LIFE SAFE-CROSSING

ACTION E7. ACTIVITIES TO INVOLVE POTENTIAL STAKEHOLDERS AND TO ENSURE REPLICABILITY AND TRANSFERABILITY OF THE IMPLEMENTED ACTIVITIES

Replicability action plan – August 2023

LIFE SAFE CROSSING
PREVENTING ANIMAL-VEHICLE COLLISIONS

NATURA 2000

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1. Introduction

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.

The project therefore had the following objectives:

- Demonstration of the use of the innovative Animal-Vehicle Collision Prevention Systems (AVC PS)
- 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

Beyond successful completion a basic requisite of LIFE funding instrument projects is that the experience and knowledge arising from proposal implementation should be disseminated more widely, and that the tools trialled and implemented in each project should have the potential to be replicated, adopted and transferred to other areas or countries in the European Union. To that end, a Replication Plan was created for project partners to highlight the way in which they will make their results known to a broader audience within and beyond the implementation area, both during implementation and after completion. Through this Replication Plan we want to share the knowledge and experience we gathered through our daily work on the project objective and actions with all those interested in maintaining and conserving Europe's natural environment. We want to make the knowledge and experience acquired during the LIFE SAFE-CROSSING project implementation period accessible and of use to the administrations, state and non-state monitoring authorities, environment conservation and protection organisations and bodies at national and international level.

In this document we therefore identify the types of interventions that have the highest potential to be applied also in other areas or other conflict resolution efforts, and for each intervention we explain the following aspects:

1. Technical specifications and methods
2. Advantages and disadvantages
3. Assumptions - permits, resources, capacities, environmental characteristics
4. Replication potential
5. Requirements: staff, funding, technical capacities
6. Costs
7. Potentially interested organizations/authorities

By discussing these points we will base our assessments on the one hand on the knowledge gained through the project development, and on the other hand on the already achieved replication cases.

2. Summary of replicable activities

The LIFE SAFE-CROSSING has developed on the hand common best practices (e.g. the monitoring and the analysis and adaptation of the crossing structures), and it has also adopted techniques that are relatively innovative and not widely used (like the AVC PS and virtual fence) as well as completely new techniques in the field of conservation (the end-to-end device developed by COSMOTE and the neuromarketing technique for the design of the road info panels). To a more or less significant extent all of these practices have a certain replication potential:

1. The monitoring methods for the assessment of the wildlife road mortality
2. The description and characterization of already existing crossing structures.
3. The Animal-Vehicle Collision Prevention Systems, which simultaneously act on animals and drivers, avoiding animal crossings when cars approach at too hight speed.
4. Virtual fence, consisting of electronic devices on the roadsides, that are activated by the headlights of vehicles and emit noises and flashing lights.
5. Adaptation of crossing structures to favour their use by wildlife.
6. The use of the neuromarketing technique for the design of road information panels that should convey a significant and impacting message to drivers.

All these techniques and methods can be used in other areas where the presence of roads represents a threat for biodiversity, especially for medium-large sized animals. The combination of the different monitoring and mitigation methods certainly will have to be adapted to the local conditions on a case-to-case basis.

3. Activities carried out to encourage replication

During the LIFE SAFE-CROSSING project the replication has been encouraged using the following steps:

1. We have widely disseminated the project activities during networking activities and at conferences and technical workshops. In fact, the implemented techniques have been presented and discussed during over 70 initiatives such as networking activities with other LIFE and non-LIFE projects, other conservation initiatives, experts, protected areas, university students etc.

2. We have presented the project techniques at specific meetings that aimed at providing not only an insight in the project but also specific information about the implemented techniques, which could meet the interest of key stakeholders and decision makers. Like this, we have disseminated the information to over 600 persons from 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 Habitas 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

3. Whenever someone expressed their interest in potentially applying one or more of the activities presented in the LIFE SAFE-CROSSING project we have provided information material and we have proposed online meetings where we provided more in-depth information on the specific topics they were interested in. In the cases in which a real replication of the activities was started we provided information and materials as far as we could in order to support the correct implementation of the actions.

