LIFE Project Number

LIFE14 NAT/PT/001081 FINAL Report

Final Report
Covering the project activities from 01/05/2005[1] to 31/05/2021

Reporting Date[2]

31/05/2021

LIFE PROJECT NAME or Acronym

LIFE LINES - Linear Infrastructure Networks with Ecological Solutions

Data Project	
Project location:	Alentejo (Évora, Montemor-o-Novo, Arraiolos, Estremoz, Vendas Novas) - Portugal
Project start date:	01/08/2015
Project end date:	31/07/2020 **Extension date:** 31/05/2021
Total budget:	5,540,485 €
EU contribution:	3,324,303€
(%) of eligible costs:	60%

Data Beneficiary	
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Project Website:	https://lifelines.uevora.pt/

[1] Project start date

[2] Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

This table comprises an essential part of the report and should be filled in before submission

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	**✓ or N/A**
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English *In electronic version only*	OK
Index of deliverables with short description annexed, in English *In electronic version only*	OK
Mid-term report: Deliverables due in the reporting period (from project start) annexed Final report: Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English *In electronic version only*	OK OK
Financial report	
The reporting period in the financial report (consolidated financial statement **and** financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	OK
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)*	OK
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. *In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals**	OK
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	OK
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	NA
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)*	OK
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) *Electronically Q-signed or if paper submission signed original and in electronic version (pdf)*	OK
Other checks	
Additional information / clarifications and supporting documents requested in previous letters from the Agency (unless already submitted or not yet due) *In electronic version only*	OK
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	OK

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

Co-financier:

LIFE-LINES (LIFE14 NAT / PT / 001081)
Linear Infrastructure Networks with
Ecological Solutions 60% co-financed
project by the LIFE - Nature and Biodiversity
Program of the European Commission

Coordinating Beneficiary:

UNIVERSIDADE DE ÉVORA

Associated Beneficiaries:

Infraestruturas de Portugal

ÉVORA Câmara Municipal

MONTEMOR | O | NOVO câmara municipal

marca

Quercus

universidade de aveiro
theoria poiesis praxis

U.PORTO
FACULDADE DE CIÊNCIAS
UNIVERSIDADE DO PORTO

Collaborators

REN

E-REDES

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AB – Beneficiário Associado (Associated Beneficiary)

ANSR – Autoridade Nacional de Segurança Rodoviária (National Road Safety Authority)

BACI – Before-After-Control-Impact

CA – Comissão de Acompanhamento (Scientific Monitoring Committee)

CB – Beneficiário Coordenador (Coordinating Beneficiary)

CCDRA – Comissão de Coordenação e Desenvolvimento da Região Alentejo (Coordination and Development Commission of the Alentejo Region

CG – Comissão de Gestão (Management Committee)

CIMAC – Comunidade Intermunicipal do Alentejo Central

CME – Câmara Municipal de Évora (Municipality of Évora)

CMMN – Câmara Municipal de Montemor-o-Novo (Municipality of Montemor-o-Novo)

CP – Coordenação do Projeto (Project Coordination)

CTAG – Comissão Técnica de Apoio à Gestão (Technical Committee to Support Project Management)

CTALEA - Comissão Técnica e Científica Mista de Acompanhamento (Joint Technical and Scientific Monitoring Commission)

EASME – Agência de Execução para as Pequenas e Médias Empresas (Executive Agency for Small and Medium-sized Enterprises)

EC – Comissão Europeia (European Comission)

EDP-Distribuição – Energias de Portugal, SA – Distribuição (Energies of Portugal, SA – Distribution)

EF/S – Ecosystem functions/services

E-REDES – E-REDES, Distribuição de eletricidade (E-REDES, Electricity distribution)

EGI – Infraestrutura Verde Europeia (European Green Infrastructure)

EGSP – Energia e Sistemas de Potência, Lda (Energy and Power Systems, Ltd)

FCUL – Faculdade de Ciências da Universidade de Lisboa (Faculty of Sciences of University of Lisbon)

FCUP – Universidade do Porto - Faculdade de Ciências (University of Oporto - Faculty of Sciences)

GA – Contrato de Subvenção (LIFE Grant Agreement)

GESAMB - Gestão Ambiental e de Resíduos, E.E.I.M. (Environmental and Waste Management, E.E.I.M.)

GI – Infraestrutura Verde (Green Infrastructure)

GIS - Geographic Information System

HRLI - Habitats Related to Linear Infrastructures (Habitats Relacionados com Infraestruturas Lineares)

IA – Área de Intervenção (Intervention Area)

IAP – Invasive Alien Plants (Plantas exóticas invasoras)

IAS – Invasive Alien Species

ICNF – Instituto da Conservação da Natureza e das Florestas (Institute for the Conservation of Nature and Forests)

IGeoE - Instituto Geográfico do Exército (Army Geographic Institute)

IP – Infraestruturas de Portugal, SA (Infrastructures of Portugal, SA)

LI – Linear Infrastructure (Infraestruturas Lineares)

LINES – (Redes de Infraestruturas Lineares com Soluções Ecológicas (Linear Infrastructure Networks with Ecological Solutions)

LPN – Liga para a Proteção da Natureza (League for the Protection of Nature)

MARCA – Marca, Associação de Desenvolvimento Local (Marca, Local Development Association)

NIA – Núcleo de Interpretação Ambiental de Montemor-o-Novo (Environmental Interpretation Center of Montemor-o-Novo)

NRDb – National Roadkill Database

PA – Acordo de Parceria (Partnership Agreement)

pA1E – Programa “Adota um Estrada” (Program “Adopt a road”)

QUERCUS – QUERCUS, Associação Nacional de Conservação da Natureza (QUERCUS - National Association for Nature Conservation)

REN - Redes Energéticas Nacionais (National Energy Networks)

SA – Área de estudo (Study Area)

UA – Universidade de Aveiro (University of Aveiro)

UEVORA – Universidade de Évora (University of Évora)

UN – United Nations

KEYWORDS: Biodiversity refuges, Deactivated railways, Ecological connectivity, ecotrils, Green infrastructure, Impact mitigation, Invasive Alien Species, National Roadkill Database, People awareness, Power lines, Roads

1. **Executive Summary**

LIFE LINES essayed and disseminated solutions that increased the sustainability of different types of linear infrastructures, including them in a large European Green Infrastructure (EGI), that is, a network of habitats managed to deliver a wide range of ecosystem services and protect biodiversity in both rural and urban settings. In the context of our project, usual functions of transportation and energy delivery were complemented with different kinds of ecological functions. We expect that they can be replicated worldwide by most linear infrastructure operators.

Specifically, the project main goals were: (i) promote landscape connectivity; (ii) reduce fauna mortality by electrocution, collision and roadkill; (iii) create biodiversity corridors and refuges, (iv) detect and control invasive alien vegetation; (v) implement a national database on wildlife mortality; (vi) inform and raise public awareness to the impacts of linear infrastructures on biodiversity.

To accomplish its targets, the project focused on a set of formerly identified problems including those of connectivity, roadkill and barrier effects of transport infrastructures, mortality in power lines, absence of refuges and corridors, control of invasive flora and scarcity of publicly available decision supporting data.

The project encompassed 35 actions included in five main groups: A - preparatory (7), C -conservation (10), D - monitoring (3), E - public awareness and dissemination (11) and F - management (4). Conservation actions were mostly based on the implementation, development and testing of demonstrative and innovative solutions. An extended and comprehensive monitoring work aimed at evaluating the effects of implemented measures on biodiversity, ecosystem functions and at socioeconomic level was done. A large part of the project was dedicated to the dissemination of the results to other potential users (mostly professionals associated with the area), both national and international, and promote awareness of ci

A list of 17 socio-economic indicators regarding economic, networking, training, volunteering and awareness and engagement issues was used to assess the direct and indirect impact of the project in the region. Overall, more than 748 000 € were invested in more than 180 local companies; 27 direct jobs were created; about 20 collaborations and protocols were signed; nearly 300 people were trained and qualified to perform conservation, 15 academic works were produced; about 4000 persons and 62 institutions were involved in volunteering work; more than 60 talks were presented in scientific events; and about to 300 awareness and training actions were carried out. The project had high public visibility through social networks and the website, reaching more than 370 000 people and more than 78 000 views of project contents. All of those actively contributed to the development of local nature conservation, economy and tourism, helping Alentejo to be included in national and international agendas concerning these issues.

The project contributed, directly or indirectly to enhancing nine Ecosystem Functions/Services. This was mostly done through the improvement of habitats, species diversity and ecological connectivity. A large investment was also made in project dissemination. We reached over 5000 people, including specialized and general audiences, with whom we discussed the project itself, the impacts of LI networks, and the solutions available to minimize them. LIFE LINES also contribute to the achievement of 11 Sustainable Development Goals (SDG). The main was for “Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss” for which the project produced a substantial added value. Most of the enhanced EF/S and SDG contribute to better-preserved and more resilient landscapes crossed by LI

networks as well as for local community awareness on the need to conserve and restore their natural assets.

Over 25 methodological approaches, sampling techniques and assessments were deployed aiming the evaluation of 33 solutions implemented through the project.

Among the interventions and assessment of their efficacy we highlight:

- Solutions to mitigate road mortality and barrier effects: solutions based on impeding movement and access to roads to reduce mortality were generally effective for carnivores (L-shape fence), rabbits (wire mesh), birds (barriers to elevate flight), and amphibians (concrete and canvas barriers). Interventions aiming to improve connectivity benefited movement between roadsides, but showed little effect in reducing roadkill, namely for carnivores (dry ledge). Deterring solutions to keep wildlife away from dangerous locations were mostly ineffective or had low impact on mitigating roadkill (e.g., Swareflex reflectors dissuasion device, for owls. The same happened with warning signals for drivers (e.g., amphibian road sign). For rodents, dissuasion device based on ultrasound emissions seems promising but needs further testing;
- Solutions to mitigate collision and electrocution in powerlines: the new pole frame (ECO-HAL A2S) developed for medium voltage power lines was highly effective in reducing electrocution and contributed to reduce collision. Deterring devices for birds showed limited capacity despite punctually contributing to flush birds from perching.
- Solutions to promote biodiversity in linear infrastructures: invasive alien species (IAS) control revealed challenging but have contributed to lower the occupancy of IAS in road verges and ecotrails, benefiting the recovery of native species. Seed-mixtures largely contributed for increasing floristic diversity either in road verges, ecotrails or poles of powerlines. The creation of micro-reserves through germination and plantation of native plants also contributed for the promotion for small fauna such as small mammals and butterflies.
- Solutions for monitoring and reporting data: the creation of the National Roadkill database stands as one of the most successful reporting tools, gathering 121 531 records in a common effort linking academy, road agencies and concessionaries, traffic and environmental police and citizens in general. The LIFE LINES App, though retrieving a number of records below expectations, was well-received and contributed with ~25% of the roadkill data during the time of operation until the end of the project.

Regarding the global impacts of the conservation interventions at the whole area, the project contributed to a decrease in mortality either in powerlines or roads. Birds and bats had significant decreases in mortality, while amphibians and owls show non-significant decreasing roadkill trends. Connectivity has increased for most species, especially in intervened areas near roads. Overall biodiversity indicators show reductions of 36% of the area covered by invasive plant species. Moreover, 14 of the top 20 most roadkill bird species presented an increase in overall abundance, as well as the two most roadkill mammals.

2. Introduction

Thousands of animals die every year in linear transport and energy infrastructures, either killed in roads or rails, or by electrocution or collision with power lines. With the expanding network of transport and energy supply infrastructure in Portugal over the last decades, animal mortality became an imposing reality, assuming itself as the main non-natural cause of death for animal species in many parts of the country. Additionally, the expansion of linear infrastructure network is one of the main causes of fragmentation and loss of natural habitats, creating barriers and repelling species which contribute to further isolation of populations. Moreover, introduction and dissemination of invasive exotic flora is often facilitated across linear infrastructure network. Despite this, vegetated areas associated with the linear infrastructure may also be an opportunity for biodiversity conservation, promoting habitat in adverse landscape contexts and enabling animals and plants to thrive and disperse.

Solutions are needed that make the presence of the linear infrastructures compatible with nature conservation, especially in areas where the natural or semi-natural landscapes are degraded and declining due to the increasing intensification of land use through human activities. Define appropriate mitigating measures to minimize linear infrastructure impacts, manage linear infrastructure marginal habitats to promote biodiversity, create foundations for the establishment of long-term monitoring and reporting systems, and raising awareness to involve and motivate citizens in the process are much needed actions to deploy context-effective solutions and consolidate its long-term reproducibility.

Project framework and objectives

The project aimed to essay, evaluate and disseminate practices directed to mitigation of negative effects of transport/energy infrastructures on biodiversity and promote the creation, along them, of a demonstrative Green Infrastructure, based in corridors and stepping stones that can increment connectivity and improve conservation of local/regional biodiversity. LIFE LINES is a Biodiversity (rather than a Nature) Project and thus does not focus specifically on Natura 2000 sites or threaten species/habitats listed in Birds (79/409/CEE; 2009/147/CE) or Habitats (92/43/CEE) Directives. However, the Intervention Area (IA) is located on the main transport corridor linking Lisbon to Madrid in a region lying between the Natura 2000 sites of Monfurado (PTCON0031) and Cabeção (PTCON0029). The area is dominated by Mediterranean agro-silvo-pastoral systems (montados) of cork (*Quercus suber*) and holm oaks (*Q. rotundifolia*) (habitat 6310, annex I Habitats Directive) which hold very high levels of biodiversity, including well-preserved communities of mammal carnivores, owls, amphibians, passerines, small mammals and butterflies. These groups are threatened by the high density of linear infrastructures in the region and are the main target of the LIFE LINES project.

Many marginal areas of linear infrastructures in the Intervention Area (IA), including road verges, are among the most biodiverse in Europe, as recognized by members of the Scientific Monitoring Committee when visiting the project area. Linear infrastructure networks are spread through the landscape and because of their nature and shape, vegetated areas associated with them have a high potential to act as biodiversity refuges and corridors linking areas of natural and semi-natural habitats, including Natura 2000 sites, which are the backbone of the EGI. In this sense, properly managed linear infrastructure networks can be multifunctional and act as key-structures in the EGI. Nevertheless, as they also pose serious risks

to wildlife (e.g. mortality), we were challenged to improve their role in biodiversity conservation while minimizing these risks. LIFE LINES addressed this challenge by testing and demonstrating new devices and management actions. Most of them can be easily exported to other areas and infrastructures, while a few need further and longer testing. Additionally, and important at the European level, the project contributed to the control of alien invasive species and conservation and dissemination of autochthonous flora.

Finally, we also aimed at demonstrating that investments in nature conservation and biodiversity such as those proposed, beyond impacting species and habitats targeted by the conservation actions, may contribute to human well-being and empower and mobilize citizens to demand political action in order to preserve and protect their natural assets.

Expected longer term results

The LIFE LINES project is an ambitious project as it targeted to supply demonstrative and innovative solutions to a wide range of linear infrastructures (roads, decommissioned railways, medium- and very high-voltage power lines) while addressing several different implications for biodiversity conservation. T

he following targets were set as the main achievements:

- A wildlife roadkill reduction of at least 20% in the specific areas of intervention and of 10% in the project area, through the adaptation of culverts, installation of fences and barriers in national and municipal roads;
- Implementing 85 new safe bird landing devices on 13 km of medium tension powerlines with an efficiency in reducing bird electrocution and collision of 80%;
- Creation of ecological corridors and micro-reserves networks in road verges and under high voltage power lines poles, with the implementation of at least 9,3 ha of new habitats for small fauna, particularly small mammals and butterflies;
- Promotion of practices for rapid detection and control of invasive alien flora allowing a reduction of 50% in the area intervened until the end of the project;
- Creation of a nursery with 0,5 ha and development of mixtures of seeds with at least 10 native species, intended for recovery of areas occupied by invasive flora and creation of micro-reserves;
- Creation and operation of a national wildlife mortality database for use by infrastructure operators and nature conservation entities, with at least 50,000 records;
- Increase citizen awareness for the issues of the project and the involvement of civil society;
- Involve at least 600 voluntaries in the data collection, using the mobile application developed in the project;
- Develop and test of automatic devices for roadkill monitoring of small fauna, with better efficacy than non-automated methods.

3. **Administrative part**

Management Structure & Organization

The partnership composition (project beneficiaries) is an added value for the project. The main beneficiary (UEVORA) team is composed by fauna and plant experts, with experience in previous LIFE projects, strongly focused on biodiversity conservation and other projects specialized in road and railway ecology, which provide the backbone of the project regarding actions' monitoring. The partnership includes the major linear infrastructure operators in Portugal, such as Infrastruturas de Portugal (IP), which will be able to replicate successful project tasks in the after-LIFE at a national level. Also includes teams from universities specialized in communicating science to citizens (University of Aveiro-UA) and on artificial intelligence and technical innovation through the development of robotic systems for monitoring roadkill, dissuading animal presence near locations with high mortality risk and identifying invasive flora through remote sensing (Faculdade de Ciências da Universidade do Porto - FCUP). A local NGO (MARCA) has large experience on volunteers and stakeholders' involvement in conservation programs. A National NGO (QUERCUS) with a strong commitment in reducing impact of powerlines on birds' mortality, joined the project as new beneficiary, replacing EGSP, since mid 2018, and developed, tested and implemented new devices aiming to reduce mortality in medium voltage power lines in the framework of Actions A.6 and C.5, respectively. The project also bridged with other major linear infrastructure operators regarding energy distribution (E-REDES – Distribuição de Eletricidade; Redes Energéticas Nacionais -REN), which have joined the project has collaborators further contributing to the development and dissemination of conservation actions. Finally, traffic and environmental police (Guarda Nacional Republican – GNR) also joined the project as collaborator, as this entity is responsible for managing the database of the car accidents involving large animals.

Face-to-face meetings of the members of the different Commissions, whenever needed, was the main *modus operandi* of the project. For implementation of the nuclear conservation actions, information compiled in previous projects in the IA and newly data gathered in the project was used to propose preliminary locations and type of conservation actions. Then, we performed joint field trips with all the partners involved in each task to evaluate *in situ* all the possible solutions and their feasibility. A final decision was taken by consensus, or, in the few cases when it was not possible, by the beneficiary responsible for each action. Moreover, partners often take advantage of each other experience, in tasks where the main responsible has fewer skills (e.g. MARCA is helping CME and IP in volunteer programs).

The project management structure is shown in Figure 1.

During the project development, several changes in the team occurred due to different reasons. Among this we highlight, in CTAG and CG, head director of Environmental Department of IP Ana Cristina Martins that was replaced by Luísa Almeida Vales (CG) and changes in Project Manager on two occasions, due to new job opportunities for the former managers, with Rui Raimundo being replaced by Nuno Pedroso, and after that, Nuno being replaced by Pedro Salgueiro.

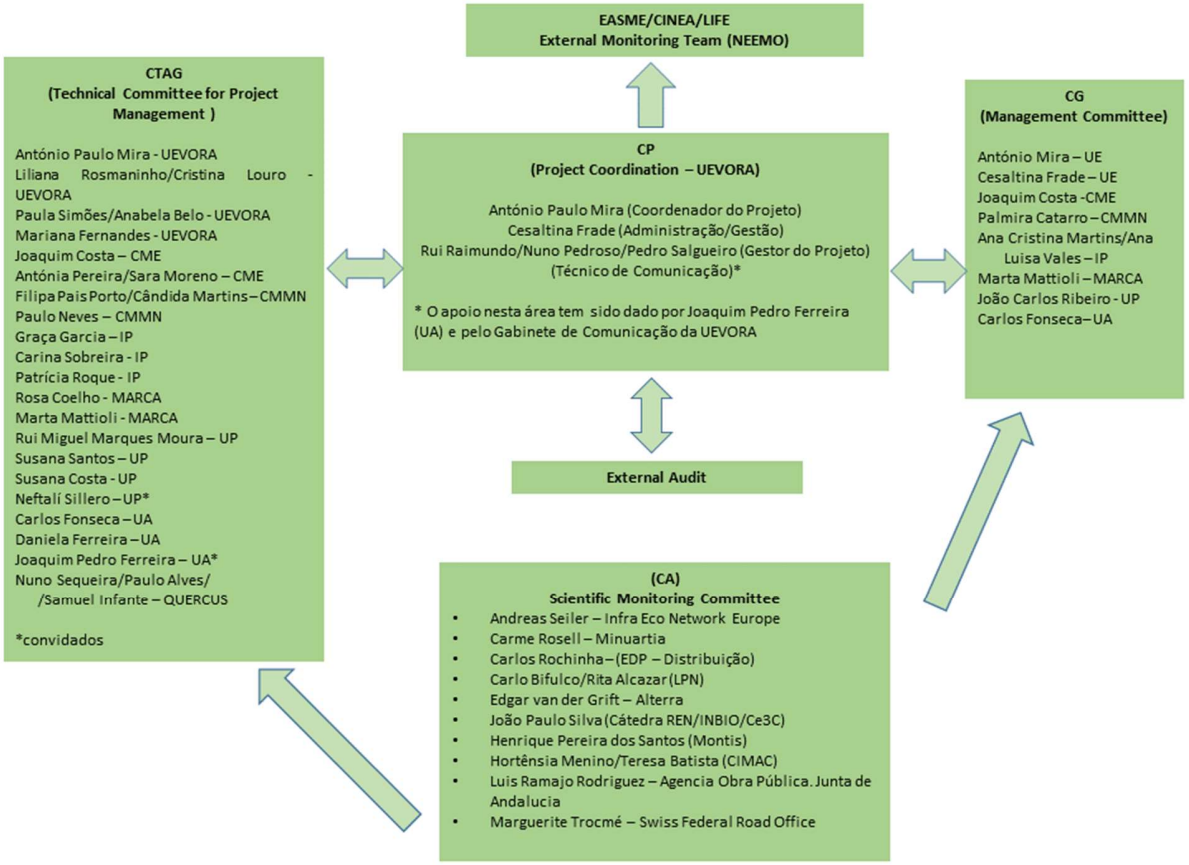

Figure 1 - Organigram of the project Management Structure.

Report and communication with EASME/CINEA and NEEMO

At the institutional level is worthwhile to mention the new EC entity CINEA (European Climate, Infrastructure and Environment Executive Agency) to whom the project reports, instead of EASME, since April 2021. Moreover, the NEEMO monitoring members as changed in the second year of the project (Dr Sara Barceló replaced Dr João Salgado). However, both members, are well aware of the particularities and difficulties often associated with the full implementation of the LIFE projects. Communication with both was easy and when requested they were available and gave LIFE LINES a strong support. This helped a lot to overcome project drawbacks.

