17 road the NGOs WWF and Salviamo l'Orso cofunded the installation of the fence. On the other 3 crossing structures originally foreseen in the project proposal only minor interventions of vegetation cleaning were carried out.

In PNM, following results of A actions as well as results of field surveys aimed at assessing fine details about the crossing structure status, slight changes were made as compared to the proposal. Two crossing structures (instead of 3) were cleaned along the SS487 and 7 crossing structures were adapted instead of 12 along the SS17. In the case of SS487 this change was just due to the fact that these 2 crossing structures were the only ones where the cleaning was actually needed. In the case of SS17 budget constrains influenced the amount of interventions possible but the thoughtful choice of the best road stretch in term of cost/benefit ratio allowed the full achievement of the project objectives even if less crossing structures were adapted. Delays caused by the extraordinary maintenance works implemented by ANAS in 2022 did not significantly affect this task and the achievement of the fixed objectives, on the contrary the collaboration with ANAS and its active involvement represented an added value and allowed the installation of an extremely well designed, well realized and effective intervention. Explanations on the budget shifts have been provided during the fourth monitoring visit and can be found in the reply to Issue 16 of the CINEA letter of 10.05.2023.

6.3 Evaluation of Project Implementation

Methodology applied:

Regarding the A actions the methodological evaluation has been included in the MTR, and no new considerations have to be added.

Action D1

The evaluation of the effectiveness of the concrete conservation actions was based on different parameters depending also on the type of the interventions implemented.

AVC-PS and virtual fence

First of all, we compared the number of road kills before and after the installation of AVC-PS and virtual fence and we calculated the percentage of this change.

The limitations of this calculation are mainly related to several aspects:

- the sample size, in some cases is too small to detect significant variation in the number of road kills before and after the installation of the prevention systems implemented;
- the number of road kills in the ex-ante period is generally an underestimation of the phenomenon because before the start of the project there wasn't in place a systematic monitoring system as was the case in the ex-post period;
- the road kills are related to other parameters like variation in population size, variation in the pattern of animal movements, that can't be evaluated;
- the interval period after the installation of the prevention devices, in some cases, was too short to draw any conclusive evaluations.

We are aware that the scientifically recognized way to evaluate the effectiveness of the prevention tools implemented would be the application of the B.A.C.I. approach, but as was discussed during a specific meeting, it wasn't possible to apply it. The application of the B.A.C.I. approach would imply to turn off the prevention tools for some period, and this couldn't be acceptable by the project partners, because in case of an accident occurred in this test period, they could be held responsible for this event. The other possibility for the application of the B.A.C.I. approach was to define a control site, where no prevention tools were installed, but we decided to discard this possibility, because we did not consider it possible to select a truly representative control site.

On the basis of the above considerations the evaluation of the effectiveness/functioning of the AVC-PS and virtual fence was made also considering other parameters.

In the case of the AVC-PS we evaluated the effectiveness of the system considering the number of activations of PIR sensors and thermal camera and the number of the activations of the acoustic scaring device. The number of activations of PIR sensors and thermal camera represents the number of times wildlife species were detected near the road, while the number of the activations of the acoustic scaring device represents the number of risky situations (simultaneous presence of an animal and an approaching vehicle travelling >50 Km/h) in which the system intervenes, and thus the potential accidents avoided by the AVC-PS.

The other system used to evaluate the effectiveness of the AVC-PS was through the installation of camera traps where PIR sensors were installed. This allowed us to obtain information about which species approach the road and the reaction of animals to the activations of the acoustic scaring device in order to also evaluate potential habituation phenomenon. Where the thermal camera was used, this could be made through video downloading, but due to internet connectivity problems, the download of the videos was not systematically possible.

The monitoring of the functioning of the AVC-PS was made remotely through a specific APP which in real time allowed the control of the proper functioning of all system components, and then intervening in case of problems. The data about the functioning of the system are sent to a web portal and classified through a specific software.

In the case of virtual fence we installed camera traps in order to evaluate the reactions of the animals to the triggering of the units. The videos collected were analysed classifying the behaviour of animals upon activation of devices. This was an important parameter to better evaluate the effectiveness of the virtual fence.

Adaptation of crossing structures

The evaluation of the effectiveness of the C2 action was made comparing the use of the crossing structures before and after the concrete interventions. This was done through the installation of camera traps comparing the number of wildlife passages before and after the interventions carried out. In Greece, the comparison was made through the use of the prototype “Wildlife Monitoring, Species’ Classification and Visualization” solution developed by COSMOTE. The prototype solution comprises:

- 4G (wireless) battery-powered, ultra-low consumption cameras equipped with small but very efficient solar panels for long operation.
Note: A SIM card / camera is also required for: (a) the (automated) uploading of snapshots/videos to a cloud infrastructure, (b) remote access to cameras for e.g., configuration purposes, playback, (c) alerting, etc.
- Cloud infrastructure for cameras’ content (automated) storage, processing and visualization [through an intuitive web-portal]
- An innovative object/species detection / categorization tool based on Machine-Learning/Deep-Learning (Artificial Intelligence – AI) techniques
- A zero-touch statistics extraction tool
- Near-real time species alerting [via push-notifications @smartphone]

Since August 2019 more than 100.000 photos and videos have been collected and processed, while various statistics have been derived like frequency of bear’s and other wildlife species detection per underpass collectively, per day, per hour of the day and per month of the year for all the underpasses.

It’s important to consider that for all the wildlife species an adaptation period to the interventions carried out is needed, therefore the use of the adapted crossing structures obtained have to be evaluated in a longer period, nonetheless the results obtained, in each project country showed the success of the interventions implemented.

Interventions on roadsides

The evaluation of the effectiveness of the management of vegetation to increase visibility of drivers was assessed comparing the numbers of road kills occurred before and after the interventions were carried out.

Road panels

The effectiveness of the road panels was evaluated by means of a specific questionnaire to assess their impact on people's driving behaviour and to understand whether the installation of

the panels was considered useful in reducing the number wildlife-vehicle collisions. The use of a questionnaire was not foreseen in the project proposal, but during project implementation, we realized that this was the best way to evaluate the effectiveness of the installed road panels. In the project proposal we planned to measure the speed of the vehicles before and after the installation of the road panels. This method was not always technically feasible and especially wouldn't provide a significant information because the results could be affected by unpredictable confounding factors. The replies to the questionnaire better express the impact of the road panels upon the drivers, because it's important to evaluate how the road panels were perceived, how attractive they were and how they were successful to promote a more responsible driving behaviour.

In any case we also calculated the variation in the number of road kills occurred before and after the installation of the road panels

In Romania the evaluation of the effectiveness of the concrete conservation actions was also carried out analysing the movements of 9 radio collared bears captured in the project area.