4. In order to support the replication of the implemented best practices and innovations we have produced a set of “Guidelines to reduce large mammal and traffic conflicts”, which provides detailed information about all best practices to reduce mortality on roads as well as the level of fragmentation represented by linear infrastructures.

4. Description of potentially replicable activities and techniques

4.1 Monitoring methods of wildlife road mortality and identification of risk hot spots

<u>Description</u>

In order to select the areas where to implement the mitigation measures the monitoring approach used in the SAFE-CROSSING project involved the following steps:

1. Collection and analysis of existing data.

Animal-vehicle collision data occurred in the last 10 years in the project area (n = 515) were collected and stored on a specific database. The main information collected were: date, locations (geographical coordinates) and species involved.

Data analysis was carried out through the use of the KDE+ method (Bil et al 2013). This method allowed us to identify (AVC clusters (hotspots of road mortality). The Clusters identified through the KDE+ method were: 1) non-significant cluster (not further processed).; 2) significant cluster with ‘low reliability’, which could be false positives, due to the rather low cluster strength or low number of records in cluster; 3) significant clusters with ‘high reliability’, which only show a probability of 5 % or less to be a false positive.

The same approach was used to analyse the available telemetry data (n =79 radio-collared bears tracked from 2005 to 2019) in order to identify road crossing points cluster (the points most used by the target species to cross the roads).

2. Monitoring and characterization of the most critical road segments.

On the basis of the results of the KDE+ analysis (, but also on the basis of previous knowledge of the target species (e.g inclusion of ecological corridors), the selected road segments were characterized and systematically monitored for at least one year. The following activities were carried out:

a) Each road segment was first of all classified with respect to the main following parameters: number of lanes, speed limit, number of wildlife crossing signs, and habitat types crossed by the road. For the whole length of the road segment, we mapped the presence and distribution of barriers to animal movements (e.g. walls, fences). All this information was stored in a common database.

b) In order to monitor wildlife road mortality, the selected road segments were travelled at least 2 times/month at low speed early in the morning to register all the animals found dead. For each carcass the following variables were recorded: species, geographical coordinates, shape of the road, speed limit, habitat type. It was also very important to include the information regarding animals found dead outside monitoring sessions, therefore we created a sort of network of observers in order to be advised each time a carcass was found on the road.

c) Traffic volume (number and speed of the vehicles) was calculated through the installation of a specific device in the selected road segments on a seasonal basis (4 times/year). Each session lasted generally 7 days in order to evaluate traffic volume during working days and during the weekend. This is a fundamental parameter to be evaluated in order to select the most suitable prevention measures, and to obtain information on driving behaviour

d) The monitoring of road crossing points, along the selected road segment was carried out through the installation of camera traps. Camera traps were moved in different locations of the road segments to identify and measure the frequency and the species using the paths to cross the roads. All the data collected were carefully analysed and stored in a common database.

Advantages

This analysis and monitoring scheme allows to get a picture of the situation of the amount and distribution of AVC also on quite large territories, because through a range of different methods it allows to start from a large area and step by step to narrow down the scale. Like this it offers the possibility to identify with a relatively high level of precision the areas where to intervene, and with what means.

Assumptions: permits, resources, capacities, environmental characteristics

The identification of the riskiest road segments and of the areas where to intervene requires the collection and analysis of historical AVC data.

The development of an adequate and regular monitoring requires some resources that guarantee the adequate quality of the achieved data:

- resources in terms of personnel that can be employed on a regular basis, for the systematic monitoring of the road segments (2 times per month per road segments).

- adequately trained technical persons who are able also to recognize the killed species and have an expertise on camera trapping.