During the Project, seven monitoring visits were carried:

- 12-13/April/2016: 1st monitoring visit with NEEMO (João Salgado);
- 23-24/March/2017: 2nd monitoring visit with NEEMO (Sara Barceló)
- 4-5/June/2019: 3rd monitoring visit with NEEMO (Sara Barceló);
- 20/June/2020: 4th monitoring visit with NEEMO (Sara Barceló) (online);

- 17/December/2020: 5th monitoring (technical and financial) visit with NEEMO (Sara Barceló) and CINEA.
- 22-23/June/2021. 6th monitoring visit with NEEMO (Sara Barceló)
- 1, 9 and 16/July/2021: 7th monitoring (technical and financial) visit, with the presence of CINEA, NEEMO, and APA (LIFE National Contact Point).

Whenever necessary, the External Monitoring Team (NEEMO) was contacted and, in exceptional cases, the European Commission, to clarify issues or to request changes and amendments.

Amendments to the Grant Agreement

According with Article II.12/Article II.13 of the General Conditions, two changes in the project were considered substantial and need an Amendment request. Thus, two amendments to the Grant Agreement were appealed and accepted by the EC:

1) *Replacement of a partner*: On October 20th of 2015, the Associated Beneficiary EGSP – Energia de Sistemas e Potência, Lda informed the Coordinator Beneficiary at the moment of the PA signature, that had to leave the project due to financial reasons. QUERCUS, an Environmental Non-Governmental Organization, have a partnership agreement with EDP-Distribution aiming the mitigation of the effects of medium voltage powerlines on wild birds for several years and set priority sites for interventions to reduce wild birds kills. A protocol of cooperation between these two entities is currently in place. Also, QUERCUS revealed immediately a high interest and availability to integrate LIFE LINES as associated beneficiary compromising with the 40% of the co-financing budget needed to complement the co-financing. Thus we proposed QUERCUS to be the new Associated Beneficiary of LIFE LINES, replacing EGSP. This change was concluded thought an Amendment request for alteration of one of the associated beneficiary of LIFE LINES project, accepted by the European Commission.

2) *Request for project extension.* Following what was discussed in the External Monitoring Team during the fourth monitoring visit to the project on 4-5 June 2019, and also what was reported at the third Progress Report, with some conservation actions delayed leading in some cases to shorten monitoring periods, and in order to fulfil adequately the project objectives, on May 2020, we asked the European Commission to extend the completion of the project until 31/05/2021, extending the project for another 10-months regarding what was previously approved in the project application.

4. **Technical part**

Technical implementation *of* the Actions

The project encompassed 35 actions included in five main groups (Figure 2): A - preparatory (7), C - conservation (10), D - monitoring (3), E - public awareness and dissemination (11) and F - management (4) (Figure 2). Preparatory actions (A) structured and supported the implementation of conservation actions (C) to specific conservation issues. Monitoring actions (D) assessed effects of the project actions on socioeconomic, ecosystems functions and several biodiversity features; Dissemination actions (E) communicated the project results to general/expert audiences allowing the dissemination/replication to other impacted sites at national and international levels and promotion of people awareness about the project and about the need to install solutions to the negative impacts of linear infrastructure networks on biodiversity; Management actions (F) deal mostly with administrative processes that are operationalized through the management structure on which the project grounds to take and officialize decisions, implement project actions and report the results to partners and the external monitoring team.

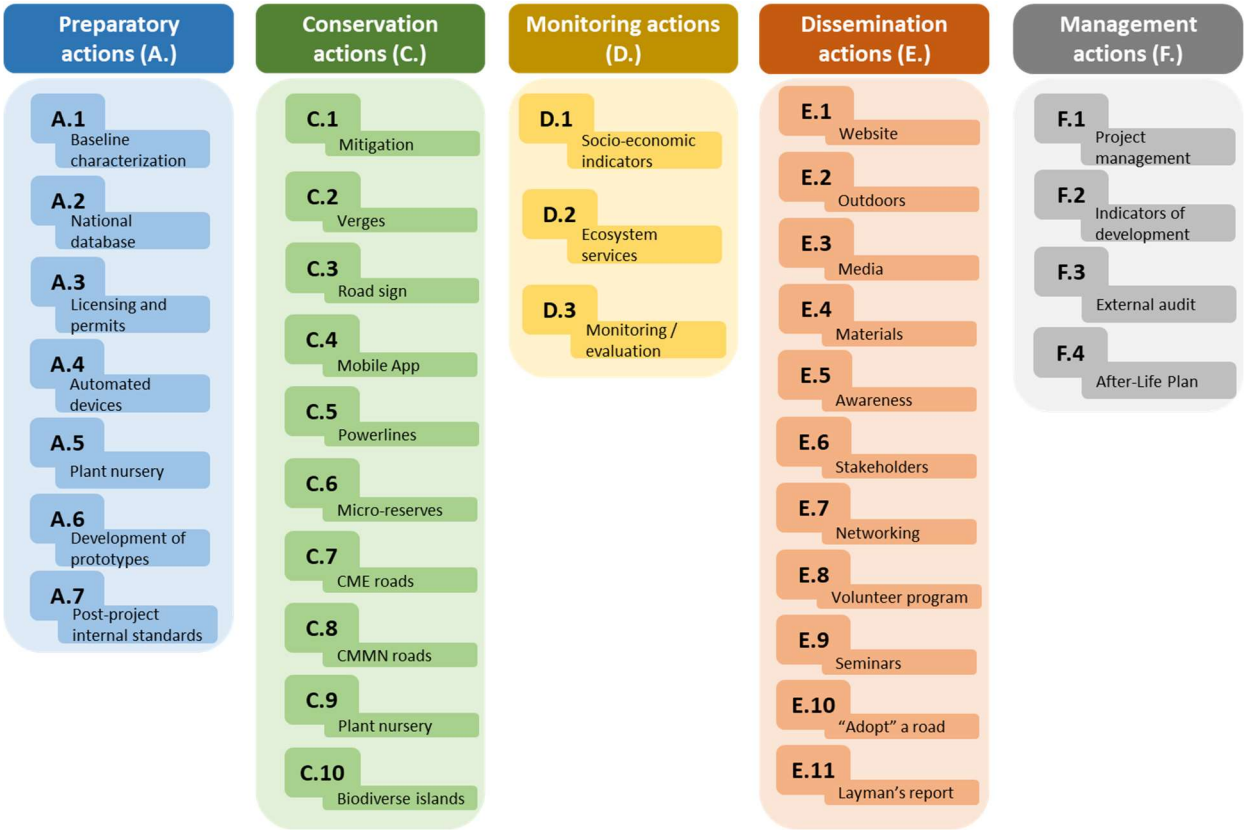

Figure 2 - Summary of all the actions previewed and implemented in the scope of the LIFE LINES project

A. Preparatory actions, elaboration of management plans and/or of action plans

Action A.1 – Completing and updating of baseline characterization

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 30/07/2016
Actual start / end date:	01/08/2015 – 31/03/2018

The action began, as predicted, August 1, 2015. Most of the work was finished by June 30, 2017. However, owl movements and one micro-reserve characterization were only completed on March 31, 2018. This postponement was not the cause for any delays in the implementation of conservation actions.

The information already existent for the Study Area (SA) concerning biophysical, socio-economic, species distribution and roadkill data was compiled in a Geographic Information System (GIS) database, a adeliverable of the Project. Based on this information, the needs for complementary data (species/groups and locations without or with poor data) were identified. Additional sampling in several locations was done for the main target groups of the project including amphibians, passerines, owls and mammal carnivores. Moreover, at intervention sites (roads, road verges, culverts, micro-reserves, and very high voltage power line poles) a detailed characterization of the main target groups for which the intervention was planned, was carried out taking into account, whenever possible, a Before-After-Control-Impact (BACI) design.

An aerial flight was conducted in May 2016 to collect aerial images of the study area, covering the roads EN4 and EN114 and the neighboring land to remotely map the invasive plants. Simultaneously, ground filed surveys were conducted along the roadsides to recognize and validate invasive species remote identification.

The process of mapping invasive plants based on information gathered through the aerial images and field surveys is summarized in Figure 3.

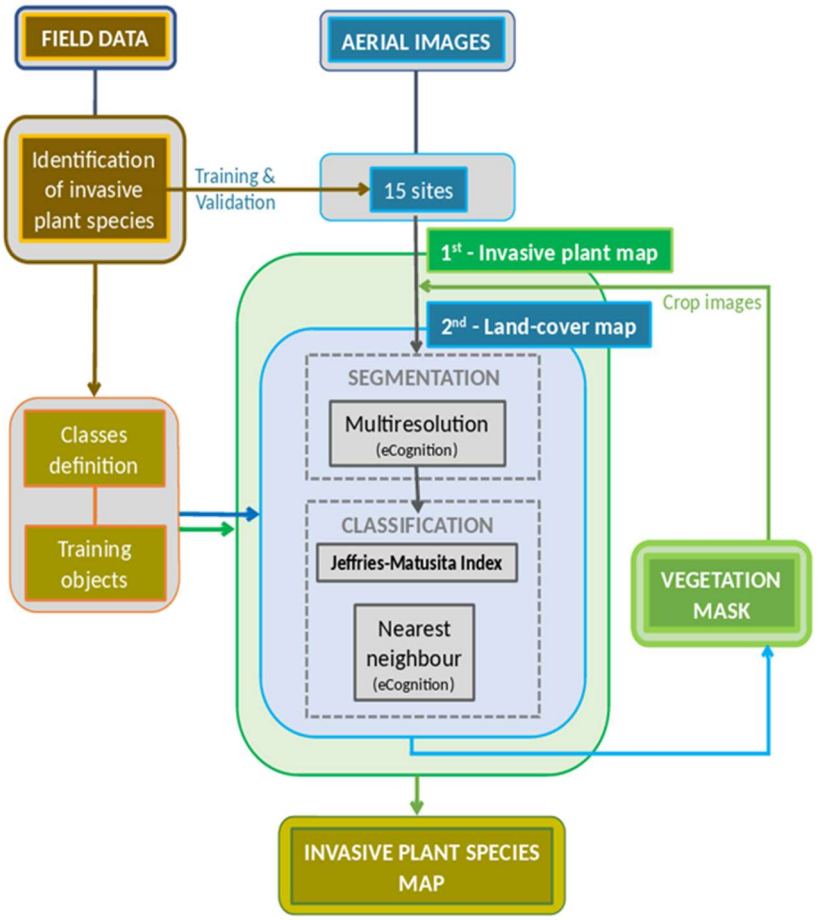

Figure 3 - Invasive plant mapping procedure work-flow.

FCUP team computed the overall accuracy (OA) and the Kappa coefficient to determine the accuracy of the land-cover and invasive species classified images and gathered very good accuracy values, over 90%, for all invasive species target in the LIFE LINES project. This means that invasive species were detected almost perfectly. Traditionally, classification accuracy values around 70% are considered appropriate in remote sensing. Obtaining such high values like here is extremely difficult.

See the "Non-technical Final Report of Action A.1" accompanying this report for further details about this action results (AnnexA.1_I).

The deliverable project GIS database layers (Annex A.1_II), excluding the six that cannot be freely distributed due to licence constraints, are available through the web link https://mapserver.uevora.pt/lifelines_geodata (username: lifelines; password: zanywhale80). All the layers were organized according to the guidelines established in the beginning of the project (Annex A._III).

Action A.2 – Compilation, structuring and implementation of a national database and multi-user web platform

Beneficiary responsible:	IP
Foreseen start / end date:	01/10/2015 – 31/12/2016 (31/05/2021 (after project amendment)
Actual start / end date:	01/10/2015 – 31/05/2021

The structure and implementation of the National Roadkill Database (NRDb) and inclusion of data already compiled was ready in December 2018. However, it continued to be updated with new data gathered from project actions and beneficiaries, as well as external sources, until the end of the project (May 31, 2021). With the extension of the project, it was pertinent to ask for the extension of this action which allowed increasing the number of entities joining the project database with their own data. A protocol with National Republican Guard (GNR), since this entity has a database of the car accidents involving large animals, was celebrated in May 2019 to integrate their data in the NRDb and simultaneously help them, through specific courses, to standardize identification, location and reporting roadkill data (Annex A.2_I). A small report analyzing the data sent by them is annually delivered to GNR (Annex A.2_II). At the end of the project NRDb included all National Roadkill gathered from IP monitoring between 2010 to 2021; and all UEVORA data since 2005. There were eight entities (IP, UEVORA, ICNF, GNR-SEPNA, Autoestradas XXI – Subconcessionária Transmontana, Ascendi - Subconcessão Douro Interior, AEBT - Auto-Estradas do Baixo Tejo, AELO Auto-Estradas do Litoral Oeste), and eight researchers (Clara Grilo; Estrela Matilde; Cláudia Encarnação; Neftali Sillero; Francesco Valerio; Giovanni Manghi; Sofia Dias; Liliana Barosa) contributing with data. In addition, data from the LIFE LINES App is also syncing with the NRDb. IP has encouraged and helped the sub-concessionaire Ascendi to implement a mobile application for internal use in its roadkill monitoring procedures. This App was inspired in the LIFE LINES App.

All other Road Concessionaries and Sub-concessionaries (highways and some more recent national roads) were contacted to contribute with their data to the NRDb.

By the end of the reporting period, 121 532 records of roadkill belonging to 230 species are already in the database. This is a National Database and records included are nationwide, despite the higher concentration in the LIFE LINES IA. The aggregated roadkill data can be viewed online through the WebGIS of the project (https://mapserver.uevora.pt/webgis_lifelines_lm313/lizmap/www/index.php/view/). This database application aims at two kinds of users: public data, available at a broad scale; and private working data that, at this stage, is available at a finer scale only for professionals requesting it.

Lastly, IP is now a member of the Working Group, created by the Government (Governmental Resolution 59/2018 and Law 75-B/2020), to establish a Programme for Monitoring and Minimising the Animal Roadkill on the National Road Network. UEVORA was invited to participate in this group meetings and LIFE LINES database was proposed to be a main tool to achieve the central objectives of the Programme in the after-LIFE period.

Action A.3 – Project implementation, licensing, procurement of permits and contracting procedures necessary to actions C

Beneficiary responsible:	IP
Foreseen start / end date:	01/08/2015 – 30/06/2017
Actual start / end date:	01/08/2015 – 31/12/2017

This action has begun on the expected date and ended six months later than predicted. Nevertheless, an additional amount of time was invested in talks with different stakeholders to improve/adapt the projects according to the expectations of all the parts involved and, whenever possible, increase the cost-benefits ratio. This, associated with all the mandatory administrative procedures needed by law are responsible for some delays. Authorizations and licenses (Annex A.3_I; Annex A.3_II; Annex A.3_III; Annex A.3:IV; Annex A.3_V; annex A.3-VI) were gathered and the following execution projects were completed:

(1) Design and authorizations of the amphibian passage warning signal
(2) Construction of dry ledges for fauna on 6 culverts,
(3) Installation of fences at N4, N114 e IP2
(4) Installation of fences plus net in L-shape on IP2
(5) Installation of walls to elevate flying vertebrates fly on N114
(6) Installation of barriers and adaptation of culverts for amphibians on N114
(7) Installation of reflectors for owls on N4
(8) EM529 - Implementation of barriers and tunnels for amphibians and walls for owls
(9) EM535 - Intervention Plan
(10) NIA – Restoration Plan for Nucleus of Environmental Interpretation
(11) Contractual procedures to promote public awareness and voluntary activities in actions in the responsibility of IP
(12) Installation of nets covering the slopes to avoid rabbits
(13) Implementation of a strawberry tree barrier to elevate owl's flight
(14) Creation of two micro-reserves

Several tasks of Action C.1 and Action C.2, such as implementing new fences along the roads, implementing reflectors to avoid owls at the road, and all the services related to Action C.2 (mowing and cutting vegetation, control of invasive species, planting vegetation) are contracted on the IP's new Road Maintenance Contract. In the Annexes A.3_V and A.3_VI, some pieces of reference terms for the new Road Maintenance Contract are presented, including the LIFE LINES specifications, the Chapter 5 (describing the implementing methods), and the timetable concerning all the actions of the Contract (not only for LIFE LINES). For a better understanding, an extract of the new Road Maintenance Contract adjusted timetable, relating the activities contracted with the actions of LIFE LINES (and the places they concern) is presented in the (Table 1)The main tasks are translated in the 2nd column.

Table 1- Extract of the new Road Maintenance Contract adjusted table, relating the activities contracted, its major code (in the original is divided in many subcodes for the different activities inside the major group) with the actions of LIFE LINES and the places they concern (in yellow).

Infraestruturas de Portugal / 2017 2020 CCC		Descrição dos trabalhos específicos em que importa realçar algumas épocas para a sua execução	LIFE LINES correspondence
5.12.1	Conservação de pavimentos		
5.12.2	Regularização e Limpeza de Bermas e Valetas, Passeios, Intersecções, Ilhéus e Separadores	Regularização e alteamento de bermas não pavimentadas	
		Regularização de valetas não revestidas	
		Limpeza por aspiração	
		Limpeza de , intersecções e ilhéus	
		Limpeza de separadores	
		Limpeza de Áreas de Repouso e Outras Zonas de Paragem	
5.12.3	Limpeza, conservação, reconstrução e construção de órgãos de drenagem	De banq., de crista, pé de talude, incl. caleiras de descida de talude	
		Valetas e Valas revestidas existentes na plataforma da estrada	
		Limpeza e conservação de outros órgãos de drenagem e acessórios	
		Conservação de sistemas de retenção/tratamento	
		Reconstrução ou construção de novos órgãos de drenagem	
5.12.4	Manutenção e estabilização de taludes (Maintenance and stabilization of slopes)	Manutenção de taludes	Removal of Arundo donax rhizomes after extraction - Parcels at EN18 and EN114
		Estabilização das zonas afetadas por escorregamentos	
5.12.5	Conservação da rede de vedação (Implementation and maintenance of fences)	Inspeção da Rede de Vedação	IP2 (kms 209-226 and culvert at km 119) EN114 (near culvert at km 168,6) EN4 (near culverts at km 92,5;102; and 111,350 and 111,390)
		Manutenção da Rede de Vedação	
		Fornecimento e colocação de Rede de Vedação	
5.12.6	Conservação de Obras de Arte e Túneis	Meios de Acesso	
		Identificação das Obras de Arte	
		Limpezas Gerais	
		Fundações e Linhas de Água	
		Componentes Estruturais	
		Guarda Corpos, Passeios e Cornijas	
		Juntas de Dilatação	
		Taludes e Órgãos de Drenagem	
		Escoramentos	
5.12.8	Atividades Ambientais (Environmental activities: mowing and cutting of vegetation; chemical and physical treatment of invasive vegetation; vegetation and trees removal; plantation, etc.)	Ceifa e corte de vegetação	IP2 (kms 209-226) EN4 (kms 82-143) EN114 (kms 161-189) EN18 (kms 229-267,5) EN18/IP2 (kms 267,5-281) Micro-reserves (EN4) Invasive vegetation parcels (EN4, EN114 and IP2\EN18)
		Corte seletivo de vegetação	
		Desvegagem química/térmica	
		Manutenção vegetação arbórea	
		Poda de árvores e arbustos e abate de arbustos	
		Proteção e manutenção de árvores com valor excecional	
		Abate de árvores	
		Remoção de cepos	
		Remoção de árvores caídas e ramos caídos	
		Caiação de troncos	
		Abertura de caldeiras	
		Controlo físico e químico de plantas invasoras	
		Eliminação de exemplares de plantas invasoras	
		Manutenção zonas com tratamento paisagístico	
		Sementeiras	
		Mantas orgânicas	
		Plantações	
		Dispositivos de proteção acústica	
5.12.9	Atividades de Segurança (Implementation of "safety equipments" such as road signs and refletors)	Conservação da sinalização vertical	Refletors - EN4 (kms 92,550 - 93,750) Road Signs - EN4 and EN114
		Colocação de sinais e aplicação de equipamentos de segurança	
		Conservação da sinalização horizontal	
		Conservação e manutenção de guardas de segurança	
5.12.10	Obras de Contenção	Execução de Muros de suporte	
		Demolição de muros	
5.12.12	Outras Atividades	Remoção de mensagens publicitárias	
		Reconstrução pontual de passeios, ilhéus e separadores	
		Correção altimétrica de cxs de visita existentes na plataforma da estrada	
		Execução dos Inventários	
5.12.17	Equipamentos complementares (complementary equipment)		Extraction of Arundo donax rhizomes - Parcels at EN18 and EN114
5.12.99	Trabalhos não especificados (unspecified works)		Installation of nets covering the slopes to avoid rabbits (EN4 km 130,660-131,160; and 88, 315 - 88,815)

These tasks (implementing new fences along the roads, implementing reflectors to avoid owls at the road, and all the services related to Action C.2) were overdue, because several issues have delayed the new Road Maintenance Contract signature. A detailed explanation of this is as follows:

The terms of reference for the new Road Maintenance Contract, including the LIFE LINES specifications were submitted to Government approval[3] in the 1st semester of 2017 but Government approval to initiate contract procedures was just published on December 29, 2017. IP has initiated the contract procedures immediately and a company was selected to contract. As soon as the Court of Auditors[4] authorized the contract, the works started.

Some of these services, especially the mowing and cutting of vegetation, were in the meantime assured by the Road Maintenance Contract that ended in December 2017. Afterwards, two contracts were made to guarantee emergency services and the main services like mowing and cutting of vegetation, during 2018.

Other tasks of Action C.1 and C.2 were implemented under the Road Maintenance Contract that ended in December 2017, such as the implementation of nets to avoid rabbits, implementing fences near culverts, and mowing and cutting vegetation along the roads (periodic task that takes place every year of the project).

The project's design for amphibian's roadkill mitigation measures and walls to elevate flying vertebrates flight (including an outdoor to promote the LIFE LINES project) for Action C.1 were concluded in October 2017. Both were joined in one single contractual procedure.

Tender process for the construction was initiated on December 28, 2017, after the execution project has been concluded, but only two companies have submitted proposals. Both applied with a budget above the base price and were excluded because public institutes are not allowed to accept proposals above this price. The base price had been estimated according to the usual price but the market has changed substantially, with increasing costs, due to new legislation concerning infrastructures maintenance (a vast amount of works, such as cutting trees and vegetation near the road in all country, is now a legal obligation with a short deadline, so the service providers are saturated and the market prices have increased substantially). Consequently, it was prepared a new tender process with an increased base price that was published on May 9, 2018.

This time, three companies submitted suitable proposals and the adjudication procedure proceeded with the chosen company.

Regarding the implementation of the fences plus the complementary net set in L-shape, although some repairs on the existing fences have been developed under the first Road Maintenance Contract, this contract was previous to LIFE LINES project and had no budget to instal fences with additional L-shape net. The new Road Maintenance Contract was approved by the Government very late as explained, and most of the roads of the district needed urgent repairs, compromising the timings and budget in general terms. So, only the first 1500 m of new fence with additional net in L shape could be implemented, in April 2019, since there was not enough budget in the contract, and it was not possible to add it to the contract due to the government restrictions. For that reason, IP has initiated a new tender process that only became public in November 2019 due to several logistic and bureaucratic restrictions. IP signed the contract in March 2020, but due to Covid-19 restrictions defined by the government, the works were only concluded by August 2020.