We evaluated the percentage of fix in a buffer area of 100 metres from the road, we analysed the road crossing points and the number of times they crossed the road where the virtual fence and the AVC-PS were installed.

Table 6. Evaluation of progress of the LIFE SAFE-CROSSING activities

Action	Foreseen in the revised proposal	Achieved	Evaluation
A1. Kick-off meeting and initial training	Kick-off meeting for the initial training of the technical and administrative staff on LIFE rules. Training of the technical staff in the use and management of AVC PS	Kick-off meeting made Training about AVC PS done ½ day in Terni Field visits/training meetings done in each project country	The field surveys have been essential for a better implementation of the monitoring activities, the selection of the sites of intervention and also of the equipment to purchase..
A2. Preparation of the administrative basis of the project	Prepare initial administrative procedures. Obtain permits for C actions	All administrative procedures done (e.g. partner agreements, contracts, development of financial monitoring tools etc.) Permits were achieved for all interventions on the roads.	Permits didn't pose any problems and didn't cause delays in the actions, because this issue has been faced well in advance
A3. Assessment of the amount and distribution of road accidents	Identify risk areas: analysis of AVC data and telemetry data through the KDE+ method.	Identification of hotspots of animal vehicles collisions and crossing point clusters through the application of KDE+ method (Bil et al 2013). Results summarized in a report.	The results of Action A3 have been very helpful to identify the areas where to narrow down the monitoring in the frame of actions A4 and A5.
A4. Analysis and mapping of existing crossing structures	Mapping characterization and selection of existing crossing structures to be adapted to favour the use by wildlife Production of guidelines. Greece: development of an innovative device for monitoring of a large number of underpasses and data transmission.	Guidelines for analysis and adaptation of crossing structures were produced. 404 crossing structures were characterized following a standard approach Selection of the crossing structures to be readapted in the frame of C actions Greece: an innovate end-to-end solution to monitor in real time the crossing structures was developed.	The action has provided a lot of useful information in order to: - Identify the crossing structures to adapt - Decide how they have to be adapted - Evaluate the wildlife use before the intervention
A5. Description of target road segments, identification of crossing points used by animals and analysis of traffic volume and speed	Selection of intervention sites for Action C1: description of roads, AVC monitoring, speed/traffic counts.	Overall we monitored 504,19 Km of rods 612 road mortality road sessions 161 animals were found dead 46 traffic volume monitoring sessions Camera trapping to monitor crossing points	The action has been carried out as planned, and it has been fundamental to identify the sites for the installation of the AVC PS and the Virtual fence.
A6. App and database	Development of a geodatabase and risk maps Development of a hybrid App	A Geodatabase was produced and is available for storage of historical and future data about	The pooling of data from other databases and Apps was more difficult than foreseen due to complex policies of data sharing and

	Sharing data with other initiatives	AVC, animal crossings and the project interventions. Risk Maps have been produced of all the project areas and are summarized in a report. An App for data collection by the public is ready. Data pooling has not been achieved.	management as well due to technical issues. The geodatabase is an important tool for the involved partners for guiding future interventions The App is an important instrument for raising awareness.
A7. Development of road info panels	Development of effective road info panels: development of panel proposals, testing with neuromarketing technique.	Panel prototypes were produced and submitted to test persons. Two panel types were selected for production in Action C3.	For the first time, at least in project countries, neuromarketing techniques have been applied to develop road panels to prevent animal vehicle collisions.
C1. Installation of innovative AVC prevention systems and accompanying measures	Installation of 27 AVC: Italy: PNALM: 3; IT-PNM: 5, IT-Terni: 2 Spain: Donana: 2; Sierra Morena: 3 Greece: Florina: 3; Kastoria: 3 Romania: 6 Installation of virtual fence: Italy- PNALM: 5 km; PNM: 20 km Spain: 4 km Romania: 5 km	AVC-PS installed: Italy: 5 in PNM; 3 in PNALM and 2 in Terni Province. Romania: 5 Spain: 5 Greece: 6 Virtual fence installed: Italy: 5 Km in PNALM and 20 Km in PNM Romania: 7 Km Spain: 4,5 Km	In Romania, Greece and Spain the tendering procedures for the installation of the AVC PS have taken longer than expected because the contracting procedures were more complex than expected and the rise of costs of raw materials increasingly complicated the process. However, all AVC PS have been installed (except one in RO replaced by virtual fence). Monitoring in Italy since 2021 and in Romania and Spain since the first month of 2023 provided significant information about the effectiveness of the devices. In Greece the monitoring of the effectiveness of the AVC-PS will continue after the end of the project as it is foreseen in the After-LIFE plan. The installation of virtual fences has not represented any particular problem and was successfully implemented.
C2. Activities to enhance connectivity between core areas through readaptation of	Adaptation of crossing structures: IT-PNALM: 7 underpasses, 400 mt. fences	Romania: 30 crossing structures have been cleaned off debris, vegetation and garbage. Greece: 55 crossing structures have been improved through a set of different and	The action was developed successfully and no major problems were encountered. The interventions carried out in the main critical areas for the target species, allowed

<p>underpasses and interventions on road sides</p>	<p>IT-PNM: 3 crossing structures, 12 fences Romania: 30 underpasses Greece: 50 underpasses Spain: road-side vegetation cleaning</p>	<p>complex interventions: planting, fence improvements, construction of stair ramps, construction of dry ledges, removal of debris, light screens and pruning IT-PNALM: 4 crossing structures have been improved through the removal of debris and management of vegetation at the entrances. In 3 of them fences were also installed on 1.800 m. IT-PNM: Totally 9 crossing structures benefited from the interventions: 2 crossing structures, previously completely blocked, have been cleaned off debris, and vegetation while 7 have been adapted with fence installation. 3 Km of the road SS17, the main barrier between PNALM and PNM have been secured, through the installation of fences between 7 crossing structures In Spain the cutting of vegetation to improve the drivers' visibility has been carried out on 27 Km of roads</p>	<p>to increase the ecological connectivity favouring the use of the existing crossing structures, and in several cases contributed to create new safe passages for the wildlife because before the interventions the passage was completely blocked. In Spain the management of vegetations on the roadsides increased the visibility of drivers and then decreased the risk of accidents in important sites for the Iberian lynx conservation It has been observed that the adaptation of the crossing structures has been very useful.</p>
<p>C3. Production and installation of specifically designed information road panels</p>	<p>Installation of road info panels: IT: PNALM: 25, PNM: 60, Terni: 6 Romania: 8 Greece: 8 + 30 (30 not foreseen in project text but only in budget) Spain: 12</p>	<p>Road information panels installed: Italy: 60 in PNM, 25 in PNALM and 12 in Terni Province. Romania: 8 Spain: 24 Greece: 8 big panels and 30 small panels.</p>	<p>This action has been very successful and appreciated. The evaluation of the panels has been positive by the persons to whom questionnaires were submitted.</p>
<p>D1. Monitoring the impact of the concrete conservation actions</p>	<p>Monitoring of following parameters: Number of road kills before and after the concrete conservation actions AVC PS N. of PIR sensors/thermal camera activations (presence of animals bear the road)</p>	<p>AVC-PS and VF were monitored as was foreseen in the project proposal. The adapted crossing structures were monitored through camera traps, while in Greece as was made in Action A4 through the use of the prototype developed by COSMOTE.</p>	<p>The action has been implemented successfully and we were able to evaluate in a comprehensive way all the concrete conservation actions implemented. The results obtained and the experience gained will be also useful for future replication actions.</p>