- KDE+ analysis requires a specific Knowledge on data analysis. The software is available online for free

Replication potential

The KDE+ analysis can be performed in any area as long as historical data about AVC are available. The application of a standard method like KDE+ will ensure the comparison with other areas

The type of analysis and the monitoring protocol adopted in the frame of the project can be applied in any place where it is known that AVC are a problem and therefore there is an interest to have an overall knowledge of the main risk areas and to narrow down the knowledge to select the areas of intervention.

Costs

The cost of this monitoring program depends on the length of road segments to be monitored. A rough estimate for one year could be around 10.000-20.000 €.

4.2 Characterization and monitoring of existing crossing structures

Description

The first phase of the action was devoted to the production, by the partner MINUARTIA, of a specific field form to characterize the existing crossing structures. The field form contained all the main parameters to be registered during field inspection and was then used by all the partners. All the data collected were stored in a specific database. This first step guaranteed the standardization of the approach in each project countries. The field form and the data base were then included in a guidance manual, which also includes recommendations for the adaptation of crossing structures (165573.pdf (safe-crossing.eu)). This document was be updated at a later stage to include the lessons learned in the frame of project development.

The most important parameters analysed in this process were:

- Location (surrounding habitats, proximity to AVC hotspots and to road crossing hotspots were considered)
- Uses of the structure
- Dimensions and shape of the structure

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 a prototype developed by the Greek telecommunication company COSMOTE (Figure 3). This end-to-end monitoring system allowed not only to monitor the use of the underpasses but to store and process automatically the videos and photos collected and extract statistics (graphs) on a per species and on a per underpass basis (respective examples in the following graphs). In one year over 75.000 videos and photos were analysed, and with this material it has also been possible to develop a software that automatically identifies the species using the underpass.

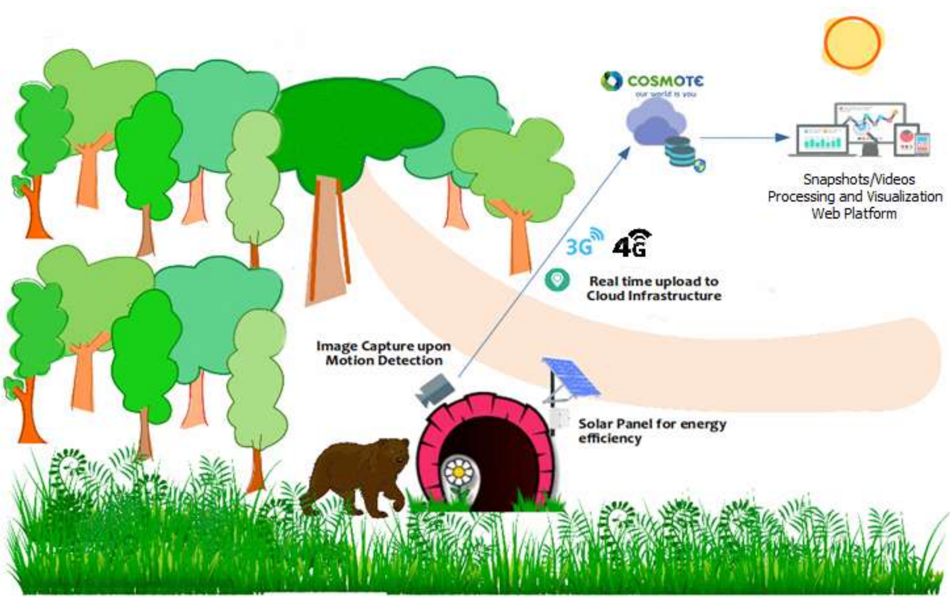

Figure 3. Scheme of the end-to-end monitoring system developed in Greece

Advantages

The methods to characterise the existing crossing structures is very user-friendly and is based on a vast preliminary experience of the authors. Therefore this methodology allows to plan future interventions in a reliable manner and with a limited amount or resources.

The end-to-end devices allow to monitor simultaneously, and with a low requirement of manpower, a big number of crossing structures. Moreover, the automated analysis of the images allows to spare a huge amount of time which would otherwise be employed to look at all the images individually and to process them.