[3] Multi-annual budgets for activities that take longer than one fiscal year must be approved by the Government (by both the Ministry of Finance and the Ministry of Planning and Infrastructure).
[4] Contracts above 950.000,00€ need the authorization of the Court of Auditors.

Nevertheless, monitoring was done under the Action D.3 by the IP team until May 31, 2021 (around 9 months of monitoring), and the monitoring still goes on during the after-LIFE period, since IP has integrated this procedure into their operational standards, allowing adequate monitoring of the mitigation measure directed to the decrease of mammals mortality.

Regarding C.10 the protocol with REN (National Electric Network) was signed in December 19, 2017 (Annex A.3_VII).

Action A.4 – Development, testing and evaluation of automated systems of monitoring and/or deterrence

Beneficiary responsible:	FCUP
Foreseen start / end date:	01/08/2015 – 30/06/2018
Actual start / end date:	01/10/2016 – 30/06/2019

In the original proposal, the University of Minho was indicated as the main developer by external assistance of the prototypes as they are Engineers in Electronic Systems and the FCUP team does not have those skills. However, the prototype costs increased substantially, and therefore the FCUP team assumed the development of prototypes without resorting to external assistance but hiring an Engineer from University of Minho and buying the materials. Thus, the University of Minho was substituted by the FCUP to maintain the final costs of Action A.4 as previously planned.

The FCUP team finished successfully the development of all five prototypes six months in advance. All prototypes were tested properly as well. The Action A.4 should have started in August 2015 and finished in June 2018. However, we were not able to hire a grant holder until October 2016. In consequence, the task started more than a year after. However, we are able to finish successfully the task in 30 months instead of 36 months. Further, we developed more prototypes than those planned originally.

We lost several prototypes during testing periods. One dissuasion devices for rodents was destroyed during cleaning works of road verges in the application of the new fire. The battery of the dissuasion device for owls was stolen. The dissuasion devices for rodents were stolen during monitoring performed under Action D.3.

In annex A.4_I we detail the development, testing and evaluation of each device.

All devices were presented and disseminated in LIFE LINES related international meetings including IENE International Conferences 2018 and 2020. Ascendi enterprise (www.ascendi.pt), one of the main private managers of highways in Portugal, aims to sign a protocol of five years with FCUP to implement different solutions (e.g. MMS3) developed during the LIFE LINES.

The assessment results for the devices are briefly presented in Action D.3, Technical-Sientific Report (Annex D.3_I).

Action A.5 – Installation of autochthonous plant nursery for conservation actions

Beneficiary responsible:	MARCA
Foreseen start / end date:	01/08/2015 – 31/12/2016
Actual start / end date:	01/08/2015 – 31/12/2016

The nursery infrastructure was finished in the foreseen end date, In the deliverable "Non-technical report of the Action A.5" accompanying this report (Annex A.5_I) it is described the location and structure of the nursery. Moreover, the same document summarizes the productive areas, lists the species being produced and make some appointments on the production procedures. Concerning Action A.5, the infrastructure and land where it was predicted to be installed the plant nursery became no longer available because in the period that mediated project proposal and approval the site was designated for other purposes by its owner. In order to attain the objectives and targets initially proposed, other alternatives were assessed. After several other institutional contacts with local partner's a new location has been found at the property of Casa João Cidade (a local association working with disabled people). The referred land parcel was made available to MARCA with the purpose of installing the Plant Nursery since the beginning of April 2016. The new place found to install the nursery did not interfere with its functioning nor with the end date of the action. All the deliverables/milestones and indicators were achieved.

Despite the action ended, there have been further expenses related to the plant nursery infrastructure to ensure the necessary production capacity, namely with the watering system and the construction of a second shadow area.

By the end of the project the plant nursery was installed in a 5000 m^2 that included:

- Shadow area 1 – 50 m^2 with watering system
- Acclimatization area 1 – 150 m^2 with watering system
- Shadow area 2 – 150 m^2 with 12 bench's and watering system
- Acclimatization area 2 – 50 m^2
- Support house – 15 m^2 with electricity and water supply
- Shade area- 15 m^2 attached to the house to work under non-favorable weather conditions.
- The remaining area is dedicated to store soil, vases and other materials necessary to plant nursery operation, mother-plants, quarantine area, working areas, acclimatization areas, etc.

Figure 4 shows a map of the plant nursery areas.

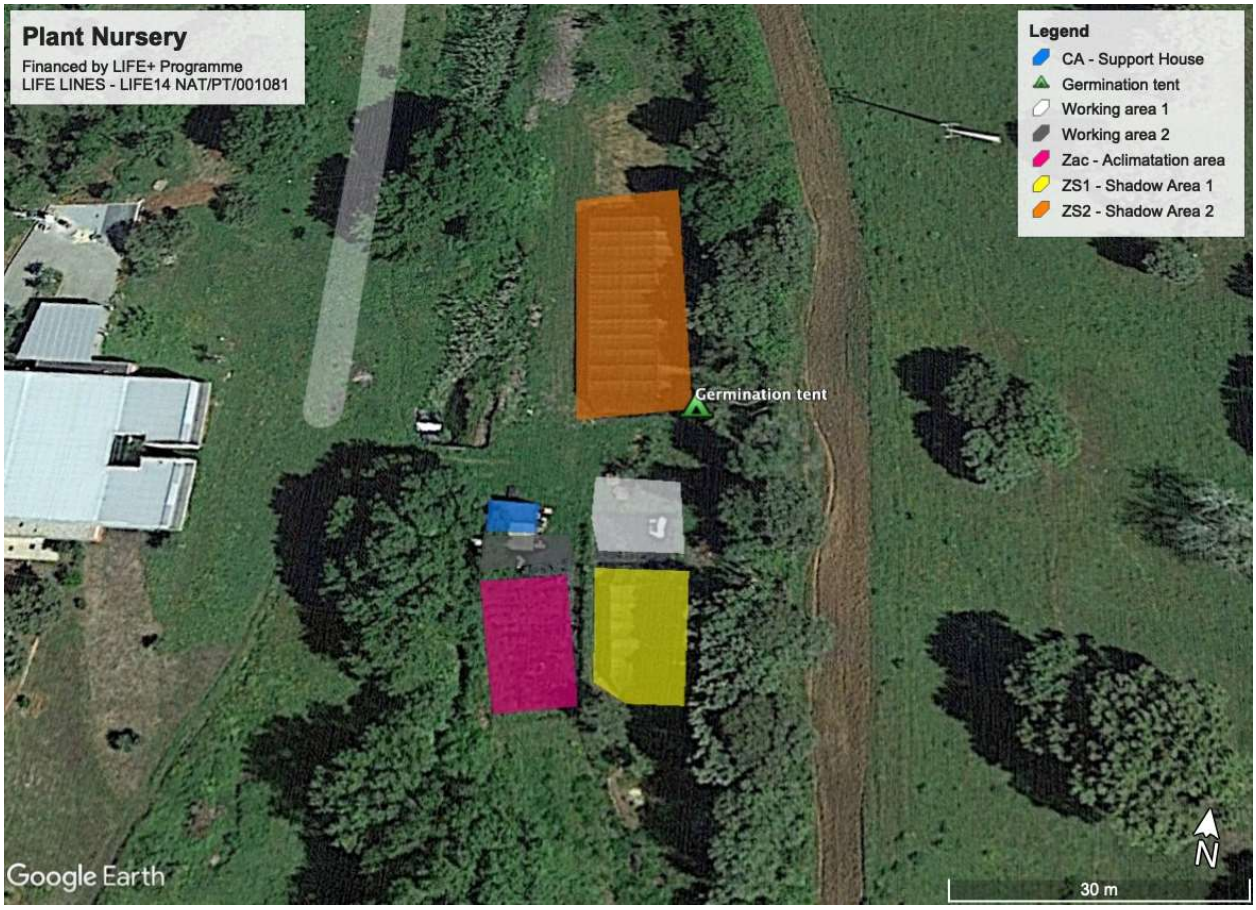

Figure 4 - Map of the plant nursery areas.

Action A.6 – Development of prototypes for deterring avifauna in medium voltage lines

Beneficiary responsible:	QUERCUS
Foreseen start / end date:	01/10/2017 – 30/06/2018 (30/06/2019 - after project amendment)
Actual start / end date:	01/09/2018 - 31/05/2019

The implementation of this action was delayed due to Associated Beneficiary (EGSP) withdrawal from the project. An amendment to the initial project proposal was sent to EASME on May 23, 2018, to include QUERCUS as Associated Beneficiary. EDP Distribuição (now called E-REDES), the main linear infrastructure operator regarding medium tension energy distribution, has also joined the project has collaborator (Annex A.6_I).

To reduce and prevent the negative impacts caused by the interaction between power lines and birds QUERCUS and E-REDES developed under the scope of the Action A.6 an innovating pole frame called ECO- HAL A2S which aims to reduce the mortality from electrocution and collision at the same time. The ECO- HAL A2S reduces the distance between phases, isolate some electric parts contiguous to the electric poles and alter the design of the top of the pole to make more difficult birds landing. Regarding the collision problem, the new structure reduces to a single horizontal plane the aerial conductors where birds can collide.

After the final ECO- HAL A2S final design, the pole frame entered production by an external firm at an experimental stage, by the end of the first half of 2019, and later in full operation. The technical design went through an E-REDES internal approval process to check if it was within all the technical requirements.

A.6 was concluded with the provision of the "Technical report of Action A.6" in May 2019 (Annex_A.6_II), a deliverable of the project.

Action A.7 Elaboration and approval of Internal Standards of guidance to support management in post-project.

Beneficiary responsible:	IP
Foreseen start / end date:	01/07/2019 – 31/09/2020 (31/05/2021 - after project amendment)
Actual start / end date:	01/07/2019 – 31/05/2021

IP has developed a guide for fauna mitigation measures [Deliverable – Internal Rules Approved - INSTRUÇÃO TÉCNICA GR.IT.AMB.001 - MEDIDAS DE PROTEÇÃO DA FAUNA (Techcnical Instruction GR.IT.AMB.001 – Measures to protect fauna) – Annex A.7_I) which includes the measures applied in LIFE LINES project that have been considered efficient. The Manual intends to instruct the application of solutions to protect fauna from the most significant impacts caused by the roads. It refers to solutions to be implemented on railways and roads, where intervention is recognized as needed, both on new roads/railways and on existing sections of already built ones where roadkill rate is previously recorded or is expected to occur.

The extension of the project beneficiated this action since allowed more time to learn from monitoring results and integrate this know-how in the norms and guidelines for future projects and management plans. This document was approved by the end of May 2021 and disseminated to all collaborators of IP. It aims to help and guide designers and constructors from IP and from companies working to IP. This document is joined to the terms of reference for future roads or road improvement projects, to assure the best practices and designs of the ecological solutions that will be applied.

The terms of reference for the actual and future Road Maintenance Contracts (of all districts) have integrated better practices in what concerns vegetation management and invasive species control (especially the ones that have shown better results, such as debarking and total removal of IAS).

IP has also started to request the identification of areas with invasive species, in the terms of reference for the environmental impact assessments of roads and railways, in order to guarantee its adequate control during and after the infrastructure construction. Also, the Landscaping Integration Project, which incorporates the Road Projects, defines the best methods to use, avoiding just cutting or reusing the same soil which may be full of seeds of AIS.

Finally, IP is disseminating to its collaborators the importance and the best methods to apply these ecological solutions and the best methods to manage vegetation along the roads, promoting workshops and training sessions as well as participating in initiatives and supporting other investigation projects concerning these themes.

C. Concrete conservation actions

Action C.1 – Integrate Mitigation of the reduction of conductivity and permeability of the landscape in national and principal roads

Beneficiary responsible:	IP
Foreseen start / end date:	01/03/2016 – 31/12/2017 (31/08/20 – after project amendment)
Actual start / end date:	01/03/2016 – 31/08/2020

Most of the procedures needed for interventions in the framework of Action C.1 started on the predicted date (Annex C.1_I; Annex C.1_II). However, time-consuming administrative processes or difficulties in contracting service providers, as explained in Action A.3, delayed the beginning of some interventions in the field.

Dry ledge installation in culverts

Installation work concluded in August 2017. Dry ledges were implemented in 6 culverts, instead of 5, because culvert 660 is connected to a second culvert (6499) that had also to be adapted for the animal crossings to be effective (see Table 2Table 2). Nevertheless, the cost did not exceed the predicted budget for this task.

Table 2- Culverts with fauna dry ledges

Culvert number	Road	Km	Name
644	EN114	169+000	Pontão da Serra de Pégoras
660 + 6499	EN114	171+700	PH Ribeira de Santa Sofia
2748	EN4	111+350	Ponte de Mendos Marques
6453	EN4	107+030	
2434	IP2	219+000	Ponte do Ribeiro das Pinas

Fence installation/rectification

Building work was concluded in November 2017, at 6 culvert locations (Figure 5; Table 3), under the previous Road Maintenance Contract.

Figure 5 - Fence installed near one of the selected culverts

Table 3- Culverts with fences installed

Culvert number	Road	Km	Dry Ledge	Fences
660 + 6499	EN114	171+700	Yes	Existing (private)
637	EN114	168+600	No	Installed
without number	EN114	166+110	No	Canceled
6439	EN4	92+550	No	Installed
2741	EN4	102+055	No	Installed
2748	EN4	111+350	Yes	Installed
Without number	EN4	111+390	No	Installed
2434	IP2	219+000	Yes	Repaired

Although it was predicted to implement fences near the culvert at EN114 (km 166+110), it was noticed that there was no space between the top of the culvert and the road to install the fence safely. So, as there was another culvert that also needed fences (culvert 'without number', at EN4 near km 111+390), IP implemented the fences at this one instead.

In what concerns culverts 660+6499, just before the beginning of the fence installation was noticed that the adjacent private landowner had installed proper fences exactly on the same place as IP was planning. So instead of spending resources duplicating this measure, it was decided to cancel it, especially because the purpose of the measure was achieved the same way.

IP is programming to install fences near culverts at spots with high mortality rates as well as in new roads.

L-shape fence adaptations

By the time of the project request for an extension, most of the tasks predicted in this action were implemented, with the exception of the additional L-shape net. As explained before the previous contract had no budget to install fences with additional L-shape net.

The new Road Maintenance Contract was approved by the Government very late (IP has only received approval to initiate contract procedures on December 29, 2017) and most of the roads of the district needed urgent repairs, compromising the timings and budget in general terms. So, only the first 1500 m of new fence with additional net in L-shape could be implemented by this contract and, for that reason, IP has initiated a new tender process that only become public in November 2019 due to several logistic and bureaucratic restrictions.

In the middle of March 2020, the contract was signed, but the works just started in June due to Covid-19 restrictions. Consequently, a new extension of C.1 was needed. The installation of the fences with the additional L-shape net were concluded at the end of August 2020, as predicted in the project extension request. About 32 kms of existing fences at IP2 were replaced and a complementary net set in L-shape was implemented (Figure 6 - Installation of a fence with additional L-shape net at the road IP2, in the framework of the LIFE LINES project: (A) attachment of the additional mesh to the fence; (B) cover and compaction of the soil at the base; (C) final aspect of the L-shape net. (Photos: Graça Garcia, Pedro A. Salgueiro)). The possibility of fence reparation instead of replacement, although initially considered was not possible, due to the lack of good conditions of the fence and also to the way the actual net was supported in the wooden posts (L-shape net has to be fixed on the outside). Another reason to replace the fence had to do with the location. IP usually implements the fences in the border of its territory. So, as there was no space to bury 50 cm of net horizontally without entering private property, the new fence had to be installed nearer to the road at least 50 cm.

Figure 6 - Installation of a fence with additional L-shape net at the road IP2, in the framework of the LIFE LINES project: (A) attachment of the additional mesh to the fence; (B) cover and compaction of the soil at the base; (C) final aspect of the L-shape net. (Photos: Graça Garcia, Pedro A. Salgueiro)

SWAREFLEX reflectors

It was difficult to find a company willing to sell and install these devices and only by the end of July 2017 we had the confirmation from one firm that were available to sell. A field visit with a technician from the firm was promoted to detail an implementation project of these devices. The installation was planned to be done under the new Road Maintenance Contract but due to its delay (as explained in Action A.3) it was decided to buy the wildlife reflectors apart this contract.

In February 2019, 100 wildlife warning reflectors were installed along a 1200 km-long segment of road in EN4, 25 m apart from each other, on both sides of the road.

Vegetation clear-cutting/mowing on road embankments and verges

These works, which are intrinsically related to Action C.2, had also the complementary aim of preventing roadkill since maintaining the verges with low vegetation improves the visibility and reduces the risk of animals approaching the road. The works were conducted under the previous Road Maintenance Contract, and the following contracts for main services as explained in Action A.3. The new Road Maintenance Contract started in 2019 and included the LIFE LINES specifications, improving the techniques used.

Regarding the improved methods for managing the vegetation along the roads, it has included mowing and selective cut of vegetation with variable frequency (shorten the time intervals between mowing actions when weather conditions promote excessive vegetation growth or not mowing at all if the vegetation was not too high). Whenever possible, it was kept a green strip as corridor for small animals, usually more than 3 m far from the road, and it was left some bushes and vegetation "islands" that can create refuges and stepping stones for small animals. Mowing was performed only at the strip next to the road, until 3 m width. Selective cut was performed in all the roadside strip belonging to IP, including the first 3 m if it did not need to be mowed.

Amphibian roadkill mitigation measures

In what concerns the amphibian barriers and the culvert adaptations, the chosen location is at one important segment of EN114 bordered by several water bodies and where have been registered a high number of amphibians' roadkill, being important to mitigate. The initial solution proposed in LIFE LINES Project (construction of specific tunnels for amphibians), was studied during the preparatory studies and the IP civil engineers did not approve it for the following reasons: due to safety and maintenance constraints it is not viable to construct in EN114 the kind of tunnels usually used in smaller roads with reduced traffic and velocity. In fact, EN114 is a main road that supports high levels of traffic associated with high speed. The introduction of different structures in the pavement can risk the safety of drivers since the irregularities associated with these different structures tend to cause accidents. This kind of problems do not happen with drainage culverts because they are installed deeper if the embankment is large enough. On the other hand, there are few segments at this road with embankments large enough to implement new tunnels, so it was necessary to look for alternative solutions.

During the preparatory studies, it was realized that there were two drainage culverts at the road segment chosen to be intervened that could be adapted to allow its use by amphibians, as long as they were guided by barriers. So, the new project included the necessary adaptations to be made on the culverts to promote their use by amphibians, instead of installing the initially proposed passages. Adaptations comprise building ramps for amphibians' access (there were steps in the previous accesses) and rising of the lateral culvert walls to connect with the barriers implemented. It is

important to notice that experts from the project Scientific Monitoring Committee agree that culverts, particularly in the Mediterranean, may be efficient for this purpose. So, it is probable that these alternative solutions achieved the same results and if so, its applicability in the future will be more viable since all roads have a large number of culverts that can be easily adapted for this purpose. The design has included the outdoor informing about the action and the LIFE LINES Project.

This action was joined with walls to elevate flying vertebrates flight height under the same single contractual procedure, for logistic reasons, and were concluded in October 2017. There were some delays in the procedures as explained in Action A.3, due to the low budget considered at the first tender process and it was necessary to develop a new one with a higher budget. Amphibian's roadkill mitigation measures were concluded in December 2018.

Walls to elevate flyng vertebrates flight height

In what concerns the walls to elevate vertebrates flight height, and following the advice of road ecology specialized members of the Scientific Monitoring Committee, it was decided to opt, in first place, by the simpler solution from the different possibilities considered in the project proposal, i.e., high barriers parallel to the road. The solution had to take into account some safety restrictions, especially in what concerns its implementation on a bridge. Implementing high barriers on bridges is unadvisable, due to the risk of falling when subjected to wind. Due to this fact there were some delays in the project design which was concluded assuming barriers of 3 m high, with metal resistant nets that are permeable to wind (Figure 7). Barriers were concluded only in January 2019 due to tender process difficulties as explained in Action A.3.

Figure 7 - Details of the 3 m-high barrier implemented on the EN114 road, made of rectangular-section metallic posts (80x60x3 cm) inserted in the foundation and topped by plastic caps, 2 m apart, that support a galvanised wire mesh welded and plasticized with PVC/polyester, with a 19 x 19 mm of diameter and a wire diameter of 2 mm. (Photo: Graça Garcia)

It is important to clarify that the increased base price was estimated accordingly to the actual market prices as well as the prices presented in the first tender process. So, it was evident that the budget estimated in LIFE LINES Project was not enough to implement these projects. IP has then drawn LIFE LINES Coordinator's attention to this question, suggesting to use part of the budget that concerned Action C.2 to fulfill the gap, namely the budget to consumables for solar systems (see Table 4) that was not essential to the success of Action C.2. After analyzing this issue, the team has agreed that the Amphibian's roadkill mitigation measures and wall to elevate vertebrates flight projects were more important and fundamental to the coherence of LIFE LINES Project. Permission was granted to EASME to remove part of the budget from consumables form C.2 and added to Service acquisition in Action C.1 (Table 4).

Table 4 - Budgets of consumables concerning Action C.2 that were used in Action C.1 (source: LIFE LINES Project, Consumables Table, p. 324)

Consumíveis para apoio à ação C.2: 2 kits solares de bombagem/rega para fornecimento de água (compostos de bomba, sensores, e painel fotovoltaico, no total de 6.400€/unidade)	12.800,00
Consumíveis para apoio à instalação de soluções de monitorização fixa contínua (painéis fotovoltaicos, baterias, sistemas de distribuição de energias e soluções antivandalismo/ roubo) para ação C.1	21.600,00
Total	34.400,00

Nets covering road slopes to avoid rabbits

It was planned to execute this task under the new Road Maintenance Contract, which includes the LIFE LINES specifications. Nevertheless, IP was able to execute this service under the previous Road Maintenance Contract (on the last trimester of 2017), ensuring that it was concluded within the original timetable.

The nets were applied in November 2017 on both sides of two segments of EN4 national road with high levels of rabbits' mortality, identified by the UEVORA team, specifically km 130,660 - 131,160 and km 88, 315 - 88,815 (Figure 8)

Figure 8 - Installation of a deterrent net for rabbits on the road slopes of EN4, Évora district. (Photos: Luis G. Sousa, Graça Garcia)

Electronic devices for deterring owls' and small mammals' presence

These devices were developed by FCUP under the framework of Action A.4. IP has helped to install them.

Due to the mentioned delays, especially the tasks depending on the new Road Maintenance Contract, we suggested extending the period of action C.1 execution until the end of August 2020.