	<p>N. of activation of acoustic scaring device (simultaneous presence of an animal and an incoming vehicle)</p> <p>% of vehicles that reduce their speed when the flashing panels of the system are triggered (driving behaviour)</p> <p>Virtual fence:</p> <p>Use of camera traps/thermal camera to monitor the reaction of wildlife to the activation of the devices</p> <p>Adaptation of the crossing structures:</p> <p>Number of animal crossings before and after the interventions</p> <p>Road panels: Monitor t driving behaviour (speed reduction)</p>	<p>The effectiveness of the road panels was evaluated, through a specific questionnaire submitted to 1319 people in the project area</p>	
<p>D2. Evaluation of project effectiveness by key actors involved in the project actions</p>	<p>Assessment of the level of satisfaction of key actors (road authorities, regional/province administrations, municipalities, drivers, associations) regarding the activities carried out in the project, through the submission of a simple questionnaire to the contacts gathered during the project.</p>	<p>The survey was successfully carried out in 2023. A questionnaire was submitted physically and through an online portal to stakeholders during public and individual meetings, during the final conference, and it was also specifically sent to some of the key actors. We achieved 92 replies.</p>	<p>We have gained an important insight in the evaluation of the project by the main stakeholders and authorities about the project. In general the evaluation was positive, although some criticisms and further recommendations were provided. These points are important for the project partners also for the After-LIFE activities.</p>
<p>D3. Assessment of the socio-economic impact of the project on the local economy and population</p>	<p>Identification of if and how the project will have a socio-economic impact, e.g. through the reduction of accidents</p>	<p>The actions were developed together. We have contracted a specialized company that helped to develop the analysis. Data collection was made on the basis of:</p> <ul style="list-style-type: none"> - the project KPIs - specifically designed questionnaires to which the partners responded - the data gathered in the monitoring activities - the replies to the surveys regarding the road info panels (C3) and in Action D2 	<p>A detailed and comprehensive analysis was made about the impact of the project both in socio-economic terms as well as on ecosystems and their services. The impact can be considered significant although a lot of work still is to be for the issue of the impact of roads on wildlife (and the target species specifically).</p>
<p>D4. Assessment of impact on the ecosystem functions</p>	<p>Analysis of if and how the project will have an impact on the ecosystem functions.</p>		

E1. Development of logo, graphic layout and information materials	Production of: Logo, graphic layout/templates, leaflet, poster, info panels, gadgets, documentary, LIFE STRADE video spot, exhibition panels, layman's report	All the materials were produced. More gadgets than initially foreseen were produced because they were very appreciated and were a big help to disseminate the road kill issue. The project was mentioned in 162 media activities (press releases, national and regional press TV/Radio programmes etc).	All materials have been successfully produced and disseminated during the other communication activities.
E2. Video game	Production and dissemination of a video game	The video game is available and can be download in Playstore and Appstore. It was seen and played by round 1.500-2.000 persons.	Due to the COVID-19 restrictions the dissemination of the videogame was possible only starting from summer 2022. Nevertheless the game was seen by a big number of persons.
E3. Mass media and social media	Creation of website Facebook page, social media Mass media activities	The website has been visited 17.034 times, with a total of 33.974 page views. 43 news have been made. Facebook: 2.428 followers IG: 416 followers Media activities: 167	The media activities are ongoing as planned. Due to COVID-19 restrictions more online activities are done than planned, for this a Communication Officer, initially not foreseen, is being selected and hired by Agristudio.
E4. Local awareness raising activities	Presentations in municipalities in project areas Poster for driving schools Participation at local events Dissemination of info materials	104 events done, 400.000 persons reached. Posters and leaflets distributed to 77 driving schools.	This action was strongly limited from COVID-19 restrictions until mid 2022. Nevertheless, a significant number of events was made and a huge number of persons was reached.
E5. Networking and experience exchange	Networking with LIFE projects and other initiatives. 3 exchange trips per area	39 networking activities done. Almost 2.000 professionals reached. 28 persons involved in experience exchange trips.	Although done only online for 2 and a half years, this action has been very useful to disseminate the project and to gather experiences to be used in the activities, as well as to disseminate the implemented actions. It contributed significantly to replication.
E6. Conferences	Final conferences Attending conferences: IENE, ICOET etc.	Project was presented at 18 conferences/workshops.	The presentation of the project among the technical audience has been very successful and helped to spread the

		It was presented at IENE 2020 conference (held in 2021) and at IENE 2022 Over 100 persons attended the final conferences.	knowledge of the activities to a technical audience.
E7. Replicability	Production of “guidelines or the monitoring and management of road kills” Organization of seminars to disseminate project activities Technical workshop Replication action plan Foreseen achievement of replications in each country.	Technical workshop done at IENE 2020 (held in 2021) and at IENE 2022. 32 dissemination activities done. 18 replications achieved.	The project has raised big attention by other potential interested parties. Significant replications have been achieved.

- Indicate which project results have been immediately visible and which results will only become apparent after a certain time period.

The main visible project result is the significant reduction of animal-vehicle collisions and the improvement of the ecological connectivity where the concrete conservation actions were carried out. These results are of fundamental importance to improve the conservation status not only of the target species but of all wildlife species present in the project area.

The reduction of animal vehicle collisions reached up to 100% in several areas where the AVC-PS and the virtual fence were installed.

It is also important to emphasise that in addition to the reduction in accidents, the analysis of the AVC-PS data shows that, in total, the system has intervened in more than 1.000 risk situations (simultaneous presence of an animal and a vehicle travelling at high speed) and only 6 accidents have occurred to date. Of course this is an indicative figure but it shows the effectiveness and potential of the system.

In the same way the effectiveness of the implemented interventions to favour the use of the existing crossing structures is evidenced by the general increased frequency of their use by wildlife in all project areas. In particular in Greece, the interventions carried out by EOSA resulted in 5 cases in which bears were able to use crossing structures that were previously unusable, this was the case of the constructions of stair ramps. The same result was achieved in Romania and Italy where the works carried out made accessible to wildlife crossing structures whose access was obstructed due to the presence of debris and vegetation. Surely the effect of the interventions carried out is important on the long term because we were able to improve the ecological connectivity of the project area, and this will have a positive effect on the conservation of the target species. For this reason, the work carried out on the SS17 road, which is one of the main barriers to the expansion of the Apennine brown bear outside the PNALM, is of fundamental importance.