Assumptions: permits, resources, capacities, environmental characteristics

The only assumption of the methodology for the characterization of the crossing structure is the availability of geographic information about the presence of the structures and the employment of one or two persons who can do the analysis on the basis of the clear instructions in the guidelines.

The use of end-to-end devices might require, according to where they are installed, the permits from the authorities that are competent for the maintenance of the crossing structure.

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.

Replication potential

The methods for the characterization of crossing structures can be used in any other initiative where there is an attempt to reduce fragmentation for one or more species. It is suitable for any species or group of species, and can be used in any type of environment.

The developed end-to-end monitoring tool is very useful in situations in which there is a high number of crossing structures to be monitored, and where the presence of personnel on the field cannot constantly be assured.

The solution exhibits a long list of benefits esp. for the environment, but also for the human resources required for the manual processing of the huge number of the collected snapshots/videos (>100.000 photos/videos). More specifically, the solution:

1. Is environmental-friendly since:
    a. It utilizes solar panels for the charging of the camera's battery
    b. It utilizes rechargeable batteries [not alkaline used in trail/trap cameras]
    c. It eliminates the need for on-site visits [reduction ~95%] to cameras' installations for snapshots/videos collection (from the SD card), because the cameras' material is automatically uploaded and stored to COSMOTE's cloud infrastructure for further processing and visualization.
2. Supports automated procedures for near-real time detection and classification/ categorization of passing species / objects [reduction ~80%], as well as the exporting of statistics / usage graphs [reduction ~99%], which is a painstaking and time-consuming task due to the huge amount of photos/videos to be processed; done manually so far.

3. Is capable of extracting statistics e.g., frequency of appearances vs. hour of the day and/or weekday, would have never been calculated, manually, without the tools that have been developed.
4. Provides live view, multiview, playback, remote configuration, battery level, etc. for all cameras. This is quite important in cases of theft, since unlike the trail cameras, one may “discover” when a camera has been stolen and possibly identify the thieve.
5. It offers near real-time alerting (for specific species e.g., bears) via rich push notifications @smartphones [text and photo]
6. Combines low cost with ease of installation.
7. Offers peace-of-mind in terms of SD-card storage, power monitoring/availability and maintenance.

<u>Costs</u>

To replicate the solution (and scale it) shall consider the following indicative price list should be considered:

- 4G cameras indicative costs: Reolink 4G Go Plus, ~250€ / camera (incl. delivery costs);
- Reolink Keen Ranger PT, ~400€ / camera (incl. delivery costs);
- Cost for SIM cards (15 GB / month) subscription [1 per camera]. Indicative monthly fees = 15€
- Backend/Cloud Infrastructure: 10.000 – 30.000 €, depending on the number of cameras to be supported, processing at GPUs -instead of CPUs-, etc…
- (Note that the development of the Tools (automated storage of cameras material, statistics extraction, species categorization, website, etc.) would require at least 1 senior developer to work for at least 6 months)
- Operation, Maintenance & Support Costs
- License fees (once off): 100€ / camera
- Annual fees (for support, maintenance, expansions): 100 - 200€ / camera
- Extra charges for additional features (e.g., species tracking)

4.3 The Animal-Vehicle Collision Prevention Systems

<u>Description</u>

The AVC PS have following functioning and structure (Figure 1): A set of passive infrared (PIR) sensors and/or a thermal camera (1) registers the presence of an approaching animal and sends the information to the electronic control unit (2). This unit triggers an alert signal for drivers (3), inviting them to slow down to an acceptable speed. A radar doppler sensor (4) measures whether the car actually slows down. If it does, the system stops to act. Otherwise, the radar sends a signal back to the control unit. This activates an acoustic scaring device (5), which shall drive the animal to escape.

Figure 1. Functioning of the AVC PS system

The functioning of the system is controlled through a modem, which sends an email each time a component is triggered (wildlife presence sensors and acoustic scaring device), and also sends information about the charge level of the batteries. Moreover, remote information can be received about the functioning of the flashing lights, and on whether the passing vehicles slow down or not. A specific software has also been developed in order to collect all this type of information, as well as an App through which is possible to control and change the setting of the different components of the systems.