Action C.2 – Potentiation of the verges and marginal parcels of roads infrastructures as shelter areas, refuge, food and / or displacement

Beneficiary responsible:	IP
Foreseen start / end date:	01/03/2016 – 30/06/2018 (31/12/2029 – after project amendment)
Actual start / end date:	01/03/2016 – 31/12/2020

Control of road vegetation and invasive species

These works were included in the new Road Maintenance Contract, which includes the LIFE LINES specifications. As explained before, the terms of reference were submitted to Government approval in the 1st semester of 2017 and Government approval to initiate contract procedures was published on December 29, 2017. IP has initiated the contract procedures immediately and a company was contracted. Nevertheless, the Court of Auditors only authorized the contract by the end of September 2018 and most of the works were delayed, especially the ones that depended on a specific season for implementation, like IAS control (most of the tasks only result if done during spring/summer).

Regarding the improved methods for managing the vegetation along the roads, it was already explained in Action C.1. Due to the previous considerations and recommendations of EASME it was decided that the area to do the vegetation management with improved techniques, at the IP2, EN4, EN114 and EN18/IP2 verges, should be increased in order to enlarge the area covered. So, in 2019, 2020 and 2021 the area was increased to an extension of 314 km, on each side of these roads, from the limit of the paved section. The area of intervention is approximately 942 000 m^2.

In 2019, under the new contract, it was also implemented the Plan to Control Invasive Species, so the actions of initial control were applied in all 58 parcels at EN4 and EN114, predicted to be intervened, in a total amount of 7073 m^2. The workers received previous training, in collaboration with the partner MARCA.

The 2nd and the 3rd phases of the Plan were performed during 2020 and 2021, particularly controlling the new shoots that appeared in some patches. It is not possible, in most situations, to guarantee the eradication of the invasive species in the first year, since there is a seed bank in the soil that will take several years to control. Also, these species are very resistant to the control actions, being necessary to repeat the procedures, sometimes year after year. These facts are well documented in the bibliography. So, IP strategy consisted in applying sequential actions, as was predicted in the Project proposal (p. 148). Therefore, there was a 2nd phase - Continuity Control - to repeat procedures where necessary and to control the new shoots. The 3rd phase, called Maintenance Control, was like the 2nd one, regarding mainly the plants from the bank seeds in the soil. This 3rd action started in 2020, continued in 2021 and will go on through the subsequent years since it is not possible to assure an effective control of invasive species in a short period of time.

After evaluating the budgetary restructuring, an additional amount became available to control invasive flora species in 53 additional plots, adding more 6565.7 m^2 to the initial area and to trying a new technique, namely the total removal of *Arundo donax* (including the roots), thus reinforcing concrete conservation actions, which benefited the project's objectives and enhanced demonstration and replication purposes. These actions were performed mainly in November 2020 and April 2021, accordingly with the adequate seasons to its implementation.

Micro-reserves for promoting biodiversity in road verges

IP and UEVORA established the parcels along the roads to be used as micro-reserves which had 3.9 ha and 1.6 ha each, in a total of 5.5 ha.

Following the selection of two micro-reserves near the EN4, under the management of the IP partner, the intervention plan previously elaborated for the flora activities was implemented by MARCA and UEVORA, with the participation of IP and several volunteers.

The interventions took place in the autumn of 2018 and included sowing and plantations of native flora species in both micro-reserves. Sowing was performed in 10 plots settled in the micro-reserves, using the biodiverse seed mixture developed in Action C.6 in one of the plots, and seeds of different herbaceous species in the other plots. The foreseen number of sown plots was six, but three of them were divided for practical reasons (these plots were too long, hampering the effectiveness of both sowing and monitoring). Plantations were carried out in the remaining available area, using the species *Fraxinus angustifolia*, *Prunus spinosa* and *Quercus pyrenaica*. These three species were more than enough, since both the micro-reserves and the surrounding area already showed a wide diversity of trees and shrub species, and also because there is a need to maintain clearings that enhance the habitat for butterflies. Plantations were complemented with *Ulex australis* subsp. *welwitschianus*, *Asparagus aphyllus* and *Calicotome villosa* to promote refuge for small mammal species. Additionally,

part of the central area of the micro-reserve A is being maintained under control to promote the regeneration of the natural vegetation, since several species with conservation interest were present here (e.g. *Calicotome villosa*, a species with restricted distribution in Portugal).

During 2019 there was a reinforcement of trees and shrubs plantation, which was executed with help from volunteers, in the framework of Action E.8.

The implementation of the micro-reserves was completed, and the associated progress indicators were achieved or even exceeded: two micro-reserves were installed, and the total area intervened to promote the habitat for target butterfly species is 5.5 ha.

Strawberry tree barriers

The strawberries trees aiming to rise owls flight were planted in the micro-reserve B, in a location where several owl road crossings were documented (see non-technical report of Action A.1). This plantation, besides its primary function, aimed at contributing to the achievement of micro-reserve goals including promotion of autochthonous vegetation and butterflies (e.g. *Charaxes jasius* which larvae fed only of this bush).

It was planned to plant the strawberry trees in the 3rd trimester of 2017, during the autumn, since it was expected that it would be raining by then. Due to the unusual, prolonged period of drought, the plantation was postponed to February 3, 2018, in order to guarantee its successful establishment and growth. This task was executed with help from volunteers, in the framework of Action E.8. By October 2018, in another volunteer action, IP planted more strawberry trees to replace the ones that had died during the unusually dry spring. In November 2019, some more strawberry trees were planted to reinforce the future barrier, along with plantations on the micro-reserves, in the framework of Action E.8.

Extending the project allowed performing additional interventions in the IP2, EN4, EN114 and EN18/IP2 verges (vegetation management and invasive species regular control).

Action C.3 – Development and installation of vertical road traffic signs

Beneficiary responsible:	IP
Foreseen start / end date:	01/10/2015 – 31/03/2017
Actual start / end date:	01/10/2015 – 30/06/2018

The design of amphibian's road sign was completed in 2016. The process of requesting authorization was initiated in September 2016. The new road sign was approved by the National Authority for Road Safety in February 2018. All the road signs were installed on national roads as predicted in June 2018. In Annex C.3_I are the proposed design for the amphibian passage warning signals and their installation on EN4 and N114.

Action C.4 – Mobile Application to promote the collection of mortality data

Beneficiary responsible:	UEVORA
Status:	Concluded
Foreseen start / end date:	01/10/2015 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/10/2015 – 31/05/2021

The development phase of the mobile application to register fauna roadkill events is concluded, as well as the testing phase and the app is available to any user that uses android operating system (version 5.0 Lollipop or greater). A specialized firm was hired to specifically develop the web services. The command lines that link the app to the database are developed allowing the synchronization of the data recorded through the app to update the database. All the information is, therefore, redirected to and collected in the roadkill national database mentioned in Action A.2.

It allows submitting mortality events with corresponding event properties such as species, age, sex, GPS coordinates, and photos. It is possible to view existing events on a map or a list.

As soon as all quality parameters were achieved, the application was made available to the public, for free, in google play. A Press Conference organized by the associated beneficiary IP, was made in the scope of the LIFE LINES App launch in July 30, 2019 (Figure 9). This Press Conference resulted in more than 30 news about the LIFE LINES in national TV, radio, journal papers, websites and social networks.

Since it started operating in July 2019 and until 31 My 2021 the LIFE LINES App has 935 registered users (of which 7.9% are regular users) including 36 institutional users, 20 academics, 10 professionals, 12 environmental NGOs and 40 regular citizens; and a total 1524 valid records, which are 24.6% of new roadkill records added to the NRDb since the App started operating. Record validation time is on average four days. Several users claim that one of the reasons for not using the App is the need to stop and get out of the car to get the roadkill record. For that reason, in the LIFE LINES data platform section (https://lifelines.uevora.pt/index.php/animal-roadkill-registration-platform/?lang=en) it is now possible to report online from home a roadkill location, although with a lower precision and only for easily identifiable specie(Figure 10).

Figure 9 A) Presentation of the LIFE LINES App by António Mira (Coordinator of the Project LIFE LINES) and Graça Garcia (Responsible for the Project in Infraestruturas de Portugal) B) coordinator of the Project being interviewed by a national TV (Photos: Sofia Eufrázio).

The extension of the project allowed the collection of more data of roadkill mortality and involved more citizens in this task.

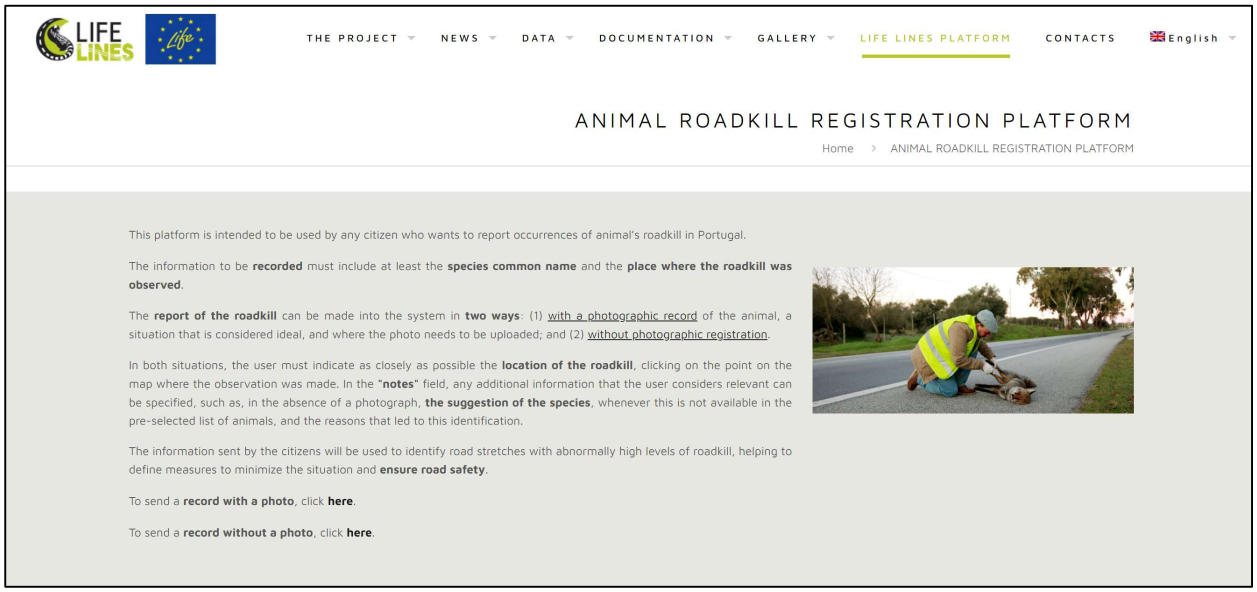

Figure 10 - Print screen of the starting page of LIFE LINES Roadkill Registration platform

Action C.5 – Testing devices for deterring avifauna landing in medium voltage lines

Beneficiary responsible:	QUERCUS
Foreseen start / end date:	01/07/2016 – 31/12/2019 (31/01/2021 – after project amendment)
Actual start / end date:	01/08/2018 – 31/08/2020

Anti-electrocution and anti-collision devices in medium voltage lines

As explained in Action A.6, the implementation of that action, and consequently of Action C.5 was delayed due to Associated Beneficiary (EGSP) withdrawal from the project. Action was set into course only in August 2018. However, the action met further postponement in the first months of 2020, on a first moment due to a delay in the payment of the subcontracted company by QUERCUS which halted pole frame installation in January, and in a second moment due to the Covid-19 restrictions. Other constraints also contributed to small delays in the installation of the structure, namely the power lines are inserted in private proprieties and there is a need to guarantee electric supply for the whole area while the work has been carried out. E-REDES collaborated in contacting with the landowners to discuss the terms for the ECO- HAL A2S structure installation, which solved this problem.

Power lines to intervene were chosen and most ECO- HAL A2S were installed in June and July 2020 with the work being finished at the end of this month. The selection of the power lines to be intervened were mainly based in previous field surveys made by QUERCUS. The power lines in this area are constituted mainly by pennant steel frame for line-up (GAL), where previous studies revealed high rates of collision and electrocution mortality where no other anti-collision or anti-electrocution

devices were present. During the installation E-REDES and QUERCUS technicians regularly monitored the operations in field.

ECO- HAL A2S were installed in 49 poles (pylons) frames along 13km of intervened lines. Action C.5 ended in August 2020.

Since this action objective was to rehearse and evaluate the efficacy of the prototype developed in Action A.6 to reduce the mortality of medium and large birds in medium voltage lines and since these birds have a recognized abundance variation within the year, for the monitoring be effective, it was advisable to have a seasonal sampling (see Technical-Scientific Report of Action D.3 – Annex D.3_I)for further details). Consequently, Action C.5 monitoring needed an extension until May 2021.

Action C.6 – Development, essay and application of biodiverse grasslands to promote biodiversity in linear infrastructures

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/01/2016 – 31/12/2019 (31/12/2020 – after project amendment)
Actual start / end date:	01/09/2015 – 31/12/2020

Action C.6 aimed to develop seed mixtures of wild native species to be sown along the marginal areas of different linear infrastructures, to promote floristic diversity, and consequently favour habitat for target species of butterflies and small mammals. These mixtures were also created to constitute an alternative to the existent commercial mixtures, which usually also include species that are exotic in Portugal. During 2017, UEVORA developed germination protocols for species with conservation interest and respective summary sheets (see Deliverable of Action C.6 accompanying this report – Annex C.6_I).

A set of 1075 flora species registered in the project's intervention area was initially included in a database with information on their bio-ecology, conservation status and potential use in linear infrastructure. Based on this information and on the prospection of flora populations in the project region (Action A.1), seeds from 165 native species were harvested. After collection, the seeds were cleaned, weighed, and used for viability estimation, and later stored in the seed bank of the University of Évora. Of the original pre-selected 165 native species, based on the database information and on the prospection of flora populations in the project region, 50 were selected to be promoted and develop the biodiverse mixtures. These species were submitted to viability and germination tests in a germination chamber to improve their germination success, complemented with equivalent tests in the greenhouse (constructed by December 2017, see Annex C.6_II). *Ex-situ* viability and germination tests (Figure 11) were used to prepare 4 seed mixtures, 2 for application on roads and 2 for application on micro-reserves in decommissioned railways (ecotrails) and powerlines pole bases.

Figure 11– *Ex-situ* plots installed in the experimental field located at Herdade da Mitra (University of Évora).

The mixtures selected in the *ex-situ* tests underwent minor adjustments in their compositions and/or proportions and were firstly sown in 23 *in-situ* plots (10x2 m^2) (**Erro! A origem da referência não foi encontrada.**), within the scope of concrete conservation measures envisaged for Actions C.2, C.7, C.8 and C.10. Plots located at the base of the high voltage power lines poles were installed in the autumn 2017, while all the others were settled in the autumn of 2018. Following the extension of the LIFE LINES project, 21 additional *in-situ* plots (5x2 m^2) were installed along roads in the autumn 2020, to enlarge the demonstration area and reinforce the project results.

The road seed mixture was sown in 10 plots of N114, 12 plots of N4 and 6 plots of N18. The micro-reserves seed mixture was sown in 6 plots of the Évora ecotrail, 7 plots of the Montemor-o-Novo ecotrail, 1 plot on N4 road, and 2 plots at the base of high voltage power lines poles (Figure 12).

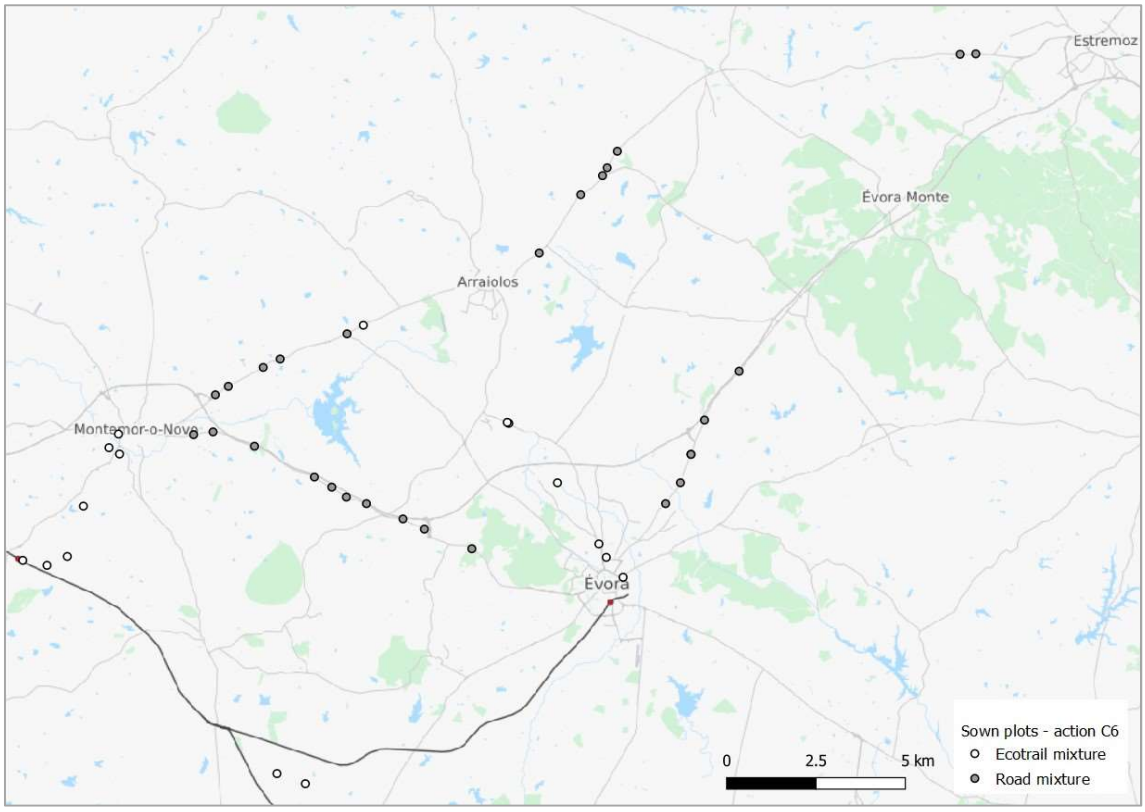

Figure 12 – Map with the location of the 44 *in-situ* plots installed on roads (N4, N18 and N114), ecotrails (Évora and Montemor-o-Novo) and powerlines pole bases.

The two biodiverse seed mixtures consisted of: (1) 19 species for the road mixture, considering road security, species with low height (not impairing visibility), low biomass (small amount of fuel), and early flowering (assuring resilience to cuts under the current vegetation management); and (2) 23 species for the micro-reserves mixture, considering less common species, without known toxicity, and with an extended flowering period that should be attractive for both citizens and target fauna of the project. In all, the mixtures included seeds from a total of 34 wild native species harvested in the study region, some of them endemic or threatened, and considering a base proportion of 30% Fabaceae, 30% Poaceae, and 10% Asteraceae.

Action C.7 – Mitigation measures and potentiation of roads in Évora municipality

Beneficiary responsible:	CME
Foreseen start / end date:	01/04/2016 – 30/06/2018
Actual start / end date:	01/10/2015 – 30/06/2020

Amphibian and owl roadkill mitigation measures in EM529

UEVORA analysed the amphibian and owl roadkill data and adjusted with CME the priority locations of the amphibian tunnels and barriers and owl walls (see A.1 final report).

Road adaptation began on November 2017 with vegetation cleaning and management, verge realignment and execution of foundations for amphibian barriers. Then, work continued with the

installation of specific ACO amphibian tunnels and newly designed (by Municipality engineers) longitudinal barriers to guide them to new tunnels and existing culverts (Figure 13). In total, seven specific ACO tunnels and 666 m of barriers on each side of the road covering 9 passages (two existing culverts plus the seven new ACO tunnels) were installed at two locations (locations are presented in Annex C.7_I). After tunnels and barriers installation, small adjustments (often cement transversal walls) were made in order to correct for uneven ground surface and better guide small animals for safe passages. Complementary work such as resurfacing, verge levelling, fence replacement when removed or damaged during passage and barriers installation and signaling with LIFE placards was also done. Amphibian (and other small fauna) conservation work ended in the final of April 2018

Figure 13 – Installed ACO climate tunnel for amphibians (left) and longitudinal concrete barriers (right).

Barrier to elevate owl flight in EM529 suffered a delay due to difficulties with public tender procedures and provider negotiations, but it was executed by September 2019. The delay in the installation of the barrier was related with the necessity to find a solution, compromising the conservation goals with the robustness to support strong winds and a light weight to not exceed pressure on bridge that will support the structure.

Roadkill moniting in EM529

Roadkill of all wild vertebrates in EM529 was monitored by UEVORA during two years (2011 ans 2012) in the pre-LIFE. In 2020 UEVORA used the same procedures to monitor roadkill and found a reduction of about 19% in the number of animals killed/year.

Micro-reserves in promoting biodiversity in road verges

During March 2017, UEVORA, in collaboration with CME, selected ten micro-reserves in Évora ecotrail, that summed up a total of 2.15 ha, and five reference plots (for the BACI procedure) totalizing 0.52 ha (Figure 14).

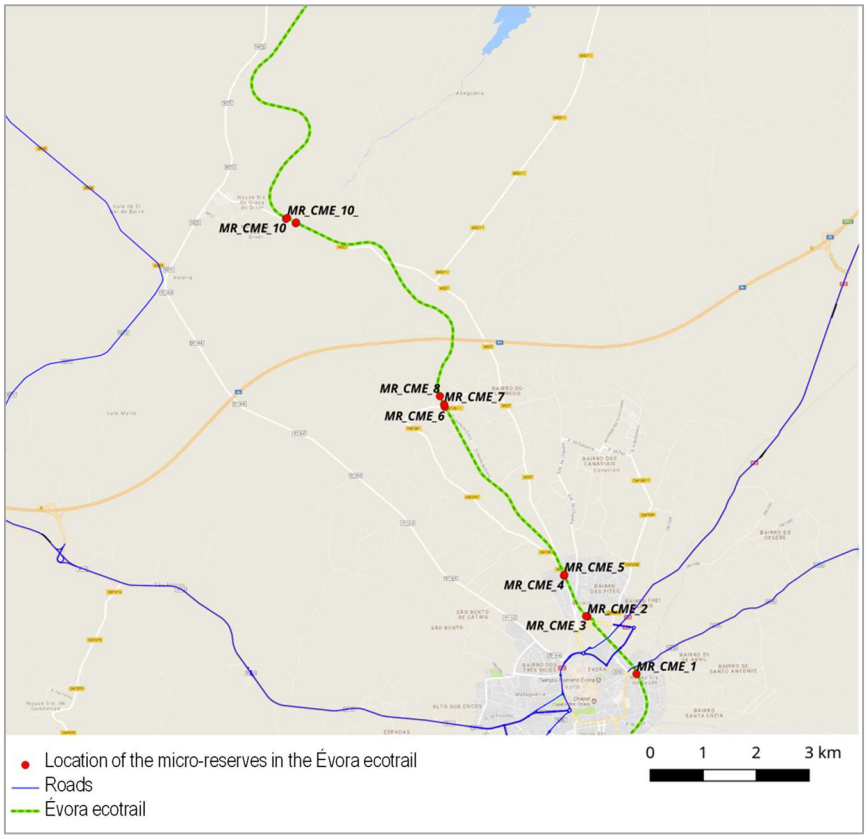

Figure 14 - Location and identification of the 10 microreserves settled along the Évora ecotrail (21 km).