Considering the technical solutions implemented, the “Wildlife Monitoring, Species’ Classification and Visualization” prototype solution developed in Greece by COSMOTE proved to be a very successful and efficient tool to monitor the use of the crossing structures, in terms not only of quality, and accuracy of data provided but also for saving time and human resources. This prototype solution also showed its great potential in terms of replicability as was witnessed by the replication cases already achieved.

Another extremely important result was the involvement and the collaboration established with the road management authorities, which will guarantee that the lessons learned will be applied in the future in other areas. Some results were already achieved, like the installation of 4 Km of fence on the motorway made by Società strada dei Parchi, with their own funds, under the supervision of PNALM in the motorway A25, one of the most important barrier to the expansion of the Apennine brown bears. The same motorway company installed, in the petrol station 20 panels about the LIFE SAFE-CROSSING project, with the same layout of the road panels of Action C3. In this sense, ANAS's involvement and support for the project is of strategic importance, considering the fact that ANAS manages over 3000 km of roads in Italy.

Regarding the collaboration with the road management authorities, one document that has strategic importance is the guidelines produced by Minuartia. This is a product that explains in a clear manner what interventions need to be made and how to implement them to reduce the impact of roads on wildlife and therefore an extremely useful tool for all practitioners.

The other added value of the project was the result of all the communication activities. Through the different activities at least 5 million people were reached by the project, this means that the main messages can be spread in all project countries. Raising the awareness of drivers about the hazard of wildlife vehicle collisions is an important tool to mitigate the wildlife roadkill risk and increase traffic safety. Driving behaviour is too often underestimated as a risk factor, even though low speed and high attention are critical in avoiding a collision when a driver encounters an animal crossing the road. Within the framework of the LIFE SAFE-CROSSING project, a great effort was made to promote awareness raising campaigns through the production of information materials (leaflets, posters and stickers) as well as organisation of public meetings, dissemination of information to media and involvement of local driving schools. We think that one of the “winning messages” of the project to involve the general public was “Let’s make the road a safe place for all”. This message means that reducing the risks of animal vehicle collision is important for the wildlife as well for people.

- If relevant, clearly indicate how a project amendment led to the results achieved and what would have been different if the amendment had not been agreed upon.

No amendments have been made

- Describe the results of the replication efforts.

As can be seen in the description of Action E7 the project has a very strong replication potential and had already achieved significant replication cases. We do not list them here again but the most significant achievements are the following:

In Italy the project has yielded the start-up of a fruitful cooperation with the road Authority ANAS as well as with the Motorway Company “Strada dei Parchi”. In fact, both these authorities have been very cooperative not only in the development of the project actions (ANAS specifically) but they have also been proactive in replicating the use of road information panels (on the motorway) as well as for the installation of the fence near the motorway in order to prevent the passage of bears on the road.

In Greece the Egnatia Odos has already invested own funds for repeating the study of the underpasses on another highway segment, and is now planning the interventions on the selected underpasses on this new road stretch. This is an excellent example of uptake of project activities as a consequence of a demonstrative start-up of an intervention during the project.

The end-to-end prototype solution (developed in Greece) has already been used for the planning of important interventions on roads in Catalonia, Spain.

Several entities in Andalucia and other Spanish Regions, some of them involved in the LIFE LYNXCONNECT project, and others not, are now planning for the installation of virtual fence in other road segments, and some segments have already been purchased.

In Italy the LIFE WOLFALPS project is taking inspiration from the road information panels (C3) to install similar panels in the Val di Susa, which is a strongly critical area in terms of habitat fragmentation by roads.

These examples show that the project has had a very significant importance in raising the awareness of the key authorities on the need to intervene for reducing the impact of roads and demonstrating them what are the best means to intervene. Certainly the project did not manage to solve the issue of road kills and fragmentation in the entire key areas, but it has been very

important for giving a first kick-off for the implementation of mitigation activities by the authorities themselves.

- Indicate the effectiveness of the dissemination activities and comment on any major drawbacks.

One of the primary impacts of the project involved heightened awareness among both the general public and stakeholders regarding the influence of linear infrastructure and relevant risks on biodiversity and wildlife. Communication and dissemination activities played a pivotal role in spreading awareness about the project's objectives and outcomes reaching over five million individuals (estimate of the report of Actions D3/D4). The use of various communication channels, including traditional media and digital platforms, helped in engaging stakeholders and the general public. Furthermore, the project has reached several persons and different kinds of stakeholders through using different types of media items.

In 2020-2021 and the first part of 2022 the dissemination activities have strongly suffered from the limitations of the COVID-19 pandemics. In fact, the year 2020 was the year in which the local activities targeting local communities should have been started, and for two and a half years these activities were delayed or replaced by online events.

As can be seen in Actions E5 and E7 this problem has had a limited impact on the action development, because many dissemination and experience exchange activities could be done online, after an initial start-up phase. This is visible in the long list of networking and dissemination activities addressing other practitioners, projects and other initiatives that are used to work with remote tools.

Therefore, these actions have been very successful, which is also demonstrated by the level of replication achieved, and by the positive evaluation of the project by the key stakeholders.

Contrarily the public dissemination activities in Action E4 have suffered more from the COVID-19 limitations, because public events could not be made online. Therefore, in the first two and a half years the communication towards the local communities was lower than expected. However, a strong effort was made by the partners in order to recover these activities at least partly, and finally a significant number of persons was still reached during the activities in public places, the initiatives with schools and with driving schools.

The video game developed in Action E2 has been exposed at a big number of public events and people were invited to play with it, an initiative that has always been greatly appreciated.

The contracting of a specific communication officer has guaranteed a constant communication through the social media, especially Instagram and Facebook, which are nowadays among the most popular media. In fact, the issue of new posts has occurred very regularly, and this has guaranteed a for the project to be constantly followed.

Therefore we can say that despite the initial delays and problems in the first two years, the project has very successfully recovered the initial problems and then been capable to very widely and effectively communicate its activities, as well as raising awareness about the problem of the impacts of roads.

- Policy impact

The interventions to enhance the use of crossing structures have been a very important contribution to the increase of ecological connectivity, and therefore also to the implementation of the Natura 2000 network. The project area initially included 29 Natura 2000 sites (SCIs), and then one more SCI was included in Romania (ROSCI 0170), where an additional piece of virtual fence was installed. This SCI is very important because it represents a stepping stone for species between two mountain ranges. By reducing the direct mortality and the fragmentation represented by roads the project contributed to the biodiversity value within the single sites, as well as to the connectivity between the SCIs. The connectivity was increased

both by reducing the habitat fragmentation as well as by improving the cooperation between the management authorities and stakeholders in the sites. The standardization of the methods and best practices implemented can be used to be exported to other areas. Finally, the intense effort of awareness raising during the project also increased the knowledge of the local communities and tourists about the Natura 2000 network.