Advantages and disadvantages

The added value of the AVC PS is that it intervenes only in risk situations, when there is the simultaneous presence of an animal on the road side and the approach of a car that proceeds at too high speed. On the one hand this still allows permeability of the roads by animals, without representing a permanent barrier for movements. On the other hand the fact that animals and drivers are alerted only in risk situations minimizes the risk of habituation by both.

The AVC PS has proven to be very effective on specific road segments, of up to 200-300 meters, where particularly risky hot spots can be identified. Contrarily, this system is not suitable for long road segments where the passage of animal is widely distributed on the whole segment. In this case the use of AVC PS must be associated with other prevention tools (e.g. virtual fence) or fences must be installed to drive the animals towards the segment protected by the AVC PS.

The use of thermal cameras, to be associated with the AVC PS, also provides very important insights in what animal species have been detected and the movements and reaction of the animals.

Assumptions: permits, resources, capacities, environmental characteristics

The installation of AVC PS requires the issue of permits of the competent road authority. In all the places where these devices have been installed up to now, no problem has ever been met to achieve the permits, but the time necessary to do the necessary procedures has to be taken into account.

The use of the AVC PC requires a good and accurate knowledge of the road kill hot spots and of the precise places where animals pass, therefore an ex-ante monitoring phase is essential. This is fundamental to select the type and number of components to be installed to detect the area and paths used by wildlife to approach the road. For this reason, the exact composition of the AVC-PS have to be adapted to the local condition. Generally, in open areas thermal camera can be the better option, while in forested areas PIR sensors are preferred.

The devices are technically sophisticated and therefore require technically competent staff for the maintenance of the systems. This can either be specifically trained staff within the organization, or a maintenance contract can be with the company that provides and installs the systems.

Since the AVC PS use the emission of sound tracks to scare animals away, the location of the installation has to take into account the distance from the next houses, in order not to disturb people. The effectiveness of track sounds have to be regularly evaluated in order to monitor possible habituation phenomenon.

In the AVC PS where only PIR sensors were used, it is very useful to install camera traps a to evaluate their functioning, and to Know which species are detected.

The AVC PS systems have to be regularly monitored on the one hand to understand if they are correctly functioning, but also to know if additional components (e.g PIR sensors or thermal camera) are needed to better cover the area used by wildlife to cross the roads.

Replication potential

The AVC PS is an effective road-kill prevention tool for animals above 5 kg. Therefore, it can be used in all those situations where road kill hotspots of middle and large size animals are identified.

Due to the requirements in terms of maintenance the use of AVC PS is the most suitable for organizations that can assure long-term monitoring and maintenance with own resources, or who can reliably assure the funding for the sustainability of their use.

The AVC PS is powered by solar panels, therefore the installation of these devices has to take into account the weather conditions of the area, because if there is not sufficient direct light the charging might be more problematic, as well as if the solar panels are covered by snow. In those cases the replacement of the batteries with a pre-charged one can be a useful alternative.

Costs

The cost of the AVC-PS clearly depends on the number and type of components installed. In the frame of LIFE SAFE-CROSSING, in Italy, where the producer company is located, the price of a system with 10 PIR sensor or 1 thermal cameras including also alphanumeric signals was around 18.000-12.000 €. This cost included also the assistance for the whole project duration.

Maintenance cost can be stimated to be around 1500 euro per year (da verificare).