For monitoring purposes, in April 2017, UEVORA performed a detailed cartography of native flora, in the selected Évora ecotrail areas (microreserve and invasive flora control), using surveying quadrats.

As requested by CME, and based on respective initial characterization, UEVORA defined the intervention plans for the Évora ecotrail micro-reserves (Table 5**Erro! A origem da referência não foi encontrada.**) (Annex C.7_II).

Table 5 - Summary of the potentiation measures implemented in each of the 10 micro-reserves settled in the Évora ecotrail.

	Micro-reserves of the Évora ecotrail									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Test of the biodiverse seed mixture (Action C.6)	x	x		x				x	x	x
Promotion of herbaceous species	x							x	x	x
Promotion of shrub and tree species	x	x	x	x	x	x	x	x	x	x
Promotion of flora species with conservation interest	x				x				x	x
Promotion of butterfly species	x		x			x		x	x	x
Promotion of small mammal species										x

The plans were implemented in two phases during 2018. In February, with the support of UEVORA, CME started the plantation of native shrubs and tree species in the micro-reserves, using the most developed plants to promote their establishment as early as possible. In the autumn, plantations were completed, and sowing of native herbaceous species was undertaken in the micro-reserves. The plants used were provided by CME, MARCA and UEVORA. The seeds used were harvested and cleaned by MARCA and UEVORA.

The control of invasive flora species was also carried out inside the area of micro-reserves 2, 3, 5, 6, 7, and 8.

Overall, in the micro-reserves installed along the ecotrail, 30 species of native shrubs and trees were planted, as well as 4 bulbous species (Table 6). Following the first monitoring results (Action D.3), dead plants were replanted in the autumn of 2019 and 2020, whenever they have not succeeded, dried, or been destroyed, therefore ensuring the achievement of the project objectives.

The promotion of native flora in the micro-reserves allowed favouring habitat for small mammals and 6 target, and 1 non-target, butterfly species: *Gonepteryx cleopatra*, *Papilio machaon*, *Vanessa cardui*, *Thymelicus acteon*, *Thymelicus lineola*, and *Zizeeria knysna*.

Table 6 - Summary of the plantations carried out in the 10 micro-reserves settled along the Évora ecotrail

Flora species	Number of planted individuals in the micro-reserves of the Évora ecotrail
Adenocarpus anisochilus Boiss.	7
Arbutus unedo L.	13
Calicotome villosa (Poir.) Link	23
Celtis australis L.	16
Cistus crispus L.	43
Cistus salviifolius L.	3
Crataegus monogyna Jacq.	8
Cynara humilis L.	19
Cytisus arboreus subsp. *baeticus* (Webb) Maire	10
Digitalis thapsi L.	3
Ferula communis L.	4
Fraxinus angustifolia Vahl	5
Gynandriris sisyrinchium (L.) Parl.	20
Hyacinthoides vicentina (Hoffmanns. & Link) Rothm., and *Ornithogalum* spp.	20
Laurus nobilis L.	5
Lonicera spp.	4
Myrtus communis L.	21
Narcissus bulbocodium L.	20
Osyris lanceolata Hochst. & Steud.	11
Phillyrea angustifolia L.	11
Pistacia lentiscus L.	6
Prunus spinosa L.	12
Pyrus bourgaeana Decne.	9
Quercus faginea Lam.	6

Quercus pyrenaica Willd.	13
Rhamnus alaternus L.	17
Rosa sp.	9
Ruta angustifólia Pers.	2
Ruta chalepensis L.	6
Salix atrocinerea Brot.	5
Salvia verbenaca L.	6
Smilax aspera L.	6
Viburnum tinus L.	10
Total plants	373

Control of road vegetation and invasive species

Arundo donax was the only well represented invasive flora species along the Évora ecotrail, thus the control methods were directed towards this species. Three more species were detected, though in small and poorly representative nuclei, difficult to be intervened: i) *Acacia dealbata* and *Acacia* sp. were observed in private properties; ii) *Robinia pseudoacacia* occurred in private properties, or in unstable and inaccessible slopes.

The intervention plan implemented by CME followed the recommendations of UEVORA, based on the available knowledge, and information obtained from technical and scientific literature. Along the Évora ecotrail, several dense and almost monospecific nuclei of *A. donax* were selected, considering 8 control areas (0.66 ha), and 4 reference areas (0.13 ha) (Figure 15 - Map with the location of the areas selected for the control of *Arundo donax* along the Évora ecotrail (21 km).).

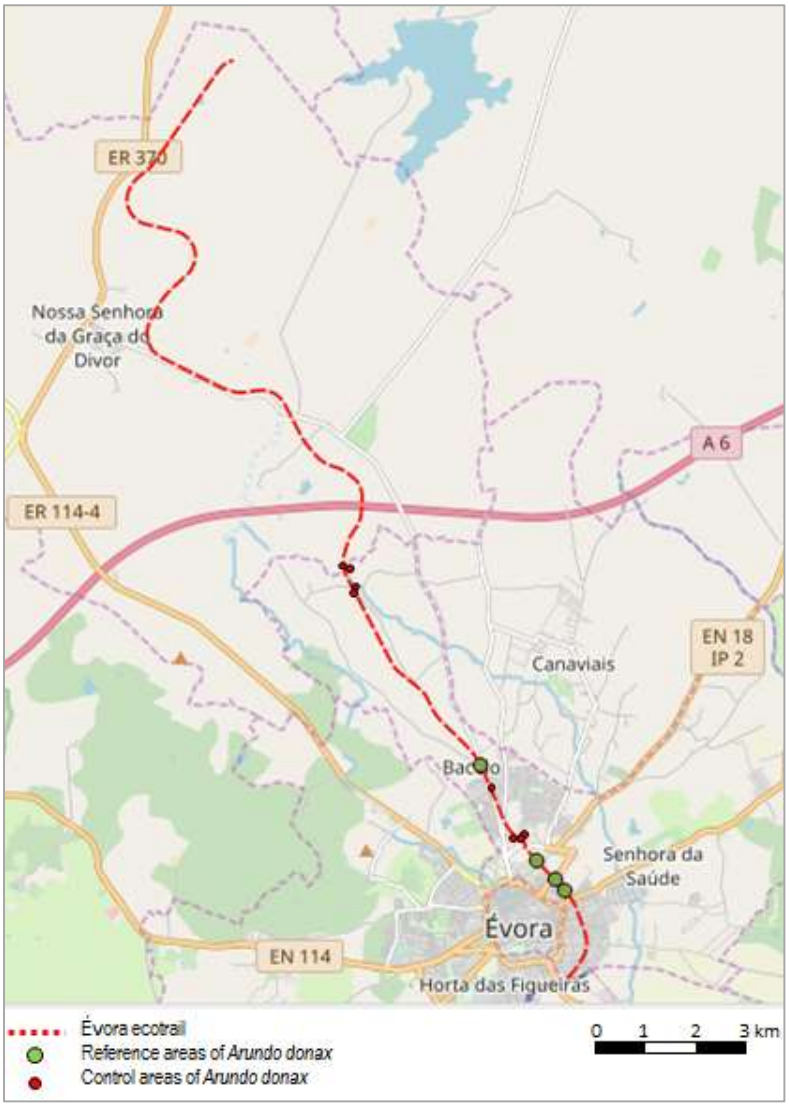

Figure 15 - Map with the location of the areas selected for the control of *Arundo donax* along the Évora ecotrail (21 km).

In the control areas, improved methods of control were used in two consecutive years. In 2017 *A. donax* was manually and mechanically cut, followed by rhizomes extraction using a backhoe, and soil sieving, to ensure that the rhizomes were effectively removed. In 2018 it was intended to reinforce the first intervention with sprouts removal and manual extraction of the remaining rhizomes. However, as the first method is more effective, and the intervened area was still not planted with native species, one more year of improved control methods was carried out. The control areas were then planted with native species. In the reference areas, only the traditional cut method was applied as control.

The foreseen progress indicators of this Action were all achieved or even exceeded, considering previously justified adjustments (Table 7):

- 8 endemic flora species were promoted, some of them only present in the seed mixture developed for the ecotrails - *Adenocarpus anisochilus*, *Anchusa undulata* subsp. *granatensis*, *Digitalis thapsi*, *Ferula communis*, *Hyacinthoides vicentina*, *Pterocephalidium diandrum, Silene scabriflora*, and *Sanguisorba hybrida;*
- habitat for 6 target, and 1 non-target, butterfly species was favoured - *Gonepteryx cleopatra*, *Papilio machaon*, *Vanessa cardui*, *Thymelicus acteon*, *Thymelicus lineola,* and *Zizeeria knysna*;

- habitat for small mammals was also promoted due to bulbous flora species plantation at micro-reserve 10 - *Gynandriris sisyrinchium*, *Hyacinthoides vicentina*, *Narcissus bulbocodium*, and *Ornithogalum* spp.;
- only 1 invasive flora species was controlled - *Arundo donax* as it was the single well represented species along the Évora ecotrail;
- The mitigation and potentiation measures were undertaken along the 21 km of the Évora ecotrail.

Table 7 - Proposed and achieved progress indicators for Action C.7 of the Project LIFE LINES

Action C.7 Progress indicators	Proposed	Achieved
Endemic flora species promoted (number)	6	8
Target butterfly species promoted (number)	4	7
Target small mammal's species promoted (number)	0	2
Invasive flora species controlled (number)	6	1
Ecotrail sections covered by mitigation measures (km)	21	21

Action C.8 – Mitigation measures and potentiation of roads in Montemor-o-Novo municipality

Beneficiary responsible:	CMMN
Foreseen start / end date:	01/08/2015 – 30/06/2018 (30/09/20 – after project amendment)
Actual start / end date:	01/08/2015 – 30/09/2020

Amphibian roadkill mitigation measures (barriers and culverts) in EM535

Different types of materials and designs were used (ACO amphibian tunnels, concrete culverts, concrete barriers, canvas barriers, etc.), as proposed in the original application. In total, 4300 m of newly designed concrete barriers (in cooperation with CME), two ACO tunnels and two new concrete tunnels were installed (Annex C.8_I). Additionally, two concrete dry ledges, for small fauna, not predicted in the initial proposal, were built in a culvert that is often flooded. About 980 meters of canvas barriers were installed at several locations along the road by Autumn 2018 with the help of volunteers in the framework of Action E.10. The delay in this installation was due to the excessive waterlogging of soil associated with the unusually high rainfall in the spring 2018. All those measures were scattered along the entire EM535 road, in locations where roadkill risk for target groups was higher.

Vegetation clear-cutting/mowing on road embankments and verges

Regarding the new practices of vegetation management on verges, the balance between fire ignition risk, roadkill risk for small fauna and role of verges as refuge and/or corridor, was assessed between UEVORA and CMMN teams in order to reach a consensus. Meanwhile, the new legislation reinforcing fire prevention measures (DL10/2018, 14 February) implied consultation of National Conservation Agency (Instituto de Conservação da Natureza e das Florestas - ICNF) and Municipal Committees for

the Defense of Forest against fires (Comissões Municipais de Defesa da Floresta contra Incêncidos) to confirm the possible exceptions for vegetation clearcutting in roads crossing landscapes with low risk of fire spreading, which delayed the implementation of this task. From those talks, UEVORA team in association with the Intermunicipal Community of Alentejo Central (CIMAC) which represents 14 municipalities in the project area and its surroundings, will produce a "Guide for Promotion of Biodiversity in Roadside Areas". Part of the recommendations were previously essayed along about 32 km of road EM535, counting both sides, in the spring of 2019, 2020 and 2021, under the supervision of CMMN and with the support of UEVORA. Those included leaving uncut small patches of verge vegetation where *Microtus cabrerae* colonies (a species included in annexes II and IV of Habitats Directive) were detected; and leaving a thinner strip of tall grass, with at least 60 cm wide, along the verge adjacent to the fence, in areas of lower fire risk (e.g. pastures and open agricultural areas). Moreover, CMMN has been increasingly involving workers that perform road vegetation management, training them for using sustainable practices and raising their awareness for the importance of verges for biodiversity conservation, as well as about the need to control of exotic invasive species. Since 2018, after amphibians barriers have been installed, vegetation along them have been cut by CMMN workers in early autumn and spring to avoid amphibians using it to climb the barriers and reach the road pavement.

Promoting biodiversity micro-reserves in Montemor-o-Novo ecotrail

In collaboration with CMMN, UEVORA selected 10 sites along the Montemor-o-Novo ecotrail to settle micro-reserves for the promotion of native flora species, and several butterflies and small mammal species, with a total area of 1.58 ha (Figure 16).

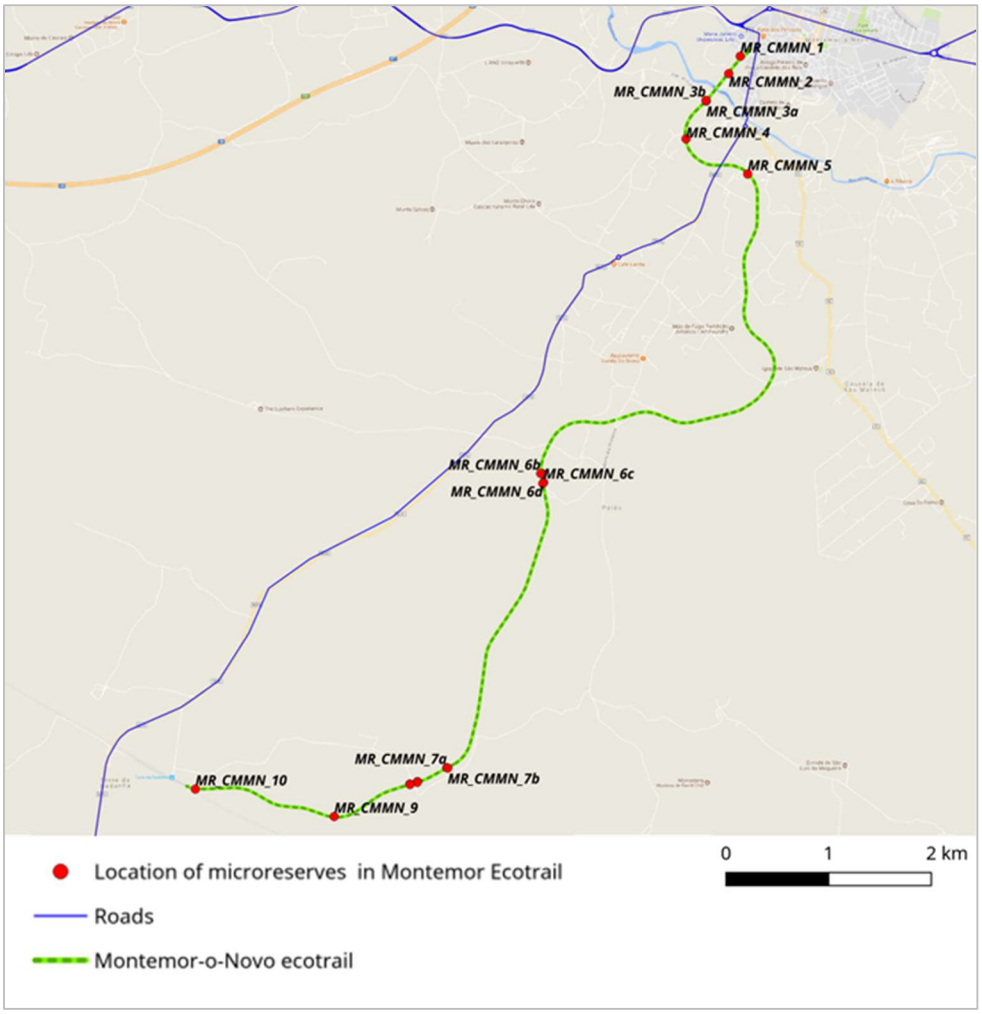

Figure 16 – Map with the location and identification of the 10 micro-reserves settled along the Montemor-o- Novo ecotrail

Based on the initial characterization carried out in Action A.1, UEVORA defined specific intervention plans for each micro-reserve, comprising the delimitation of distinct areas, where native flora species were either sown or planted with different purposes (Table 8):

- Test of the biodiverse seed mixture developed by UEVORA in the scope of Action C.6. This seed mixture was sown in plowed plots of 10 m x 2 m located in 7 micro-reserves (Annex C.8_II). An additional set of 6 plots (0.14 ha), not intervened and located nearby, were used as references for the test;
- Promotion of herbaceous flora species sown in several plots, where the soil was previously plowed. Different species were alternately sown in spots of 1 m^2, covering all the available area of the plot (Annex C.8_II);
- Promotion of shrub and tree species that were evenly distributed and planted in the micro-reserves' area, maintaining a minimum distance of 1.5 m between plants, and without overlapping the sown areas (Annex C.8_II);
- Promotion of native flora species with high conservation interest, using a selection of endemic or restricted distribution species (Annex C.8_II);

- Promotion of target butterfly species by sowing and planting flora species known to be specifically associated with target butterflies;
- Promotion of small mammal species through sowing and plantation of herbaceous bulbous species, and shrub species (Annex C.8_II). These areas provide shelter and may constitute important feeding areas, though the grass meadow areas created for the promotion of butterflies can also contribute to improve small mammals' habitat.

Table 8 - Summary of the potentiation measures implemented in each of the 10 micro-reserves settled in Montemor-o-Novo ecotrail.

	Micro-reserves of the Montemor-o-Novo ecotrail									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Test of the biodiverse seed mixture (Action C.6)	x			x	x	x	x		x	x
Promotion of herbaceous species				x		x	x			
Promotion of shrub and tree species	x	x	x		x	x	x	x	x	x
Promotion of flora species with conservation interest	x	x	x	x	x	x		x	x	
Promotion of butterfly species	x	x	x	x	x	x		x	x	x
Promotion of small mammals' species	x				x	x	x	x		x

The intervention plans were implemented by CMMN, with the support of UEVORA, in the autumn of 2018. In November 2020, CMMN increased vegetation cover through the plantation of new shrubs. Both the production of the plants, and the harvest and cleaning of the seeds used, were ensured by UEVORA and MARCA. The control of invasive flora species was also carried out inside the area of micro-reserves 1, 3 and 10.

Control of invasive plant species

The selection of the invasive plant control plots was finish by CMMN, with the collaboration of UEVORA and MARCA.

Twenty-two patches totalizing 0.84 ha were selected to control the four woody invasive species present in the CMMN ecotrail. This area is smaller than that foreseen in the project (3.2 ha), since not all invasive plots were selected for intervention. In fact, some plots are located on high step slopes, difficult to access. Others extend to private property. Due to available resources and for security reasons, it was decided not to intervene on these places. UEVORA made the baseline characterization of the selected invasive plants plots.

Control of exotics was made, through individual manual removal (mostly for young plants), repeated cutting followed by detailed individual chemical control, perforation and chemical injection inside the trunk and, for *Acacia* sp., individual debarking including, whenever possible, trunk scraping. Some of these techniques were learned in the Seminar "Municipalities and Invasive Plants Management" organized by LIFE Biodiscoveries, in which CMMN has participated.

To control invasive plants, CMMN hired specialized services for vegetation cutting and application of herbicides. Due to legal constrains, those services were performed by different firms. Despite this, all

the work was supervised by CMNN and performed according to the municipality specifications. Field work took place on two different occasions, and methods used were chosen according to plant species and its development stage (Annex C.8_III).

Simultaneously to the work developed by CMMN, and in the framework of Action E.10, MARCA performed additional invasive plant control interventaions in small patches along the ecotrail. With the help of volunteers, it was possible to remove core of reeds at the ecotrail, and planting *Pistacia lentiscus*. Annex C.8_IV provides a photographic record of the works.

The extension of the project was necessary to accomplish the invasive species control in the Montemor-o-Novo ecotrail. At the beginning, due to difficulty in getting local man-power / qualified companies, the control campaign covering around 0.5 ha scheduled in the third progress report for autumn 2019 had to be postponed. This difficulty was finally overcome and task was accomplished.

Action C.9 – Operations in plant nursery to the conservation actions

Beneficiary responsible:	MARCA
Foreseen start / end date:	01/01/2017 – 30/09/2020 (31/12/2020 – after project amendment)
Actual start / end date:	01/01/2017 – 31/05/2021

The nursery is fully operational, and several works are involved in the production and maintenance of plants and space care. All action indicators were achieved or surpassed. The plant nursery was able to provide the foreseen conservation actions project needs and to build stock to sell or to support future conservation activities.

Project implementation allowed to produce, by end of the project, 93 plant species, of which at least 80% of these species belong to project area natural habitats. By the end of the project, the plant nursery had in stock 13 210 plants of 93 species (Annex C.9_I).

About 75% of the produced plants came from plant's populations within project area. In total 224 seed collection activities were made (Annex C._II). Only when necessary, the seeds were purchased.

Along the project plant nursery protocols were developed in order to ensure:

- Bi-annual stock evaluation
- Germination / propagation success
- Identification of seed collection and mother-plants sites
- Propagation methods
- Monitoring of plant propagation
- Optimization of plant watering
- Optimal Phyto sanitarian plant production conditions
- Health and safety of plant nursery operation

Along action implementation there was the need, particularly in the last 3 years of the project, to reinforce human resources allocated to implement project action.

These first years of plant nursery operation, within LIFE LINES context, were crucial to develop a sustainable operation, being one of the key aspects the production capacity of the infrastructure. It was necessary to enlarge the shadow and acclimatization areas, supported by watering system, from

what was previously predicted. It also allowed disseminating this infrastructure to several stakeholders, which already are or can be potential clients.

Action C9 was extended until the end of the project so it could continue to fulfill project needs (plants, seeds, data, etc), and prepare plant nursery for post-project after-LIFE operation.

Action C.10 – Promotion of "islands" of Biodiversity along power lines

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/01/2017 – 31/12/2018
Actual start / end date:	01/01/2017 – 31/12/2018

Action C.10 aimed to enhance landscape connectivity, by creating demonstration plots (micro-reserves) in the base of sequential power lines poles, where native flora species were promoted, providing also habitat for target small mammals and butterfly species, thus constituting stepping-stones for fauna.

A first group of 5 sequential high voltage power lines poles were selected to be intervened. constituting stepping-stones for fauna, namely small mammals and butterflies – poles 165, 166, 167, 168, and 169 (Figure 17 - General (a) and detailed (c, d) maps with the location of the selected very high voltage power lines poles. The number of the poles are shown to facilitate the identification. Colour codes distinguish different types of intervention carried out in the plots (micro-reserves), in the base of each pole.). The selection procedure followed two main criteria:

- Poles located in private properties whose landowners were included in a list provided by the National Energetic Networks (REN), and agreed with interventions in the poles bases;
- Poles located in an area with poor vegetation cover, but whose sequential location could provide connection between two Mediterranean forest patches, and other suitable wildlife areas.