Italy: The Abruzzo Region has approved the new Regional Regulation “APPROVAZIONE PROCEDURA OPERATIVA PER LA GESTIONE DEI SINISTRI CAUSATI ALLA CIRCOLAZIONE STRADALE DALLA FAUNA SELVATICA E DAGLI UNGULATI SUCCESSIVI AL 1 LUGLIO 2019, RICADENTI NELLA POLIZZA RCT/O DELLA REGIONE ABRUZZO N. F1900010292.”, DGR n. 44 of 03/02/2021, a legal tool which for the first time in the area regulates the compensation of damage cause by AVC. This legal process, which is ongoing since several years, has come to an end also due to the strongly lobbying by the Italian beneficiaries PNM and PNALM, and the awareness raised by the SAFE-CROSSING project.

In December 2021 the LIFE SAFE-CROSSING project was mentioned as an example to be replicated, in the final report about the implementation of the Italian national bear action plan (PATOM - stato di attuazione dell’A.P.A. PATOM 2019-2021 Accordo tra Pubbliche Amministrazioni per l’implementazione del Piano d’Azione per la tutela dell’Orso bruno marsicano (PATOM) nel biennio 2019/2021). Specifically the document recommends implementing the activities developed in the LIFE SAFE-CROSSING project in order to reduce the impact of roads on bears.

The minutes of the sessions of the Italian Senat mention that on 30 November 2021 the LIFE SAFE-CROSSING project was mentioned in the discussion regarding the implementation of the national action plan for road security to 2023 (Piano nazionale della sicurezza stradale 2030: indirizzi generali e linee guida di attuazione). Specifically, it was mentioned that activities such as the LIFE SAFE-CROSSING project should be implemented in order to reduce animal vehicle collisions.

Greece: The new National Bear Action Plan was developed in the frame of the IP project - LIFE-IP 4 NATURA (LIFE16 IPE/GR/000002) has been approved by the Ministry of Environment and Energy and is expected to be published in the National Gazette in the following weeks. Following the example of the LIFE SAFE-CROSSING project actions for deterring devices (AVC PS) use along roads have been included in the Action plan. In particular the following measures were included: Objective (1)/ Measure (1.8) = Reduction of road mortality/ Actions (1) = Special signage, alarm systems, escape ramps, etc. on fenced highways; Action (2) = Special marking, installation of deterrent and special Vehicle-Animal Collision Prevention (AVC-PS) Systems on non-fenced roads.

Spain: In Spain, the new areas that become part of the distribution of the Iberian lynx are included in the areas of recovery of the species, which are approved together with the corresponding recovery plan, by regional regulations in Spain and come to be considered within the framework of national or regional land-use and development policies, in accordance with article 10 of the Habitat Directive.

Within the Working Group on habitat fragmentation caused by transport infrastructures, the project contributes to the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration, which aims to be the strategic planning document that regulates

the implementation and development of Green Infrastructure in Spain, establishing a harmonised administrative and technical framework for the whole of the Spanish territory. As a result of the collaboration with this working group, on 31 May and 1 and 2 June 2023, a conference on ecological restoration and transport routes was organised in Seville, in which LIFE SAFE-CROSSING also collaborated. The aim of these conferences was to share strategies and actions aimed at reducing the difficulties between the conservation of species and existing infrastructures.

6.4 Analysis of benefits

1. Environmental benefits

The effects of the concrete interventions of the project can be considered very significant. During the monitoring activities we have recorded a decrease of animal-vehicle collisions up to 100% on the road segments where AVC PS and virtual fences were installed. Also the adaptation of the crossing structures has been very successful, with a registered increase of the use of the structures by wildlife. This is particularly significant in Greece, where we have recorded an increase of over 100% of the use of the adapted underpasses. The monitoring with camera and video traps has also shown extremely interesting footage of the behaviour of animals using the adapted structures.

Also the results of the evaluation of the road information panels are very encouraging, with the majority of the respondents indicating that they have considered the panels positively and that their driving behaviour has changed after seeing the panels.

Another important effect of the project is that a big number of key stakeholders have been involved in the networking and replication activities, and now have an increased knowledge of potential instruments they can use to reduce the impact of linear infrastructures. The interest of the stakeholders and authorities is demonstrated also by the big number of replications that were already recorded.

As was also explained in the proposal, an immediate effect on the population sizes of the target species is not realistic to be registered. But the project will surely have a strong impact also on the long term, due to the following benefits:

- the reduction of the killing on roads, not only of the target species but of wildlife in general
- the increased connectivity that allows connectivity between metapopulations and eases the migration of animals into new areas
- the increased awareness and participation of the key stakeholders, who have learned new important mitigation tools, which they can adapt also in the future

Besides the immediate reduction of mortality, the project will therefore have an important impact also in terms of population dynamics, genetic flow, and as a basis of improved conservation measures.

The results of the project interventions (increased number of animal passages in crossing structures and reduced number of AVC along the virtual fence) have an important impact in terms of improvement of connectivity of Natura 2000 sites, of protected areas, and of metapopulations of the target species. The project took place in 30 Natura 2000 sites, and therefore the impact inside and among these sites will be very significant.

In Italy the activities on Road SS17, which divides PNM from PNALM, reduces the fragmentation between these two protected areas and therefore eases the movement of bears

from PNALM (the bear core area) towards PNM, and from there into other territories. This expansion is extremely important for the future conservation of this strongly endangered endemic species.

In Romania a strong benefit is on the connection of the Natura 2000 sites Piatra Mare (ROSCI0195) and Postavaru (ROSCI0207), which are interrupted by the targeted road and both are important bear areas. The installation of the 2 unforeseen km of virtual fences in the Prejmer area (ROSCI 0170) is important because this area was recently recolonized by bears, and since it is located in the lowlands surrounded by mountain and forest areas, this site is to be considered an important stepping stone now only for bears but for all wildlife.

In Greece the works on the underpasses on the Egnatia Highway has an extremely strong defragmentation value in terms of connecting different bear ranges. Bears have moved to these areas on both sides of the highway after its construction and trying to move from one side to the other they were often killed on the road. An especially reinforced fence was built in 2014 to avoid accidents along the motorway section under study, which caused fragmentation problems. The works done under LIFE SAFECROSSING were a clear case to be followed, in cases that existing motorways turn to hindering infrastructure for wild fauna.

In Spain the conservation actions (actions C1 to C3) of the project are being carried out within areas included in the Natura 2000 Network or which, not being included, connect them. The area of Donana is one of the historical ranges of the Iberian lynx, and therefore represents a fundamental nucleus for the expansion of the species into other areas. Contrarily, the area of Sierra Morena is one of the recolonization areas, and therefore the conservation of the species is crucial also as stepping stone into new ranges.