4.4 Virtual fence

<u>Description</u>
The virtual fence (VF) consists in a series of electronic devices installed on the road posts on both sides of the road (fig. 2). These devices, powered by a lithium battery charged by a solar cell, generate sound and light stimuli when activated by the headlights of approaching vehicles to avoid wildlife road crossings.
Each unit has strobing LEDs, which emit blue and amber light, and two sound settings, one for rural areas and a higher frequency for residential areas.
The main feature of the 'virtual fence' is that it actively emits light in response to a vehicle's lights, rather than reflecting the vehicles' light as wildlife warning reflectors do, therefore the units of the virtual fence are called wildlife active warning reflectors. This is possible because each unit has a sensor that, once is hit by the headlights of the vehicles, triggers the sound and light stimuli.
The units are aligned so that the sound and light they emit are directed away from the road surface and towards the roadside verge.
In the frame of LSC project the virtual fence was installed on 36,5 Km of roads in Spain, Romania and Italy.
In the PNM area a new type of devices has also been installed. These devices are wireless connected so when the first one is activated, it triggers the following devices, this can be particular useful in road segments with many curves. Each chain of devices wireless connected is composed by 12 units.

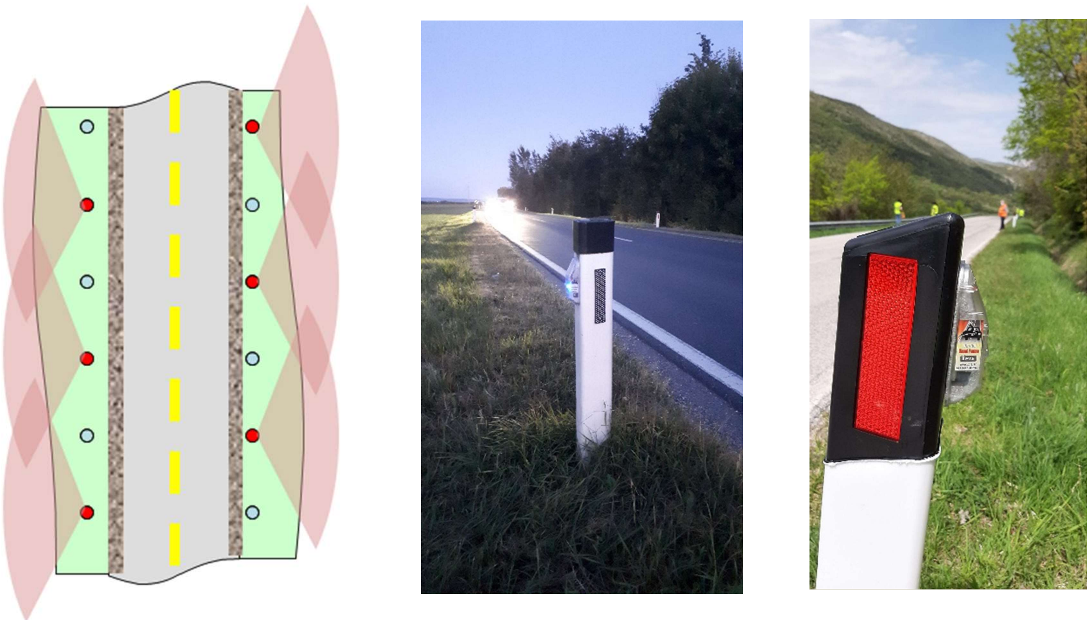

Figure 2. Components of the virtual fence

<u>Advantages and disadvantages</u>

The installation on the road posts is very easy, because the devices are attached to the post using simple screws.

A part on the road posts, the devices can be installed also on a concrete wall or on the guardrails using specific mounting accessories.

Assumptions: permits, resources, capacities, environmental characteristics

The installation of the virtual fence requires the issue of permits of the competent road authority. In all the places where these devices have been installed up to now, no problem has ever been met to achieve the permits, but the time necessary to do the necessary procedures has to be taken into account.

The virtual fence needs to be regularly monitored in order to identify if some single devices are not working, and to potentially replace them.

It is also very useful to install camera traps to monitor the reaction of wildlife to the light and sound emitted by the units of the virtual fence.

Replication potential

The use of virtual fence can be used in all those conditions when the passage of average to large sized animals is a problem on relatively long road segments. In general the installation is easy and this tool can be used in all kinds of landscapes and on all sizes and shapes of roads.