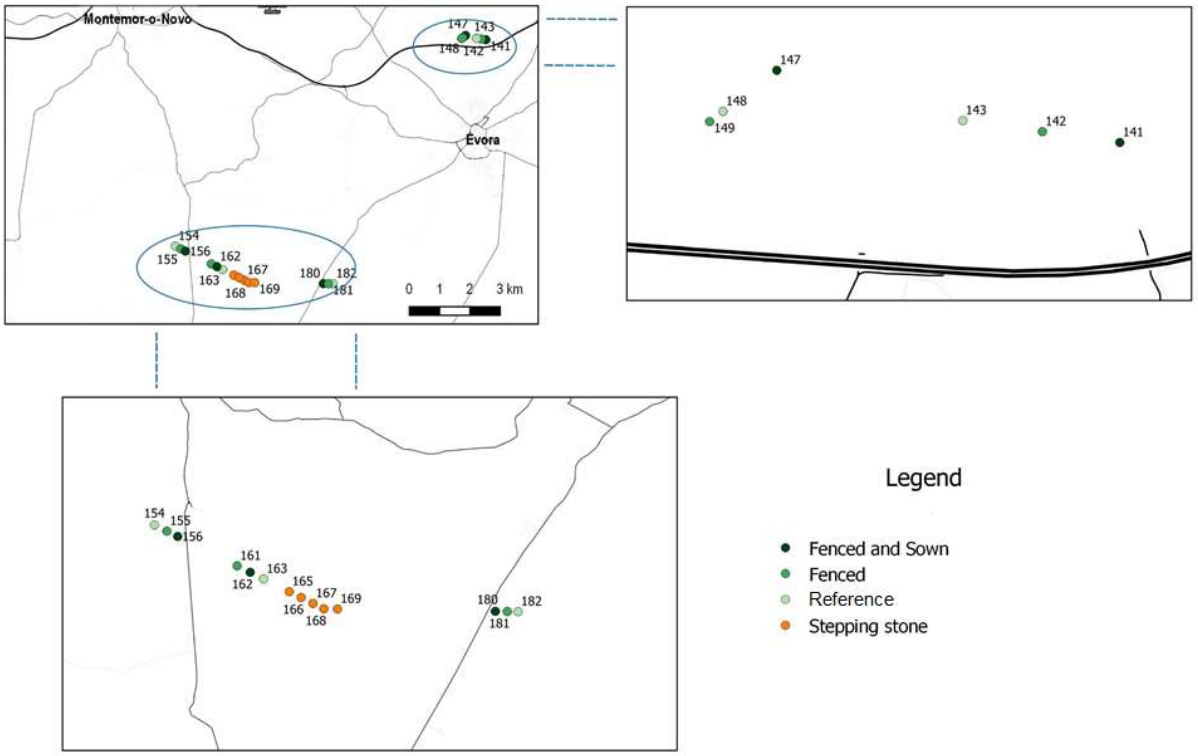

Figure 17 - General (a) and detailed (c, d) maps with the location of the selected very high voltage power lines poles. The number of the poles are shown to facilitate the identification. Colour codes distinguish different types of intervention carried out in the plots (micro-reserves), in the base of each pole.

Additionally, with the agreement of the REN biodiversity chair holder, 15 more high voltage power lines poles were selected not sequentially, in order to evaluate whether the seed bank already present in the soil of the stepping-stones plots would regenerate by itself without being subjected to any intervention, or if it would be advantageous to implement active measures for plant recovery (Figure 18). Despite its complementary approach, this essay will also contribute to promoting native flora species, while providing habitat for small mammals and butterflies, in accordance with the overall objectives of Action C.10.

Micro-reserves under sequential high voltage power lines poles (stepping-stones)

The 5 sequential plots were subjected to distinct types of interventions, including fencing to prevent livestock grazing, sowing and planting of native herbaceous species and shrubs (namely using the biodiverse seed mixture developed in the scope of Action C.6), and the construction of a pond. Each plot covered an area of 48 m^2, centered at the base of the poles.

The base of poles was fenced to prevent livestock grazing (mainly cattle). In order to maximize the diversity of habitats and the promotion of different species of fauna and flora, these plots were subjected to distinct types of intervention:

- The base of the power lines poles 165, 166, 168 and 169 were plowed, and then sowed with herbaceous species and planted with shrubs (Figure 19) ;
- In the base of the power line pole 167 the intervention included the construction of a central pond, sowing herbaceous species and planting shrubs in the pond's edge and surrounding area (**Erro! A origem da referência não foi encontrada.**).

Figure 18 - Photos of the plots settled in the base of powerlines poles 165, 166, 168, and 169, demonstrating the several steps of the interventions: fencing (a), tillage (b), sowing (c), and after sowing (d).

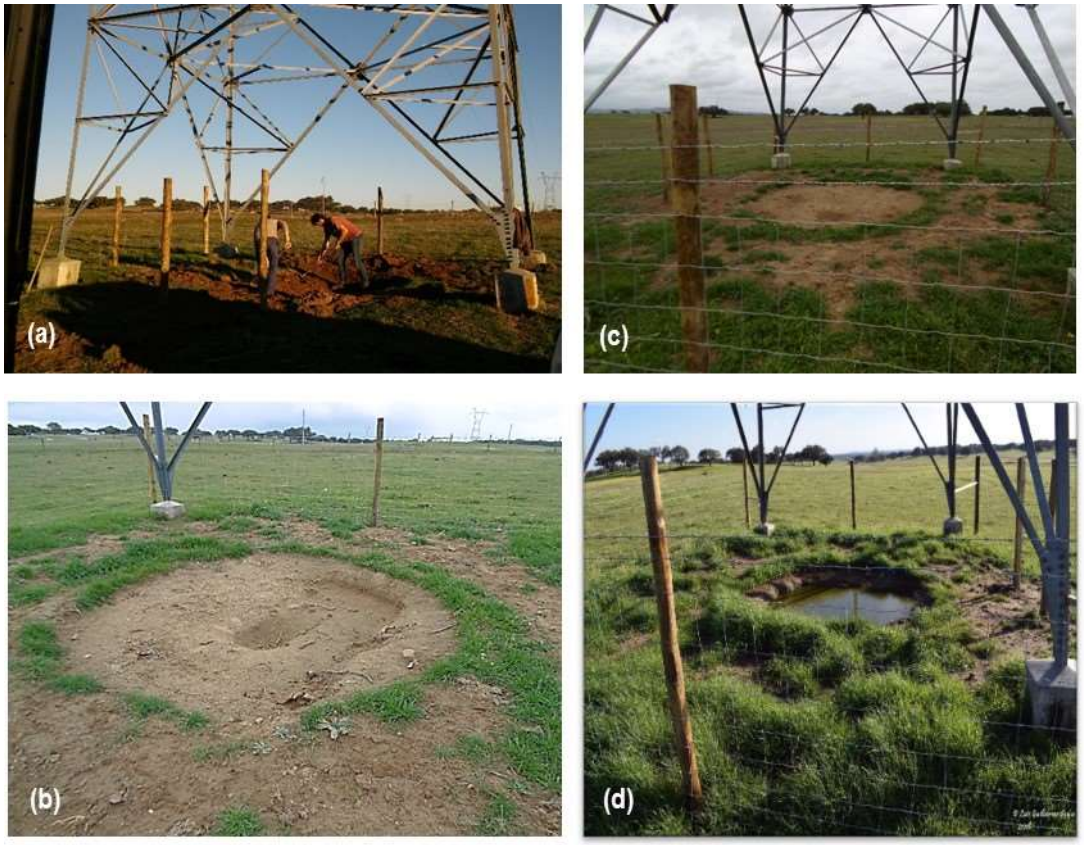

Figure 19 - Photos of the plot settled in the base of the power line pole 167, demonstrating the construction of a central pond (a), and the evolution of the sown and planted vegetation around the pond, along with the water filling progress (b, c, d).

Nevertheless, a second group of 15 non-sequential poles, not foreseen in the application, were additionally selected, to evaluate the most advantageous interventions for plant recovery in the plots. 10 of these plots were intervened, whereas the other 5 were used as references. The interventions took place in December 2017, but adjustments to the initial intervention plan and replanting of dried shrubs were performed in the autumn of 2018.

Micro-reserves under additional high voltage power lines poles

The 15 additional power lines poles were spatially distributed in 5 groups of 3 poles, and located in areas with different land cover, including open areas (3 groups; N=9), and cork and holm oaks (2 groups; N=6). Each group of 3 poles included one pole base without any intervention (reference), one pole base fenced (to prevent livestock grazing), and one pole base fenced and intervened through sown (Figure 20):

- Not intervened poles (reference) - 143, 148, 154, 16,3 and 182;
- Fenced poles - 142, 149, 156, 161, and 181;
- Fenced and sown poles - 141, 147, 155, 162, and 180.

Figure 20,- Photos of a group of 3 plots in the base of the additional high power lines poles, each one subjected to different interventions: 1 plot without any intervention – reference (a); 1 fenced plot - to prevent livestock grazing (b); 1 fenced and sown plot (c).

For the 10 intervened additional plots (excluding then five that acted as control), a biodiverse seed mixture was specifically developed, including both herbaceous and shrubs species. This mixture was sown directly, and through seed balls, a technique tested in this Action. Both the use of a seed mixture with herbaceous and shrub species, and the seed balls, have an immediate practical advantage, since they facilitate the sowing procedure, and hence the applicability of the measures and their possible replication.

Overall, the measures implemented in Action C.10 promoted a total of 18 flora and fauna species with conservation interest.

The progress indicators foreseen in the proposal of the Project LIFE LINES for Action C.10 were all achieved, and largely exceeded: 5 demonstration plots constituting biodiversity "islands" were settled, to which 15 more plots were added (10 of which were intervened, and 5 references not intervened), also contributing to this Action's objectives; a total area of 720 m^2 was intervened; a total of 420 m of fence was installed in the plots.

Further details about interventions on powerlines poles are shown in annex C.10_I.

An assessment of the results of this action concerning the achievement of project aims and targets can be found in Technical report of Action D.2 and Technical and Scientific report of Action D.3.

D. Monitoring of the impact of the project actions

Action D.1 – Monitoring / evaluation of socio-economic effects of the project

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/08/2015 – 31/05/2021

The evaluation of socio-economic effects of the project conducted in this Action results from the discussions that took place on CTAG meetings during the first quarter of 2017. The list includes 17 socio-economic feasible indicators reflecting the direct and indirect socio-economic impact of the

project in the region (action deliverable - Annex D.1_I). Initially, a regular update every three months was scheduled up to 15 updates. However, as most of the hiring, expenditure and travel allocations took place in the first half of the project only eleven further updates of the socio-economic indicators were carried out in a total of twelve. These last updates have already accounted for the cumulative values since the beginning of the project. There are items related to the improvement of infrastructures, local businesses dynamics and creation of employment (economic) and others related to training (capacity building), synergies and leverage (social). Detailed information about the socio-economic monitoring/assessment is shown in the Non-Technical Report of Action D.1. (Action deliverable - Annex D.1_II). Here we present the most relevant points, as follows:

The LIFE LINES Project has its intervention area in Central Alentejo, a region of Portugal characterised by having an ageing population, a high illiteracy rate (compared to the rest of the country), and few job opportunities, in addition to a decreasing number of inhabitants and a low birth rate. There is an urgent need to reverse these negative demographic, social, economic, and educational trends and LIFE projects should also have a role in this.

Within the scope of this project, indicators were assessed considering five pillars rated as being key to evaluate project socio-economic outcomes by the associated beneficiaries: economic, networking, training, volunteering, and awareness and involvement.

In the economic sector, we highlight the investment made in the project area, in which 748 256.49 € were spent in 181 companies. Additionally, 27 direct jobs were created by the project. This investment contributed to the dynamization of the local economy in a rather impoverished region and with a low proportion of active people in relation to the elderly population.

Regarding volunteering, through volunteer work, we involved 3926 people and 62 entities, with the participation of local and non-local agents, including foreign people that wanted to actively intervene in the project's tasks.

A major positive impact of the project on society was achieved through project awareness and training actions. Those included, among others, workshops and field visits targeting specific and general audiences, and direct work with local schools. The project team carried out a total of 327 initiatives to raise awareness and involve young people and the general population. Awakening curiosity and the importance that the conservation of biodiversity and ecosystems have for society was our main goal, alerting particularly to threats associated with linear infrastructure networks

Cooperation and involvement with different types of institution was intense, including official partnerships with GNR, REN and EDP (now, E-energia) and informal collaboration with at least 17 other institutions, counting NGOs, all stages of school and academic pre and postgraduate levels, conservation agencies, vegetation management workers, etc. Fifteen Academic works of all levels (Bachelors, Masters and PhDs) were done entirely or partially withy the support of LIFE LINES project and at least four will be finished in the immediate after LIFE period.

Action D.2 – Evaluation of effects of the project on ecosystem functions

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/06/2018 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/06/2018 – 31/05/2021

Action D.2 started in mid of 2018 with a compilation of information concerning ecosystem functions and services in the context of project actions. We started by clarifying what are ecosystem functions and their similarities and dissimilarities with ecosystem services. Most of the time they are synonymous. However, some authors claim that they are different as ecosystem functions don't necessarily contribute to people well-being. For that reason, we opted to name functions and services jointly as "Ecosystem Functions/Services" (EF/S)

We assessed project effects on nine (EF/S), based on project main goals and on outputs of conservation and awareness actions executed.

The contribution for each EF/S was inferred indirectly through the effects of the project on three main drivers, hereafter called indicators, of RF/S: (1) ecological connectivity, (2) biodiversity and (3) people awareness, all of which were globally improved through project interventions. The impact on each EF/S was scored as small, moderate, or high. Positive moderate/high Impacts were mostly associated with improvements in ecological connectivity and people awareness. EF/S relying on biodiversity alone were scored as positive, but most of the time were small. This is because, despite overall biodiversity assessed across the entire study area and locally at intervention sites have been enhanced, for some fauna groups (e.g. carnivores, amphibians) we had equivocal results, probably related with different weather conditions on years being compared. Facing those results, we opted to use a precautionary approach. Thus, it's possible that at least a few EF/S may have a higher positive score than the one we attributed to them. However, we simply cannot securely infer it through the project monitoring data. The nine EF/S assessed, and their enhancement score are shown in

Table 9.

We also assessed the impact of LIFE LINES project for the United Nations "Sustainable Development Goals" (SDSs). The major contribution is for "Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss" supporting mostly targets 15.1 (conservations, restorations and sustainable use od ecosystems); 15.5 (reduce de degradation of natural habitat and loss of biodiversity); 15.9 (reduce the impact of invasive alien species); and 15.9 (integrate ecosystem and biodiversity values into planning). Nevertheless, a small direct or indirect contribution for at least other 10 SDSs must be accounted for.

Table 9- Ecosystem functions/services enhanced through LIFE LINES interventions and level of improvement. (+) small; (++) moderate; (+++) high

	Ecosystem Functions/Services	Main project contributions	Level of Contribution
	Seed dispersal	Local connectivity was increased for important species dispersers (Stone marten, Badger and Genet)	++
	Pollination	Increase overall abundance and diversity of butterflies and facilitation of their movement through the landscape	++
	Biological control	Higher ecological connectivity for amphibians; higher overall abundance of amphibians and birds; lower mortality of amphibians, birds an bats	+
	Security Road safety	Decrease of Vehicle collisions with large mammals: with Wild boar and Red fox	+
	Habitat for species	Creation of new habitat patches; increase in the suitability of habitat; control of invasive plants; management of verge vegetation in a better and more conservation-friendly way	+++
	Maintenance of genetic diversity	Specific and overall increase in ecological connectivity	++
	Outdoor Recreation and Tourism	Enhancement of biodiversity including flagship groups that are easily seen and are particularly appreciated by people	+
	Learning and inspiration for culture and science	Invasive plant control and promotion of autochthonous fauna and flora provide more pleasant landscapes; many solutions tested need further development which is an opportunity for learning g and inspiring science	++
	Spiritual experience and sense of place	Many LL actions contribute to better-preserved landscapes and global biodiversity enhancement providing through his way better spiritual experiences and sense of place	++

Most project conservation (C) and awareness (E) actions contribute in some way to EF/S and SDSs, among which we highlight C1, C2, C7, C8, C10, E8 and E10.

Detailed information about the EF/S monitoring/assessment is shown in the Technical Report of Action D.2 (Action deliverable - Annex D.2_I).

Additionally, we conducted surveys of local people and visitors using the target infrastructure for recreational purposes to assess changes in perceptions about the local fauna and flora values, as well as on existing threats due to the presence of invasive flora invasive flora (see Technical Report of Action D.2 - Annex D.2_I). People show high awareness and attributed high importance for nature conservation in general and for the LIFE LINES goals and actions.

Action D.3 – Monitoring / evaluation of the effects / impacts of conservation measures

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/07/2016 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/07/2016 – 31/05/2021

This action started on the predicted date. However, because the closing of the works of several conservation actions due to Covid-19 restrictions the finishing date was delayed. Thus, the monitoring also to started later than expected for some tasks. This may have affected some monitoring results because often animals need time to adapt for the presence of new structures on their territory; and also because Interannual variations in weather conditions may have a strong influence in fauna activity and detetction and on plant development. Nevertheless, in many cases, these delays and circumstances have not hindered the evaluation of the implemented actions.

Monitoring of the actions involved the following tasks:

- Daily roadkill monitoring (all year) on EN4, EN114 and EN18 from August 2015 to September 2019 (with a 6-month hiatus in 2017 to assist actions implementation) [UEVORA: C.1, C.2, C.3, C.7, C.8];
- Additional roadkill monitoring extended from September 2019 to October 2021 to complete monitoring for delayed actions [UEVORA: C.1, C.7];
- Roadkill monitoring (all year) of IP2 during the period of the project [IP: C.1];
- Daily monitoring of dry ledge use and fence installation in culverts with camera trapping, from April 2016 to May 2019 [UEVORA: C.1].
- Specific road mortality surveys for amphibians in EM535 and M529 under adequate conditions for amphibian activity between 2016 and 2020 [UEVORA: C.7, C.8];
- Monitoring of the use of culverts by amphibians in EM535 and M529 between 2016 and 2020 [UEVORA: C.7, C.8];
- Monitoring of the use of a culvert in the EM529 road using a custom made automated monitoring system with high-frequency time-lapse infrared image recording between January 2017 and May 2017 [UEVORA: C.7];
- Monitoring of small mammals' abundance through capture-recapture techniques and transects for cues in road verges of M535 subjected to cutting in winter of 2017, 2019 and 2020 [UEVORA: C.8];
- Capture of small mammals using Sherman traps in road verges near dissuasion devices for rodents, between February 2020 to April 2020 [FCUP: C.1];
- Monitoring of owls' sightings and vocalizations near dissuasion devices for owls [FCUP: C.1];
- Monitoring of medium and large bird species perching behaviour near deterring devices for medium voltage powerlines between February and May 2020 [FCUP: C.5];
- Mortality surveys through transects under power line sections to evaluate anti-electrocution and anti-collision structure in medium voltage lines from August 2020 until the end of the project [QUERCUS: C.5];
- Assessment of plant species abundance based on their representativeness along linear transects for: (1) invasive alien species (population structure and vigour), (2) recovery of native plants community, in 146 plots between 2018 and 2021 [UEVORA: C.2, C.7, C.8];

- Evaluation of the performance and sustainability of the *ex-situ* plots biodiverse herbaceous seed mixtures through assessment of species frequency, abundance, and biomass production [UEVORA: C.6];
- Evaluation of the performance of the seed mixtures *in-situ* through the assessment of species germination (%), community composition, percentage cover (%), and height (cm), based on floristic inventories during the spring of 2019 and 2020 [UEVORA: C.6];
- Assessment of germination success (%), and vegetation cover (%) of sown herbaceous species, based on floristic inventories in micro-reserves in spring 2019 and 2020 [UEVORA: C.2, C.7, C.8, C.10];
- Prospection of small mammals through transects to identify signs of the presence in road and ecotrails micro-reserves during spring and summer of 2017 to 2020 [UEVORA: C.2, C.7, C.8];
- Monitoring of small mammals' abundance through capture-recapture techniques in power lines micro-reserves in spring of 2017, 2019 and 2020 [UEVORA: C.10];
- Prospection of butterflies along linear transects, using an entomological sleeve, in road, ecotrails and power lines micro-reserves during spring and summer of 2017 to 2020 [UEVORA: C.2, C.7, C.8, C.10];
- Monitoring of carnivores use of power lines micro-reserves using a camera trapping technique in May 2017 and 2019 [UEVORA: C.10];
- Monitoring of Genet movements in the vicinity of culverts with dry ledges and/or new fences with GPS tracking [UEVORA: D.3];
- Monitoring of Tawny owl movements in the vicinity of the N4 road with GPS tracking [UEVORA: D.3];
- Monitoring amphibians' abundance in ponds over the intervention area between 2016-2017 and 2019 [UEVORA: D.3];
- Monitoring passerines abundance using point counts over the intervention area in the spring of 2016 and 2020 [UEVORA: D.3];
- Monitoring tawny owl territories through playback induced response in point counts over the intervention area in spring 2016 and 2019[UEVORA: D.3];
- Monitoring of carnivores, lagomorphs and wild boar abundance through transects for the identification of signs and cues over the intervention area in 2015 and 2016, and after implementation in 2019 [UEVORA: D.3].

The following results stood out:

- Solutions to mitigate road mortality and barrier effects: solutions based on impeding movement and access to roads to reduce mortality were generally effective for carnivores (L-shape fence), rabbits (wire mesh), birds (barriers to elevate flight), and amphibians (concrete and canvas barriers). Interventions aiming to improve connectivity benefited movement between roadsides, but showed little effect in reducing roadkill, namely for carnivores (dry ledge). Deterring solutions were mostly ineffective or with low impact mitigating road mortality for owls (Swareflex reflectors, dissuasion device), and amphibians (road sign). For rodents, dissuasion device seems promising but needs further testing;
- Solutions to mitigate collision and electrocution in powerlines: the new pole frame (ECO-HAL A2S) developed for medium voltage power lines was highly effective in reducing electrocution and also contributed to reduce collision. Deterring devices for birds showed limited capacity despite punctually contributing to flush birds from perching.