2. Economic benefits

The decrease of traffic collisions with wildlife, due to the concrete conservation carried out, can be translated into a decrease of material damage of vehicles and of injuries to persons (and, in the worst case, of mortality of persons). According to expert estimates (Camps et al. 2016) on average a road collision with an animal causes costs of 8.000 € in terms of damages to vehicles, injuries, working time of police staff, damage to the roads etc.

The reduction of up to 100% of animal-vehicle collision, in the areas where AVC-PS and virtual fence were installed, is difficult to quantify in economic terms, but surely has a significant economic impact.

In the same way we can consider that the increase in the use of the adapted crossing structures by animals results in the avoidance of an animal crossing the road and thus a potential accident and its economic consequences.

Besides the up-mentioned evaluations, it must be pointed out that 19 private companies have been involved in the development of the activities of the LIFE SAFE-CROSSING project, such as the companies that were contracted for the installation of the AVC PS, the virtual fence, the company that developed and tested the road information panels in Action A7, the companies that were involved in the adaptation of the crossing structures and those that collaborated in the communication activities. For all these the project has provided a more or less significant economic impact.

3. Social benefits

The social benefit of the project is basically the reduction of the impact of traffic accidents with wildlife for drivers, mainly through a reduction of the cases of injuries and, in extreme cases, mortality, but also because an accident with a large animal such as a bear can cause shock and emotional problems after the accident. Therefore, the reduction of AVCs surely has a direct benefit by avoiding such traumatic situations.

The activities implemented to raise awareness of drivers (road info panels, video game, online awareness raising, info materials, media work etc.) will result in a generalized more careful driving behavior, which not only reduces the number of AVCs but also of road accidents in general, caused by too high speed.

As was revealed by the analysis made in Actions D3/D4, the project beneficiaries and the main stakeholders considered that the activities of the project resulted in improved road safety. In fact, one of the primary impacts of the project involved heightened awareness among both the general public and stakeholders regarding the influence of linear infrastructure and relevant risks on biodiversity and wildlife.

Therefore the project can be considered to have an important impact on drivers' safety.

Besides this, another important social benefit is the improvement of the ecosystem services. The interventions of the project do not benefit only the target species but wildlife in general, and they improve the connectivity of the Natura 2000 network and reduce habitat fragmentation. This is an extremely important social benefit because the presence of healthy nature and the possibility to enjoy areas where the ecosystems are relatively intact have a big importance for leisure and recreation.

4. Replicability, transferability, cooperation:

The activities implemented in the project have a strong potential to be replicated and transferred to other areas. This is also demonstrated by the number of already achieved replication cases, as reported in Action E7.

The used AVC PS can be installed on many types of roads and almost in any kind of environment, because the sensors that register the presence of animals can be adapted to the local environmental conditions. The thermal camera that can be associated to it for the detection of animals on the roads sides is extremely sensitive and can detect also small size mammals such as fox or hare. Therefore, the systems can be used for the prevention of any type of AVCs involving mammals.

Since the problem of road collisions with animals is a problem that occurs all over the world such solutions have an extremely big replication potential.

It is important to consider that the system obviously needs special expertise for correct installation and maintenance, a factor that must be taken into account by those who want to use it (e.g. the effectiveness and functionality of the components in adverse weather conditions of snow or rain, such as the charge of the batteries with solar panels). It is therefore important to take into account that some components might have to be specifically adapted to the local conditions.

The AVC PS has been developed by an Italian company and until now commercialized always by this company. Thanks to the fact that during the project the AVC PS are used in three more European countries, and disseminated in the frame of the E actions, companies in other countries have been involved in its commercialization and therefore additional income can be generated.

The cost for one AVC PS including installation and maintenance for 4 years ranges from 18000 to 25000 €. Considering the further up mentioned amount of 8.000 € of costs for each AVC the cost for the System are compensated with round two avoided collisions, which is estimated to be the case in a quite short time. Therefore, although the initial investment seems costly, in the long term it surely pays off considerably.

The virtual fence is a useful tool to be used in all those conditions where there are long road segments where no specific animal passages can be localized, and as accompanying measure for the AVC PS. This system is simply triggered by the headlights of vehicles and therefore can be applied for any kind of animal that risks to be killed on the road. Since it is quite low cost and easy to install and to maintain it can be easily used in all kinds of environments and also without the need of specific expertise.

The road information panels (C3) were designed with a specific technique that aimed at optimizing the message that reaches drivers. The aim of this was to have a tool that is more effective in communicating a message than the commonly used road signs. As has been seen in the polls regarding the effectiveness of these panels (Action D1) indeed the evaluation by the interviewees has been very positive. In this sense the use of neuromarketing techniques has a very high potential to be used for any kind of communication activities in the field of nature conservation.

The prototype solution developed by COSMOTE (Action A4) has also a high potential to be used in other cases, especially in physically unattended sites, or remote areas experiencing difficulties in access, where wireless monitoring (and/or alerting mechanisms) would ensure assets security and safety. In fact, this prototype solution has already been replicated in Spain, and it can be used in all situations in which a big number of sites must be monitored and a significant amount of images must be processed.

During the project the replication and transferability was also enhanced by the fact that local authorities responsible for road management and for compensation of damage caused in accidents (e.g. road authorities, Province administrations etc.) have an extremely strong motivation to apply any kind of suitable instrument to reduce the number of AVC. This has led to a big number of replications, and also to the fact that several other projects, protected areas, local authorities have requested detailed information about the implemented tools, because they are strongly interested in their implementation.

One very important aspect of the LIFE SAFE-CROSSING project has been the cooperation with the Italian road authority ANAS. Thanks to a row of preparatory meetings and information sessions the Regional staff of ANAS got very interested in the activities carried out in PNM and PNALM, and provided a lot of support to the activities. Besides the permits for the development of all the works, ANAS has also participated in several field surveys to commonly decide where and how to best intervene. ANAS has also asked to have its logo included on the road info panels, because it strongly approved the initiative of the installation of these devices. This cooperation between the Parks and ANAS has then raised also the interest of the Motorway Company Strada dei Parchi, which has installed the road panels in the petrol stations.

Also in Romania the road company CNAIR has provided strong support to the project, also there participating actively in the field activities, besides providing the necessary permits.

5. Best Practice lessons:

Regarding the installation of AVC PS, which are still relatively innovative (they have been developed in the previous LIFE STRADE project), for reaching the best results the materials that compose one AVC PS can vary strongly from one location to another. According to the surrounding environment a choice has to be made between the use of thermal camera, infrared sensors or a combination of both. In some cases it can be necessary to combine to AVC PS into one double system in order to double the protected road segment. For this reason it is important that the target spots are studied in sufficient detail and the materials for each AVC PS has to be determined on a case-to-case basis.