In cold environments the installation might require to place the devices on posts that are higher than the expected snow levels.

Costs

The cost of the basic device is around 60 Euro per one unit, while the price of the wireless connected devices is around 90 € per unit.

Considering that the units are usually spaced 50 meters from each other along the same side of the road, it means that generally 40 devices are mounted in 1 Km of road.

4.5 Adaptation of underpasses and fencing of roads

Description

The selection of the structures to be adapted was based on the distribution of AVC clusters (hotspots of road mortality) and crossing points clusters (hotspots of road crossing) as well as on 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. Another important aspect was represented by the results came out from the ex-ante monitoring of the use of the crossing structures, in particular the huge amount of data obtained in Greece by the installation of the prototype developed by COSMOTE. These data allowed to make a very detailed analysis to understand the main parameters of the structures which favoured bear use thus facilitating decision making on the required interventions. Finally, we discarded those structures characterized by a high level of human disturbance or those for which their use could potentially represent a danger for wildlife.

The main interventions on the crossing structures consisted in:

- Removal of garbage and debris that hinder the access of animals
- Planting of vegetation to encourage the approach of animals
- Fencing of areas near underpasses, in order to drive the animals towards the structures
- Construction of exit ramps to ease the use of structures with steep slopes

- Construction of dry ledges to better allow small and medium-sized mammals to safely cross under roads while avoiding the water inside of the culverts
- Placement of light barriers at the entrance of structures, to create a safer perception of passages
- Placement of natural materials at the entrance of structures, to create a more natural environment, especially for smaller animals

For each underpass, after it's characterization, a specific work project was made to select the main features that could be improved, resulting in different combinations of the up-mentioned types of interventions.

The fences to be installed to favor the use of the crossing structures have to be designed in a detailed way, especially in the definition of their starting and ending points in order to drive the animals toward the structure avoiding to create a potential "trap".

<u>Advantages and disadvantages</u>

The adaptation of existing structures, generally built for other purposes, is one of the safest way and long term solution to increase ecological connectivity.

The ex post monitoring of the adapted crossing structure showed an high level of effectiveness.

Depending on the local situation, the interventions to be carried out may require a huge amount of work in terms of personnel and means to be involved.

The solutions to be applied needs a specific planning phase that has to be based on a detailed monitoring program.

The interventions require a regular maintenance to ensure their effectiveness in the long term. The status of the installed fences has to be checked, planting have to be maintained and a constant management of the surrounding vegetation have to be ensured.

<u>Assumptions: permits, resources, capacities, environmental characteristics</u>

The interventions on crossing structures generally requires the issue of permits from the competent road management authorities. Besides this, if the works extend beyond the area under the responsibility of the road authority, the permits of the landowners of the neighbouring lands has to be achieved, therefore the timing of this bureaucratic procedure has to be taken into account.

Whereas the characterization of the crossing structures and the potential needs of intervention can be done by field personnel, zoologists etc., the planning of the interventions require the consultancy of engineers or other specialized experts.

<u>Replication potential</u>

The interventions on existing crossing structures can be replicated everywhere and their positive effects will extend on all the wildlife species. These interventions are surely cheapest respect to build overpasses or new underpasses, therefore in certain situations they represent the best solution to increase ecological connectivity and to reduce the impact of linear infrastructures on animal movements.

Costs

The cost of the interventions to adapt the existing crossing structures, clearly depends on the type of works to carried out than its estimation has to be done on a local basis.

In the frame of the LIFE SAFE-CROSSING project for the adaptation of 50 underpasses under the Egnatia Highway of Greece the cost has been of 150.000 €. Most of these interventions were complex ones such as the construction of escape ramps and dry ledges, the drainage of completely obstructed passages, the planting of plants and big irrigation systems etc.