- Solutions to promote biodiversity in linear infrastructures: invasive alien species (IAS) control revealed challenging but have contributed to lower the occupancy of IAS in road verges and ecotrails, benefiting the recovery of native species. Seed-mixtures largely contributed for the indicators of the floristic community increasing local biodiversity either in road verges, ecotrails or poles of powerlines. The creation of micro-reserves through germination and plantation of native plants also contributed for the promotion for animal communities such as small mammals and butterflies.
- Solutions for monitoring and reporting data: the creation of the National Roadkill database stands as one of the most successful reporting tools, gathering 121 531 records in a common effort linking academy, road agencies and concessionaries, and traffic and environmental police. The LIFE LINES App, though retrieving a number of records below expectations, was well-received and contributed with ~25% of the data during the time of operation until the end of the project.
- Global impacts of the interventions: overall the project contributed to a decrease in mortality either in powerlines or roads. Birds and bats had significant decreases in road mortality, while amphibians and owls show non-significant decreasing trends. Connectivity has increased for most species, especially in intervened areas near roads. Overall biodiversity indicators show reductions of 36% for invasive plant species in the area, 14 of the top 20 most roakilled bird species presented an increase in overall abundance, as well as the two most roadkilled mammals.

All monitoring results are thoroughly detailed in the Technical-Scientific Report of Action D.3 (Action deliverable - Annex D.3_I).

E. Public awareness and dissemination of results

Action E.1 – Communication Plan- Project website

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/07/2016 – 31/07/2020 (31/05/2021 – after project extension)
Actual start / end date:	01/07/2016 – 31/05/2021

A preliminary version of the website was online in October 2015 (https://mapserver.uevora.pt/lifelines, a page that is now disabled), and a first small update of this page was made in December 2015, as predicted in the proposal. A larger update of the website, with a different internet address and web design and a new concept integrating the new graphic image of the project was online in February 2016 (https://lifelines.uevora.pt/?lang=en) in both English and Portuguese languages. The new page also includes a link to the LIFE LINES Facebook account. Since then, adaptations to the page design and structure have been made considering the feedback of people visiting the page, and the content has been updated was done whenever new information and outputs were produced which happened more frequently than the trimestral basis initially predicted. Overall, the LIFE LINES webpage has been updated 268 times during the period of execution of the project. The page views accounted 78 743 from 13 804 registered users, having an average number of 223 users / month. The visits were from 112 different countries, with the five top countries being Portugal, the United States, Brazil, Spain and Ireland. The site has been used to disseminate to the general public the project actions and outputs and also to provide awareness on the impacts of linear

infrastructures on biodiversity, ecological connectivity, Green Infrastructure, etc. This was done through small texts and reports, teasers and other videos, scientific meeting proceedings, interactive RNDb, best practice guides, etc. that were created in the framework of the project. The website includes a news section (https://lifelines.uevora.pt/index.php/news/?lang=en) to disseminate the most important events and activities of the project including invitations to attend workshops and participation in the different initiatives (e.g. LIFE and Biodiversity and Ecology Days) or announcing of other important events such as the publication of the Best Practice Guidelines. The team also created specialized sections to disseminate the outputs of specific events such as the Workshops (https://lifelines.uevora.pt/index.php/gallery/project-videos/workshops-2/?lang=en) and the LIFE LINES Final Seminar (https://lifelines.uevora.pt/index.php/life-lines-final-seminar/?lang=en).

A Facebook account was created in February 2016 to increase the promotion and dissemination of the project by reaching a larger audience. As referred before, a link to the LIFE LINES Facebook account was also included in the web page so the visitors could see the update of the Facebook simultaneous in the site. The number of followers of the account reached a total of 2451, and in the last years the number have been increasing. During this period, the account had two main moments of increasing followers and views probably related to the launch of the App LIFE LINES, July 2019, and the online activities promoted by the project about European Natura Day, May 2020.

Action E.2 – Communication Plan - Outdoors in the intervention areas

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/10/2015 – 31/07/2020 (31/05/2021 – after project extension)
Actual start / end date:	01/10/2015 – 31/05/2021

During the execution of the project, 64 medium size outdoors were installed in the intervention area (Table 10; Figure 21) and 13 were replaced due to vandalism. In addition, a large outdoor was installed within Action C.1 interventions (Figure 22).

Table 10 - Action identification, content, and number of each medium size outdoor.

Action	Content	Number
A.4 (3)	Deterrent prototype to avoid avifauna landing in medium voltage lines	1
	Deterrent ultrasound prototype to drive owls away from road verges	1
	Deterrent ultrasound prototype to drive small mammals away from road verges	1
C.1 (27)	Barriers to elevate the owl's flight on N114	3
	Deterring mesh for rabbits	4
	Fauna passages in culverts	5
	Fences with additional L-shaped mesh	4
	Implementation and rectification of fences near culverts	5
	Road barrier effect and passages for small fauna	3
	Swareflex wildlife warning reflector	3
C.2 (13)	Implementation of a strawberry tree barrier to elevate owl's flight	2
	Implementation of micro-reserves along the roads	4
	Invasive flora control	4

	Seeding in patches along the roads	3
C.3 (2)	Amphibian's road sign	2
C.5 (3)	Prototypes for deterring avifauna in medium voltage lines (ECO- HAL A2S)	3
C.6 (2)	Biodiverse mixtures	1
	Rehabilitation of Greenhouse	1
C.7 (5)	Barriers to elevate the owl's flight on EM529	1
	Évora ecotrail micro-reserves	2
	Road barrier effect and passages for small fauna	2
C.8 (6)	Montemor-o-Novo ecotrail micro-reserves	3
	Road barrier effect and passages for small fauna	3
C.9 (1)	Plant nursery	1
C.10 (1)	Promotion of "islands" of biodiversity	1
E.10 (1)	NIA - Environmental Interpretation Centre	1

Figure 21 - Project outdoor installed in the Montemor-o-Novo ecotrail.

Figure 22 - Large outdoor associated with flight elevating wall installed in the framework of Action C.1.

The design and contents of the outdoors were developed by the members of CTAG and maintained a common image template across all project beneficiaries (Annex E.2_I).

Action E.3 – Communication Plan – Public disclosure sessions and contacts with the media

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/2021 – after project extension)
Actual start / end date:	01/08/2015 – 31/05/2021

A Communication Plan produced with the help of a professional Communication Agency was produced and approved by CTAG in November 18, 2016. It includes a communication strategy and standard graphic guidelines aiming a better and uniform image for LIFE LINES promotion and dissemination. At the same meeting, a LIFE LINES Communication Committee (integrating the project manager and specialized communication technicians from IP and UA) has been approved. The Communication Plan stresses the communication strategy, namely at the public relations and press office level, in order to ensure the better dissemination of project outcomes. This plan acted as a guide for project communication, providing all partners with standard messages and key materials that guide LIFE LINES communication. It was updated whenever necessary. The the last update was caried out in February 2021 (Annex E.3_I).

Although the project team always applied the effort to achieve the indicators as initially predicted, we recognize that some indicators, mainly the number of press releases and conferences, may have been overestimated in the initial proposal. As so, although we achieved one press conference and six press releases related to the Seminars and the LIFE LINES App launch (annex E.3_II), we replaced this

indicator by written news in the LIFE LINES website and news in other media. The project has produced 727 news, including 15 in national TV, 175 in journals, 145 in communication websites, 308 Facebook posts, six radio interviews, and 72 radio online news (Table 11) (Annexes E.3_III and E.3_IV). Additionally, 72 radio spots ("LIFE LINES em FM") have been produced and transmitted (for more information see Action E.4).

Table 11 - Number of LIFE LINES news by type of media.

Type	Detail	Number	Total
TV	National TV	15	15
Printed journals	Printed journals	16	16
Online journals	Websites press	159	159
Communication websites	Institutional Websites &newsletters	59	155
	News by LIFE LINES (website)	96	
Facebook	Posts in LIFE LINES Facebook	250	308
	Posts in other Facebook accounts with reference to the project	58	
Radio	Radio (interviews)	6	6
Radio online	Radio Online	78	78
Radio spots*	Radio spots ("LIFE LINES em FM")	72	72
		Total	737

** - The Radio spots ("LIFE LINES em FM") were not accounted in the total news.*

From the outputs that have been produced we highlight:

- a piece in a private TV channel (TVI) regarding roadkill and the project LIFE LINES (2016);
- two participations in the program "Biosfera", a program focused on environmental issues (broadcasted on National Television Network - RTP2 on April 2017 and March 2021);
- two participations on a short radio program of the series "90 segundos de ciência" (90 seconds of science) that was broadcasted on National Radio (Antena 1) in July 2017 and March 2021;
- three participations on the series "Minuto verde" (Green minute) that was broadcasted on National TV (RTP1) (one transmitted in 2017 and two in 2019);
- a piece in National TV (RTP regiões) regarding fauna passages in 2018;
- an interview about the new traffic sign in the program "Reportagem ao Minuto", transmitted by TVI in January 2019;
- several news in the national TV channels and in the national press regarding the launch of the LIFE LINES App in 2019.

In addition, it is important to highlight that between July 2017 and January 2018, three different political parties present in the National Parliament projects aiming to produce legislation to monitor and reduce roadkill at a national level. All the news about this subject refers the LIFE LINES project.

The project team has also participated in the commemoration of several international days as the European Night of Researchers 2019, 2020 and 2021, and the Biodiversity Day 2020, among others.

All public dissemination activities are available in annex E.3_V.

Still, in the frame of this action, four public seminars were organized. The Seminars were entitled "LIFE LINES – Linear Infrastructure Networks with Ecological Solutions" (2016); "25 years of LIFE projects in South of Portugal" (2017); "2nd LIFE LINES Seminar" (2018) and the series of webinars organized by the ICNF, Portuguese Environmental Agency, "Webinar às terças: Impactes e oportunidades das estradas na conservação da biodiversidade" (2021).

The public seminar predict for 2019,was replaced by a "LIFE LINES Open Day" that took place on the 15 of June. During this event, the participants (37) were invited to see *in loco* and learn more about the project and the measures implemented, through a field visit to several intervened sites. In 2020, due to the Covid-19 restrictions, it was not possible to organize a Seminar. The pandemic situation also limited the organization in-person seminars in other municipalities, as Montemor-o-Novo and Arraiolos, as predicted. However, in January 2021 The LIFE LINES final seminar took place as a side event of the online IENE International Conference 2020, fulfilling the five public Seminars predicted initially. LIFE LINES participated in the webinars organized by ICNF, which had 280 participants from all over the country.

Anexx E.3_VI (action deliverable) shows the updated Media Report of the project.

Action E.4 – Communication Plan – Complementary works and materials

Beneficiary responsible:	UA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/08/2015 – 31/05/2021

In the scope of the project, 20 teasers, 20 thematic videos were produced and one documentary, as predicted in the initial proposal. Regarding teasers, a total of 22 minutes were produced, with a mean of 3 minutes and thirty-one seconds each, and 7467 plays on the Vimeo platform (Figure 23). Seventeen teasers were made to disseminate the main actions and moments of the LIFE LINES. One was produced to disseminate the IENE 2020 International Conference and LIFE LINES Final Seminar and two aimed to promote the project final Documentary. The most viewed teaser was the Project presentation, with a total of 2254 plays, 356 regarding the version in Portuguese and 1898 in English.

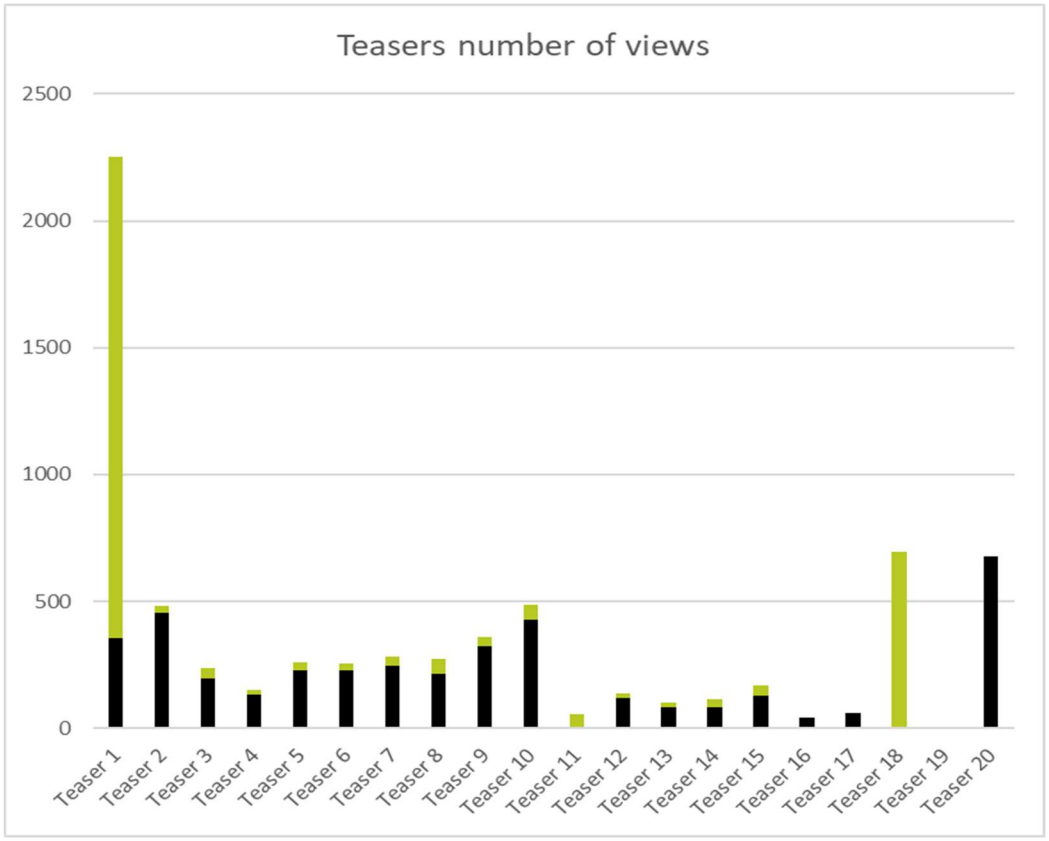

Figure 23 – Number of views of each teaser regarding the versions in Portuguese, represented in black, and English, coloured in green.

The list of the teasers is presented in Table 12 and Annex E.4_I, a deliverale of the project.

Table 12 - List of teasers and respective publication date.

Teaser	Po rtuguese version	English version
Teaser 1 - Project presentation	January 10, 2020	February 11, 2016
Teaser 2 - Green Infrastructure	June 9, 2016	June 27, 2018
Teaser 3 - Volunteering for Nature	January 5, 2017	January 13, 2017
Teaser 4 - Biodiverse Mixtures	May 8, 2017	June 27, 2018
Teaser 5 - A Practical Class in Biodiversity	August 4, 2017	June 27, 2018
Teaser 6 - Remote Detection	August 4, 2018	June 27, 2018
Teaser 7 - Spying to Help Nature - Carnivores	June 12, 2018	July 17, 2018
Teaser 8 - Spying to Help Nature - Owls	June 12, 2018	July 17, 2018
Teaser 9 - Amphibians - Discover to Help	January 17, 2019	January 17, 2019
Teaser 10 - Passages for Amphibians	January 17, 2019	January 17, 2019
Teaser 11 - All about colours – creation of a demonstrative green infrastructure along a grey infrastructure		November 14, 2019
Teaser 12 - Owls Away From Roads	PT -January 6, 2020	January 6, 2020
Teaser 13 - Remember them while Driving	PT -January 6, 2020	January 7, 2020
Teaser 14 - Road Signs and Billboard	PT -January 6, 2021	January 7, 2020
Teaser 15 - APP LIFE LINES	March 12, 2020	March 12, 2020
Teaser 16 – Micro-reserves – Safe Islands of the Biologic Biodiversity	January 25, 2021	

Teaser 17 – Power Lines more safe for the birds	January 27, 2021	
Teaser 18 – IENE 2020 International Conference Presentation		August 12, 2019
Teaser 19 – Promotion for the Documentary Architecture for wildlife	January 19, 2022	
Teaser 20 - Promotion for the Documentary Architecture for wildlife – short version	July 20, 2021	

Regarding the thematic videos, over 60 minutes of videos were produced, with a mean of 2 minutes and 43 seconds, and a total of 478 views (Figure 24). The thematic videos were interviews with simple editing to be available to the media whenever necessary, and only the Portuguese version was produced.

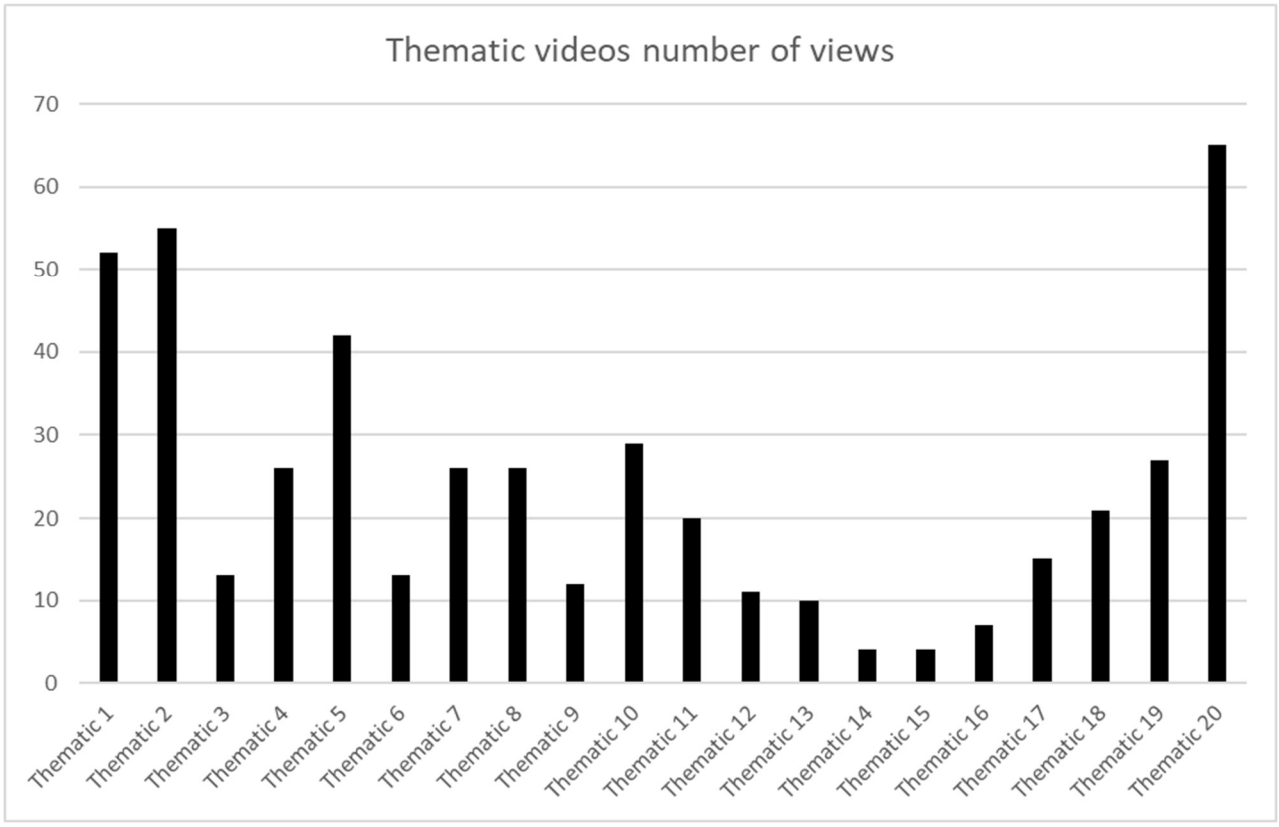

Figure 24 - Number of views of each thematic video.

The 20 thematic videos are presented in Table 13**Erro! A origem da referência não foi encontrada.** and Annex E.4_I, a deliverale of the project.

Table 13 - List of thematic videos and respective publication date.

Thematic video	Publication date
Thematic video 1 – Aim of the Project (António Mira)	June 25, 2020
Thematic video 2 – The Importance of the micro-reserves for the Butterflies (Otília Miralto) 4	June 25, 2020
Thematic video 3 – The Impact of the Green Infrastructures in the Flora's Conservation (Paula Simões)	June 25, 2020
Thematic video 4 – The Contribution of IP to the Project (Graça Garcia)	June 25, 2020
Thematic video 5 – The Participation of the FCUP in the Project LIFE LINES (Neftalí Sillero)	June 25, 2020
Thematic video 6 – The Participation of the CME in the Project LIFE LINES (Joaquim Costa)	June 26, 2020
Thematic video 7 – The Impact of the Road Infrastructures in the Carnivores (António Mira)	June 26, 2020
Thematic video 8 – The Impact of the Road Infrastructures in the Amphibians (Paulo Sá Sousa	June 26, 2020
Thematic video 9 – The Participation of the CMMN in the Project LIFE LINE (António Pinetra)	June 26, 2020
Thematic video 10 – Interventions in the Municipal Road 529 (Cláudia Angelino)	June 26, 2020
Thematic video 11 – Following Tawny Owls and its Importance (Rui Lourenço)	June 26, 2020
Thematic video 12 – What is the Role of the Micro-reserves? (André Oliveira)	July 15, 2021
Thematic video 13 – The Importance of the Micro-reserves (Mariana Fernandes)	July 15, 2021
Thematic video 14 – Interventions Assembled in the Power Lines (Carlos Rochinha)	July 15, 2021
Thematic video 15 – The Importance of the LIFE LINES Project to QUERCUS (Samuel Infante)	July 15, 2021
Thematic video 16 – Road Signalization, Signs and Outdoors, and the LIFE LINES APP (Graça Garcia)	July 15, 2021
Thematic video 17 – Dissemination Campaign of the Drivers to the Risk of Fauna Roadkill (Marta Matiolli)	July 15, 2021
Thematic video 18 – Greenhouse (José Mateus)	July 15, 2021
Thematic video 19 – How does the LIFE LINES APP works (Nuno Pedroso)	July 15, 2021
Thematic video 20 – Participation of the Conde Vilalva School in the LIFE LINES Actions (Margarida Araújo)	July 15, 2021

In addition, two tutorial videos were produced, Tutorial App LIFE LINES and the Project Summary, presented during the IENE 2020 International Conference. The App tutorial have a duration of 3 and 51 seconds and had 183 plays and the Project Summary has 10 minutes and 50 seconds and had 80 plays. Both videos were relevant for the outputs of the project since the first aim is to help the public to use the LIFE LINES roadkill application and the second was presented in the LIFE LINES virtual stand at IENE 2020 Conference to disseminate the project achievements and conclusions to the participants of the event.

Other thirteen dissemination videos were produced in the frame of the project. In 2016 the students of the 10th grade of the Tourism course at Montemor-o-Novo produced a video focus on the program "Adopt a road" (E.10). UEVORA produced other three videos focusing on some events regarding commemoration Days as the European Night of Researchers in 2019 and 2020, as well as the video created to support the kids draw contest within the scope of European Natura Day 2020. In addition, IP, represented by Graça Garcia, talked about LIFE LINES Project in a video produced by ASCENDI to

commemorate the Biodiversity Day 2020. In the scope of the events organized by the project, more five videos were created: one to welcome the participants at the IENE 2020 International Conference, by the project coordinator António Mira; two videos recording the LIFE LINES Final Seminar; and the recordings of the four workshops organized by the project team.