In fact, in the project planning phase we had foreseen, in Action A1, that all the partners visited the AVC PS already installed in Terni Province and then would plan the installation of the devices in their territories autonomously. However, it was seen that it was important that experienced technical staff assisted the partners in the start-up phase of the planning of the installation of the devices in order to make sure that the right components were chosen and installed in the precisely correct place. This is why in Action A1 the project management staff made an initial field visit to each project country in order to make a field survey and discuss the installation with the partners.

The virtual fences that were installed appeared to be a good protection under specific conditions, and in one instance (in Romania) it has shown that this tool was actually preferable to the AVC PS, because the area to be protected was too large.

Therefore it is important to have an accurate insight also on the length of the road segments to be protected in order to choose the correct road kill prevention tool.

In the frame of action A4 guidelines for the analysis of crossing structures and for the adaptation of the structures were produced. On this basis the analysis of the crossing structures was made and the adaptation of the different sites was planned. It has been seen that a standardized guidance for this kind of interventions is crucial.

The delays incurred in Greece, Romania and Spain in the tendering for the installation of the AVC PS indicates that for the assignment of a contract for such complex devices sufficient time has to be planned. The same applies for the achievement of permits for the interventions on the roads. Actually for different types of interventions different permit procedures might be needed, and the technical details for the interventions have to be available. Therefore sufficient time has to be planned for all this preparatory work.

6. Innovation and demonstration value

The two most innovative aspects of the project were the end-to-end “Wildlife Monitoring, Species’ Classification and Visualization” prototype solution developed by COSMOTE and the neuromarketing technique used for the development of the road info panels.

The end-to-end prototype solution developed by COSMOTE was an innovative wildlife monitoring and species classification solution (exhibiting a long list of innovative features, most of which are not available in the market) with a two-fold objective:

- To efficiently monitor (incl. AI-based species/object detection, alerting/notification upon detection, visualization options) the usage of 45 underpasses in NW Greece (along Egnatia Odos) by the wildlife and extract, in an automated way, statistics to facilitate decision making about the appropriate interventions for protecting the biodiversity.

- To minimize the huge manual effort required for the species/object classification (based on AI) and statistics extraction (more than 100.000 snapshots and 100.000 videos collected during the two monitoring periods of the project).

This system has proven very efficient for two aspects: 1. It allows to analyse a huge amount of data in a time effective way and with a limited effort of work force and 2. through the classification of the 100.000 images it has developed the capacity to automatically identify the species that uses an underpass. These aspects taken together comprise a very effective and cost-efficient monitoring tool.

Re-usability of the Solution

The solution developed in the context of the LIFE SAFE-CROSSING project combines low cost with ease of installation but most importantly, it is an expandable and reusable solution, in any country in the world, since as all you need is wireless 4G cameras, photovoltaic panels and SIM cards so as to guarantee “always-on” connectivity with the internet. During the LIFE SAFE-CROSSING lifetime, Minuartia installed two 4G cameras in Spain to monitor the wildlife utilizing COSMOTE’s cloud infrastructure for storage, processing and visualization of the cameras’ content. Cameras’ configuration performed remotely by COSMOTE and the proper operation of the solution, end-to-end, was validated. Based on this experience, for testing purposes and/or in the context of another EU-funded project, COSMOTE may offer its backend cloud infrastructure for free.

We shall also stress that the solution can be utilized for offline detection and classification of species by processing snapshots/videos that have been gathered by e.g. trail cameras that have been installed elsewhere.

As a future expansion, COSMOTE could develop a smart “species tracking solution”, which, upon detection, will follow the movement of specific animals, by utilizing Pan-Tilt-Zoom (PTZ), battery/Solar-powered cameras, such as the Reolink KEEN Ranger PT one (<https://reolink.com/product/keen-ranger-pt/>).

The neuromarketing technique, used for the production of road info panels in Action A7, had never been applied in the field of conservation activities. The project (Action C3) aimed at raising awareness of drivers regarding the importance of an adequate driving behaviour. One tool to do this is the use of impacting road information panels that alert the drivers. However, it was not possible to foresee the installation of test panels and then replacing them after their optimization following the feedback of drivers. Therefore the optimization of the panels has been done with the help of specific tests done on a group of volunteers. These tests not only revealed the best message to convey but also how to improve the graphics of the systems in order to maximize its clearness and visibility.

These two innovations have a strong demonstration value, and both have already been object of replication in other areas. Besides this, also the best practices used have a strong demonstration value, not so much for their technical peculiarities, but because all tools that can help reduce the impact of roads are greatly interesting for the authorities responsible for road management, for compensation of road accidents, and those who have to guarantee road safety. In fact, many of the actors who have shown interest in replicating the project activities are entities that are somehow involved or responsible for the reduction of the impact of roads and therefore are eager to achieve knowledge of potentially cost-efficient tools.

In Greece the involvement of the motorway company Egnatia Odos has raised the awareness of this institution about the importance of the interventions on underpasses, which is now replicating this on other road segments.

7. Policy implications

In Italy the project fully complies with the objectives of the “Piano di Azione e Tutela dell’Orso Marsicano” PATOM, the national action plan for the conservation of the Apennine brown bear. The Lazio Region, which is part of PATOM, has requested to be provided with information on the monitoring procedures adopted within the project. Two more members of PATOM (WWF and Parco Nazionale d’Abruzzo Lazio e Molise) have visited the project in order to learn more about the activities carried out and how they could be implemented in other areas.

The LIFE LYNXCONNECT project (LIFE 19 NAT ES/001055) includes six beneficiaries that have the responsibility of road management: Portuguese Infrastructures (IP), Spanish Ministry of Public Works (MITMA), Consejería de Fomento de Andalucía (CFIyOT), Ministry of Development of Extremadura (DGMIV_EX), Badajoz Provincial Council (DB_EX), Consejería de Fomento of Castilla-La Mancha (CF_JCCM). These authorities got interested in the activities implemented in the frame of LIFE SAFE-CROSSING project. The SAFE-CROSSING project has encouraged them to include provisions for the reduction of impact of roads on lynx (and biodiversity) in their regulations and policies. This task was facilitated by the presence of CAGPYDS and AMAYA in both projects as associated beneficiaries.

The LIFE SAFE-CROSSING project included several activities that take place directly on the roads. Therefore it was of fundamental importance that all the activities complied with the national road regulations. This has been taken into account, with specific assessments, during the development of Actions C1, C2 and C3. This is why for the installation of the road information panels (C3) a specific inquiry was made by the beneficiaries in the four project countries regarding the conditions and graphic requirements for the installation of panels on the road sides. This was done in order to avoid problems with the installation of the already printed panels.