4.6 The neuromarketing technique for the design of road information panels

Description

Neuromarketing is a new field of marketing which uses neuroscience technologies to study consumers' sensorimotor, cognitive, and affective response responses to visual stimuli. In a first step we produced four prototypes of road panels, which were then submitted to 36 test persons in a virtual reality setting. The test persons are fitted with “eye tracking glasses”, which are able to track the eye movements, thus detecting in which area and on which features of the panels (writing, colours, images etc.) the eyes concentrate more or less. Simultaneously the test persons were submitted to an EEG, which registered the drain activities in response to different stimuli. This provided information regarding:

- which features of the panels were more or less attractive
- on which features the test person had to concentrate more to visualize or understand it
- which features were misplaced
- on what messages the persons concentrated most
- the emotional reaction of the persons

After this, the test persons were also submitted a “post-test rational interview” in which they were interviewed regarding the different stimuli they received.

These tests allowed us to identify the most effective images and to understand which graphic elements had to be changed or improved in order to optimize the visual message.

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

Advantages and disadvantages

It is not always possible to test information or awareness raising campaign before its implementation. In this sense the use of neurosciences is a big added value because it allows to design information tools and campaigns evaluating in advance their effectiveness.

The use of objective neuroscience tools assures that the gathered data is reliable and scientifically sound.

Assumptions: permits, resources, capacities, environmental characteristics

The neuromarketing technique requires the employment of a specialized company capable of planning and implementing all the research phases.

Replication potential

Neurosciences are already widely used in the field marketing and publicity. It has been seen that this tool has also been very useful for the development of the road information panels within the LIFE SAFE-CROSSING project. It can be considered that this method can be used in any situation in which a well-tailored and effective message must be conveyed to a specific and known target group.

Costs

In the frame of the LIFE SAFE-CROSSING the development of the road information panels with the use of the neuromarketing technique has had a cost of 40.000 €. But it must be considered that this was a particularly complex situation in which there were three different target species and four different languages involved, which requested for the development of a big number of prototypes to be tested. In case of more simple messages and less languages this costs can drastically decrease.

5. Potentially interested parties in replication

Since all the up-listed project components are part of one singe objective (the reduction of the impact of roads on the target species), the potentially interested persons and organizations in replicating the activities apply to all these components.

The potentially interested parties in the replication of the activities are mainly:

- Policy makers
- The responsible authorities for wildlife management
- The competent road management authorities
- Local authorities
- Management bodies of protected areas
- NGOs and private companies
- Drivers associations
- Insurance companies (in cases where they cover damages by AVC PS)
- Landscape planners
- Scientific communities

6. Potential funding sources

The funding of activities to mitigate the impacts of roads on wildlife, and on nature in general, is not easy, because this is a trans-sectoral issues for which no specifically competent entities exist. The responsibility for these activities have to be taken over either from the authorities and stakeholders responsible for road management, or by those that deal with nature conservation.

The national competent authorities for road management could be a significant funding source, since these usually have the responsibility to guarantee the safety of drivers, and to minimize the environmental impact of the infrastructures they are managing. In cases of the construction of big infrastructures with environmental impact, the responsible authorities could direct the foreseen compensation measures onto the implementation of mitigation measures ranging from minor road kill prevention tools until the construction of significant structure such as ecoducts.

Therefore, one of the crucial steps would be to gain the support of road management authorities, Minstries of transport, Regional/provincial competent offices etc. in order to convince them to start financing activities that mitigate the impact of roads.

Besides this, funding can be retrieved from specific EU funding programmes as well as from national funding programmes.

At European level the main funding can come from structural funds such as the LIFE program and INTERREG, for the implementation of concrete interventions. The Horizon2020 programme can be a funding source for activities that imply research or the development of new technologies, which could be the basis for future mitigation or planning activities.

The availability of national fundings is extremely heterogeneous at European level, ranging from countries that have significant state funding sources for environmental activities, until countries where funds are very scarce.

Finally, in the case of significant cases of conflicts between roads and wildlife (e.g. regarding specifically threatened species, or extremely impacting roads) funding can also be sought from private donors that have a special awareness and attention towards these issues.