The national road regulations have also guided the choice and installation of the type of panel included in the AVC PS (flashing light panel + plus the electronic writings).

8. Synergies with other projects

The LIFE SAFE-CROSSING project has built strong synergies with the following other LIFE Projects:

Lynxconnect (LIFE 19 NAT ES/001055): in this project the project area overlapped with the Spanish project area of the LIFE SAFE-CROSSING project. No doubling of funds has occurred because LYNXCONNECT does not implement any of the actions foreseen in our project. However, synergies have been made because the LYNXCONNECT project aims at improving connectivity for different nuclei and metapopulations of Iberian lynx and therefore the activities developed by the SAFE-CROSSING project have been an example for some of the LYNXCONNECT partners, which have chosen to apply some AVC prevention activities (see Action E7).

Besides this, LIFE SAFE-CROSSING and LYNXCONNECT have commonly developed some activities such as awareness raising activities, as well as the cooperation in the organization of the seminar 'Ecological restoration and transport infrastructure, 30.05-01.06.2023

LIFE AmyBear (LIFE15 NAT/GR/001108) was developed in the Regional unit of Florina (Greece) and therefore its project area partially overlapped with the SAFE-CROSSING project area. However, also this project did not implement any of the actions foreseen in our project, therefore no doubling of funds occurred. In fact, the AmyBear project mainly implemented

actions to reduce conflicts between bears and human activities (e.g. development of Bear Emergency Team, distribution of Livestock Guarding Dogs and electric fences etc.. From the point of view of roadkill prevention the AmyBear project has installed the “virtual fence”, which in the LIFE-SAFE-CROSSING project is not installed in Greece. Contrarily, there were strong synergies between the two projects regarding AVC prevention, on the one hand through exchange of information and experiences, on the other hand because the projects have collaborated in the selection of the locations for the installation of the prevention measures. Moreover, the experiences of the LIFE AmyBear Project with the installation of virtual fence (started earlier) have been interesting for the staff of the LIFE SAFE-CROSSING project who installed the devices in the other countries.

The LIFE ArcProm project (LIFE18 NAT / GR / 000768) did not overlap geographically in Greece (it mainly focuses the area of Prespa, which is not part of the SAFE-CROSSING project area) but the PNM was included as project area in both projects. However, no actions of the SAFE-CROSSING project are implemented in the LIFE ArcProm. These two projects however complemented each other through the communication and dissemination actions, also promoting each other in the media activities. Many of the public events organized in PNM were organized commonly by the two projects.

The LIFE Bear Smart Corridors project (LIFE20NAT/NL/1107), which started in October 2021, aims at the strengthening of corridors for encouraging the movements of bears. The project area partially overlaps with the LIFE SAFE-CROSSING project area both in Italy and in Greece, but the LIFE Bear Smart Corridors did not implement the same types of activities on the roads. However, the interventions of the LIFE SAFE-CROSSING project surely contribute to the optimization of the corridors, and therefore to the success of the Bear Smart Corridors project.

Two beneficiaries of the LIFE SAFE-CROSSING project (Agristudio and Minuartia) were also part of the consortium of the Horizon 2020 CSA project “Bison – Biodiversity and Infrastructure Synergies and Opportunities for European Transport Network” (101006661). The BISON project contributed to prepare European research organizations and companies to address the challenge of the impact of infrastructures on biodiversity. The project built on existing experience to improve environmental performance of European transport infrastructure and networks. The BISON project partners were a mix of transport and environment administrations, infrastructure managers or owners, research institutions and private companies, who together provided the cutting-edge research and practice. One of the Tasks of the Bison project foresaw the organization of knowledge uptake from LIFE projects, and the SAFE-CROSSING project provided an important contribution to this. Different partners of the BISON project also contributed with their knowledge and experience to the Final Conference of the LIFE SAFE-CROSSING project.

7. Key Project-level Indicators

Regarding the Key Performance Indicators the following deviations are to be reported compared to the version submitted with the MTR.

Indicator 1.5 - We had previously indicated a surface, but since all the concrete interventions have been carried out along the roads we have now indicated the length of the road segments. In the comments we have also reported the surface of the regions where the project areas were located, because these were the areas that coincide most with the number of persons targeted by the local communication activities.

Indicator 1.6 - We have modified the calculation of the parameters in order to our best understanding.

Persons concerned by the project independent of the project area: We had previously included here the persons targeted by activities to enhance replication (E7) but we now interpret that here it is more correct to include persons targeted by media activities. We referred to table 4 (Action E3) and multiplied the number of media issues with an average estimated number of targeted persons.

Persons who changed their behaviour or practices due to the project actions: In addition to the AVC PS we calculated also the persons who saw the road information panels. The estimate is extremely difficult because 1) we do not know the numbers of persons commonly on the roads + the number of tourists. 2) we do not know how many persons have seen the panels once or more than once.

Persons who may have been influenced via dissemination or awareness raising project-actions (reaching): We have included the number of persons targeted by the dissemination activities (Action E4) and the number of gadgets produced, which were disseminated among people.

Persons with improved capacity or knowledge due to project actions: Number of persons involved in the activities of Action E7, because they received substantial practical information about the mitigation activities + staff mainly involved in the project in partners who had no expertise with road ecology.

Indicator 10.2 - The number of “Private for profit” entities has greatly increased because this includes 77 driving schools and in Italy it includes 60 tourist guides, which were initially not foreseen to be involved in the project.

Indicator 12.1 - The number of “Professionals” has consistently increased respect to what was estimated. The “professionals” had been underestimated, and during the project a very big number of networking activities was done. The “pupils” indicator has been moved to Indicator 12.2 by the responsible Monitor.

Indicator 12.2 - The number of professional has significantly increased because the activities developed in Action E7 were more than foreseen. The activities in Action E7 mainly consisted in providing detailed information, often on request, about details regarding the interventions carried out during the project - the functioning of the AVC PS and virtual fence, the development of the road panels with the neuromarketing, the planning of the interventions to adapt crossing structures.

Activities in schools had not been actually planned during the project, but several activities in schools have finally been developed.

Indicator 14.2.2 - This indicator has newly been included to report on the amount that we expect will be spent in the frame of replications after the project. The amount expected to spend for replication is much higher than initially estimated (and wrongly reported in 14.2.3). This is because the replications achieved during the project are much more than initially expected, and since it is likely that similar replications will occur after the project, the sum is higher than foreseen.

Indicator 14.2.3 - No revenue is included here because none of the partners is expected to have any revenue after the project.

Indicator 14.2.4 - The value reported is round half than initially reported (during MTR reporting). During the MTR reporting the amount was calculated for 3 years. Now it was calculated for 1 year, because it is not known for how many years the effect will continue. Therefore, all in all the cost does not increase but increase, because we have included also the effect of the virtual fence, which was initially not calculated.