The documentary "LIFE LINES – Architecture for wildlife", a deliverable of the project, was also produced in the scope of this action. The documentary can be assessed through the link https://mapserver.uevora.pt/documentary/ (username: lifelines; password: zanywhale80). The film has a duration of 44 minutes and 23 seconds and points out all the major actions and conclusions of the project, for a non-specialized public. On the three of May of 2021 was establish an agreement between SIC – Sociedade Independente de Comunicação, S.A., a Portuguese national TV, and PlaySolutions regarding the transmission and dissemination of the documentary in the SIC National and International TV, as well as the online audiovisual service OPTO SIC. Although it took place during the post-LIFE period, at the time that this report was delivered, the documentary was already transmited in the TV, on 24 of July of 2021. It is important to highlight that SIC was entirely responsible for the date of the transmission of the documentary on the TV, according to its programming schedule. Only after the license time agreed in the contract is reached (1 of June of 2023), will be possible to make the documentary freely available for the general public. The documentary was produced in Portuguese but English subtitles were included in order to present it in scientific events and future upload in the LIFE LINES website.

Regarding the radio spots, a collaboration with Radio Nova Antena (highest rated local radio) was established at the beginning of the year 2019 and was finished at the end of the year 2020, after a break due to the pandemic situation of Covid-19. This weekly radio rubric entitled "LIFE LINES em FM" accounted for 72 radio spots transmitted, including the interview of the project coordinator to the Radio Station explaining the new rubric to the audience and the project LIFE LINES. Seventeen of these radio spots were repeated once, while 54 were entirely new. The list of the themes broadcast is in Annex E.4_I, a deliverale of the project.

Action E.5 – Awareness and involvement of the academic community in collecting information / data

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2016 – 31/07/2020 (31/05/2021 – after project extension)
Actual start / end date:	01/08/2016 – 31/05/2021

During the project six Master thesis based on project results, not predicted in the LIFE LINES application were concluded (Annex E.5_I). At least two others are ongoing. The thesis focused on several relevant aspects of the LIFE LINES as the impact of roads, both on roadkill mortality and ecological connectivity, and monitoring the effect of some conservation measures for fauna. Three PhD thesis are still ongoing, one focusing on the evaluation of the changes in landscape connectivity, other on amphibian mortality and efficiency of mitigation measures; and two other concerning habitats related to linear infrastructures as an opportunity for biodiversity conservation and enhancement of ecosystem services. In addition, the project supported 9 bachelor's thesis (Annex E.5_II).

Besides, the PhD thesis based mostly on LIFE LINES results and monitoring. Other two ongoing theses whose statistical modelling was supported partially by the project team are ongoing: (1) aiming to

assess road impacts on bat mortality, activity and movement; (2) small mammals population parameters and movements on roadsides.

Ten university room and field classes focused in the general aims of the project, conservation actions and promotion of the LIFE LINES App, were done in several institutions (University of Évora, Faculty of Sciences of University of Lisbon, University of Aveiro, Universidade Lusófona) (Figure 25), reaching over 400 undergraduate and pos gratuate students. Additionally, a summer course co-organized with CEBE (Council of Biology Students of University of Évora) took place between 7 and 11 of July 2019.

Figure 25 - Presentation carry out online (during COVID pandemic confinement) at University of Aveiro on January 2021.

In October 2019, António Mira concluded his habilitation on Conservation Biology with a public class on the theme “The impacts of roads on biodiversity”. Moreover, topics related to impacts of linear infrastructure on biodiversity were strengthened in “Conservation Biology” and “Biodiversity and Conservation” disciplines of the Biology Bachelor and Conservation Biology Masters of University of Évora

Fourteen scientific papers supported entirely or partially by LIFE LINES were published in prestigious scientific journals. Those papers are relevant since they disseminate the project aims and finds among the international scientific community.

In Annex E.5_I, besides other already mentioned outputs, we can find two of the three predicted deliverables for this action (Master thesis approved on the effectiveness of automatic amphibian monitoring devices and Master thesis approved on the effectiveness of deterrent devices for birds). The PhD thesis on the assessment of changes in landscape connectivity resulting from the implementation of the project will be defended on February 2022 and because of this, due to university rules, cannot be publicly available before the integration of plausible changes that may be suggested by the jury.

Action E.6 - Training / dissemination among stakeholders

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/01/2018 – 31/07/2020 (30/11/2020 – after project extension)
Actual start / end date:	01/01/2018 – 31/05/2021

In the scope of this action, 12 workshops were organized. It started in 2018, with the training of the IP teams that monitor the roadkill and insert the data in the IP's GIS, reaching an audience of 40 people. IP monitoring program and database have a national scope, so all the road inspectors received this training to enhance their skills.

Three workshops were organized regarding the control of invasive plants. The first was led by IP; the second by IP and MARCA in partnership; and the third by UEVORA within the scope of the 1st National Week on Invasive Species. The three workshops aimed to train the practitioners and general public and disseminate the measures applied in LIFE LINES project to detect, prevent and control invasive plant species. The events reached a total audience of 61 (30, 15 and 16 persons, respectively).

Five workshops focused on the importance of properly acquiring and registering fauna roadkill records. Three of them were organized in the scope of the protocol with the GNR. The GNR workshops entitled "The Importance of the Records of Fauna Mortality by Roadkill for the Conservation of Biodiversity and Road Safety", took place in person on 9 of January 2020, and online, due to Covid-19 restrictions, at 16 and 17 of March of 2021. These workshops accounted for 37, 152 and 94 participants, respectively. Regarding GNR workshops, 97% of the 85 participants that answer to the inquiries after the event considered that it was very useful or useful (Figure 26). Moreover, 12% of the inquired consider that after the workshop will register more often roadkill and 19% will use the LIFE LINES App for this purpose. 29% already used the Fauna Manual produced by the UEVORA team to help the correct identification of roadkilled species and 94% considered this document useful or very useful (Figure 27).

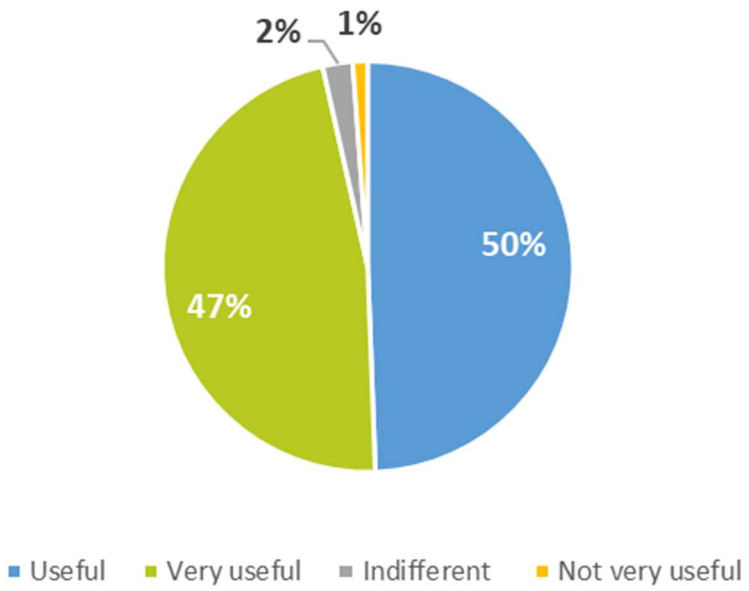

Figure 26 – Results of the inquires do GNR workshop participants regarding the usefulness of the event

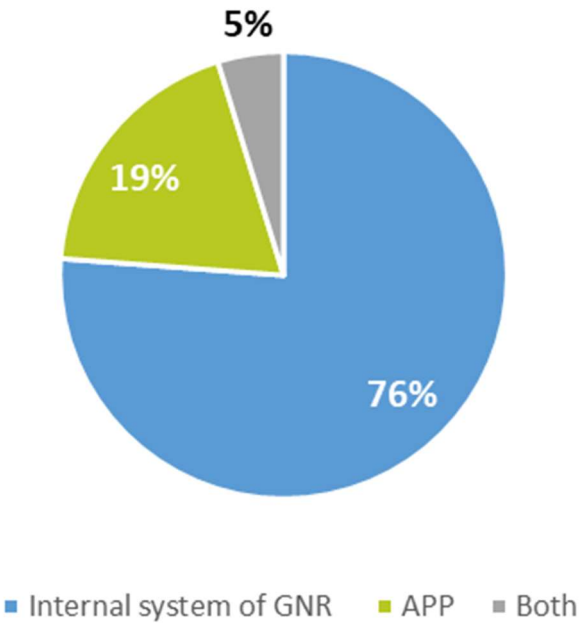

Figure 27 - Results of the inquires do GNR workshop participants regarding the the system used to report roadkill.

Another Roadkill workshop was organized within the scope of Ecology Day 2020. It involved 14 participants, from Universities of Évora, Porto, Trás-os-Montes e Alto-Douro; and NGOs - Geoparque Arouca, Scientific associations - Sociedade Catalana de Herpetologia.

In the framework of project LIFE LINES four Best Practices Guides in Portuguese and English languages (deliverables of the project) were produced, instead of the three originally predicted because predicted Guide for Linear Infrastructure Designers was in reality divided into two guides, one exclusively for roads and other for power lines, because they target different audiences (Figure 28):

1. Best practice guide for roadkill monitoring and data recording;
2. Best practice guide. Vegetaion Management for promotion of biodiversity in Linear Infrastructures;
3. Best practice guide. Solutions for mitigating th impacts of roads on animal commnunities;
4. Best practice guide. Innovative solution to reduce mortality of birds in medium voltage power lines - pole frame ECO- HAL A2S.

The Portuguese versions of the first three guides and the English version of guides 2 and 3 are already online on LIFE LINES website (https://lifelines.uevora.pt/index.php/guioes-de-boas-praticas/). The Portuguese version of guide 4 is in Annex E.6_I This version needs some pictures to be replaced for a better resolution. The English versions of guides 1 and 4 ar being reviewed after small typos have been detected. All guides, in both languages, will be available at LIFE LINES website very soon.

The “Best practice guide for roadkill monitoring and data recording” aims to gather and disseminate the for the collection and processing of information relating to observations of wildlife roadkill, based on the experience gained during the LIFE LINES project. It is a guide that points to the dissemination of basic or introductory aspects related to implementation of a plan to monitor wildlife roadkill being directed mainly to practitioners in the areas of environmental monitoring or citizens that care about this situation. In this way, it is intended to provide the adoption of Good Practices in monitoring and registration of roadkill and contribute for its mitigation of mortality as well as for road safety, from a local to national scale.

Best practice guide - Innovative solution to reduce mortality of birds in medium voltage power lines - pole frame ECO- HAL A2S intends to promote an innovative solution for the reduction of mortality by collision and electrocution of birds in medium voltage power lines – the Horizontal Eco Mat (ECO-HAL A2S). The main objective of the guide is to present the characteristics and technical requirements for its installation as well as highlighting the benefits for conservation. Therefore, therefore, it contributes with an effective alternative in the mitigation of mortality of birds in medium voltage electrical lines, publicizing it to the actors working in the area of electric energy distribution, public entities in the area of nature conservation and environmental NGOs

Figure 28 - Best Practices Guides produced in the framework of the LIFE LINES project

The Best Practice Guides produced by the project were presented on four workshops attended by a specific audience and other citizens, as follows:

- "Innovative Solution for the Reduction of Bird Mortality in Medium Voltage Power Lines: the Eco Esteira Horizontal" (28 April 2021);
- "Solutions to Minimize Road Impacts on Fauna" (29 April 2021);
- "Promotion of Biodiversity in Linear Infrastructures: Module I – Control of Invasive Plants" (6 May 2021);
- "Promotion of Biodiversity in Linear Infrastructures: Module II – Promotion of Native Flora" (13 May of 2021).

Additional supporting material for those workshops is in Annex E.6_II.

The workshop aiming to disseminate ECO- HAL A2S (Eco Esteira Horizontal), had representatives from Universities, (Évora, Porto and Lisboa), managers and practitioners of power lines companies (E-REDES and REN), municipalities of the project intervention area (CIMAC), Portuguese Conservation Agency (ICNF), Environmental Portuguese Agency (APA), and GNR, among others, counting with 54 participants. Regarding this workshop, from the 14 participants that answer the inquiries, 78.6% considered that the workshop was very useful and 21.4% considered it useful. 28.6% answered that they did not know about the project before the workshop. 100% think that event and the device presented were very relevant for biodiversity conservation.

The workshop "Solutions to Minimize Road Impacts on Fauna" reached 90 participants, accounting with managers and practitioners of road companies (Ascendi, Brisa, IP and Global via Transmontana),

Universities (Évora, Lisboa and Aveiro), environmental impact assessment companies (Biota and Strix), environmental NGOs (SPEA and QUERCUS), as well as ICNF and APA. 62.9% of the 35 participants that answer the inquiries considered that the workshop was very useful and 37.1% considered it useful. 17.1% answered that they did not know about the project before. 77.1% found it very relevant to biodiversity conservation. 100% of the inquired considered that measures shown in the workshop are very relevant for the conservation of fauna.

The workshop Promotion of Biodiversity was assisted 81 participants in the Control of Invasive Plants component and 76 people in the Promotion of Native Flora component. Institutions participating included Universities (Minho, Coimbra, Évora), ICNF, CIMAC and several municipalities (e.g. Almada, Montemor-o-Novo), road operators (Ascendi, Brisa) and NGOs (e.g. GEOTA). The inquiries indicated that 100% of the participants considered that the event was very useful or useful, from a group of 22 answers. 20% of 5 participants considered the removal of invasive plant species executed during the project is important, while 80% answered very important. 82.4% considered very relevant the plantation of autochthones shrubs and trees implemented within the project framework.

Action E.7 – Networking with other LIFE and non-LIFE projects

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/04/2016 – 31/01/2020 (31/05/2021 – after project extension)
Actual start / end date:	01/02/2016 – 31/05/2021

On the scope of the Action E.7, 15 direct and regular contacts have been made between the LIFE LINES team and other LIFE projects. The contacts began before predicted in the application, taking advantage of partnerships with other ongoing projects at IP and UEVORA. On the 24th February 2016 part of the team of the LIFE LINES conducted a field trip to Toledo, Spain in order to visit the study area and discuss the predicted interventions to minimize collisions with birds in the framework of "LIFE Impacto Cero" (Development and demonstration of an anti-bird strike tubular screen for High Speed Rail lines - LIFE12 BIO/ES/0000660). The main goal was to promote the sharing of experience and knowledge between both LIFE projects teams on the design of measures to mitigate the negative impacts of linear infrastructures on birds, as well as on the methodologies used to assess their effectiveness.

Afterwards, two different visits (MARCA and UEVORA) were made to Buçaco (BRIGHT - Bussaco´s Recovery from Invasions Generating Habitat Threats - LIFE10 NAT/PT/0000759) in the framework of invasive plants control actions.

For several years, the LIFE LINES have been a partner of the LIFE PT CAPACITY BUILDING (LIFE14 CAP/PT/000004). This partnership have enhanced the dissemination of the activities of the LIFE LINES.

More recently, the manager of the project participated in LIFE IMPERIAL (LIFE13 NAT/PT/001300) meetings. In September and October of 2020 the project team established contacts with LIFE+ Stop Cortaderia (LIFE17 NAT/ES/ 000495). The networking with this LIFE project originated the organization of public dissemination activities related to the control of invasive flora species (Action to remove Pampas grass (Cortaderia selloana) in the city of Évora promoted by LIFE LINES as part of the 1st National Week on Invasive Species). Since the beginning of 2020, the project team have been in regular contact with the LIFE SAFE-CROSSING (LIFE17 NAT/IT/000464). The two project teams co-organized the Training session "Monitoring wildlife crossings and roadkills", which took place at the

IENE International Conference 2020. This partnership is still ongoing and both LIFE projects are collaborating to organize another joint training session at IENE International Conference 2022, which will take place in Romania in September 2022.

Strong networking took place also when the LIFE LINES team was invited to present the project in events organized by several LIFE and non-LIFE projects. From those it is important to highlight: (1) Seminar "Ways to Green Infrastructure Today and Tomorrow" (poster) - organized the LIFE ZARAGOZA NATURAL - Creación, gestión y promoción de la Infraestructura Verde de Zaragoza - LIFE12 ENV/ES/000567" (Zaragoza, October 2016); (2) "1st Ibero-American Congress on Biodiversity and Road Infrastructure" (oral talk), organized by Centro Brasileiro de Ecologia de Estradas (Lavras – Brasil, November 2016) (with no costs for the LIFE LINES project); (3) Seminar "INTER LIFE PT 2016" (oral talk) organized by LIFE14 CAP/PT/000004 (Luso, Novembro 2016); (4) II International Congress Education, Environment and Development (oral talk) (5) Workshop "Formation/Capacitation to support of call proposals" (oral talk) , organized by LIFE14 CAP/PT/000004 (Évora, April 2017); (6) "Grupo de Trabajo de fragmentation de Hábitats causada por Infraestructuras de Transporte" (Barcelona, October 2019); (7) Workshop Stakeholder meeting ControlINRoad (oral talk) (Vienna, Austria, 2019); (8) Project coordinator long interview (1 hour) in III Congresso Iberoamericano de Biodiversidade e Infraestrutura Viária (III Iberoamerican Congress on Biodiversity and Road Infrastructure) held online between 7 and 11 December 2020. In addition, the project, represented by the project manager Nuno Pedroso, participated in the event "The future of the LIFE programme – Which are your expectations?" organized by the European Commission, where the future of the LIFE subprograms were discussed. Other major networking event occur when the project participated in the event Virtual LIFE Platform Meeting: 'Lessons from LIFE on ecological connectivity towards a coherent, functional and resilient network of protected areas'. During this meeting, Graça Garcia from IP, presented an oral communication about the project and the project coordinator made a short presentation about connectivity.

Moreover, the coordinator of the project attended 5th IENE International Conference on Ecology and Transportation in Lyon in August 2016, where he applied for the organization of the 7th IENE International Conference in 2020 to be held in Évora in the framework of the LIFE LINES. In 2018 several team members attended in Eindhoven the IENE International Conference 2018 where several LIFE LINES actions and interventions were presented and a strong promotion of the project and of IENE 2020 to be held in Évora was done. On this occasion, the LIFE LINES coordinator was invited, and accepted, to integrate the Organizing Committee of the International Conference on Ecology and Transportation whose theme was "Transforming Transportation Ecology in the Global Village". The conference took place in Sacramento, USA between 22-29 September 2019 and LIFE LINES issues related to road verge vegetation management were presented in an oral talk.

Two members of the team attended the "CEDR research Workshop on Roads and Wildlife Workshop" organized by Conference of European Directors of Roads (Cologne, November 2016) and the Railways Ecology Symposium organized by Cátedra REFER (Lisbon, December 2017).

In 2020, two team members of the project attended EU Green Week and actively participated in the discussions online.

A list of projects with which LIFE LINES team have cariied out networkin is in Annex E.7_I.

Action E.8 – Volunteer Program for young people

Beneficiary responsible:	MARCA
Foreseen start / end date:	01/04/2016 – 31/07/2020 (31/12/2020 – after project amendment)

Actual start / end date:	01/10/2015 – 30/05/2021

Marca-ADL is the beneficiary responsible for the implementation of the action. In all, Marca - ADL implemented about 152 activities that have been developed with medium and large groups and others with occasional collaboration of young volunteers or small groups. In total, approximately 3122 participants were involved, corresponding to an average of 20 participants per activity (Annex E.8_1). This volunteering program had several target audiences:

- 52 % of activities had Youth as target audience
- 32 % of activities had NGO's as target audience
- 13 % of activities had enterprises as target audience
- 3 % had mixed audience

Overall activities ensured the support to:

- Native species propagation
- Invasive alien species control
- Seed collection
- Composting
- Reforestation activities
- Plant nursery infrastructure works

Volunteering activities took place in different places of project IA, but the predominant sites were Marca-ADL Plant Nursery and Ecotrail of Montemor-o-Novo.

The volunteering program was crucial to ensure conservation actions implementation and at the same time to create awareness on the projects aims and a different and more informed perspective on the role of the natural environment in quality of life.

A questionnaire was given to most of the project volunteers to evaluate the impact of the project and their level of satisfaction. More than 80% were satisfied or very satisfied with the participation in the activities; More than 70% are willing to participate in voluntary environmental activities in the future; More than 80% of participants consider that they have acquired new knowledge related to project issues.

In what regards action expenses, there was the need to allocate part of the foreseen costs with consumables to the purchase of a vehicle to support volunteer transportation to activity sites. Without this change, has we already communicated, it was not possible to engage as many young people as this action did.

IP held 15 events of public awareness and dissemination of results with employees and relatives (seeTable 14), with a total of 513 participants.

There was some delay in what concerns the number of executed events, due to IP's constrains in contracting this kind of services, especially in the first year. In the recent two years there was another delay due to COVID-19 since some planned events had to be cancelled.

IP compensated this delay by increasing the ratio number of participants by event. IP was supposed to develop 16 events with 30 participants each (total of 480 participants). Indeed, 513 participants attended these volunteer events achieving and even overcoming the main objectives proposed.

Table 14 - Events held by IP

	Event	Date	Number of participants
1	Collecting acorns for replantation	12-11-2016	35
2	Sowing seeds and pricking plants	23-09-2017	41
3	Controlling invasive species	21-10-2017	45
4	Planting shrubs in micro-reserves	03-02-2018	47
5	Planting shrubs in micro-reserves	11-10-2018	11
6	Sowing seeds and pricking plants	13-10-2018	44
7	Controlling invasive species	10-11-2018	33
8	Planting trees and shrubs in micro-reserves	01-12-2018	42
9	Sowing seeds and pricking plants	25-05-2019	42
10	Sowing seeds and pricking plants	21-09-2019	31
11	Controlling invasive species	19-10-2019	21
12	Planting trees and shrubs in micro-reserves	16-11-2019	44
13	Sowing seeds and pricking plants	3-10-2020	13
14	Collecting seeds in the natural habitats	24-10-2020	28
15	Sowing seeds and pricking plants	08-05-2021	36
	Total		513

Within the scope action E.8, CME was in charge of the promotion of volunteer activities aimed at improving the ecological quality of Évora ecotrail. Those activities were included in three main tasks which are briefly described bellow:

Volunteering with the students from School Conde de Vilalva

The volunteer program, started in April 2017 with work to control invasive exotic flora (*Arundo donax*) (annex E.8_II). In the first year periodic activities that were carried out every Friday with students from Escola Conde de Vilalva. Two groups of 10 to 20 students participated in each event, which also included special education students

In addition to the invasive plant control, sowing of native trees and shrubs was carried out in a nursery kept at the school until the plantation in the Évora ecotrail which took place in following winter.

Figure 29 - Sowing of native trees and shrubs in school plant nursery with the students of Escola Conde de Vilalva

Additionally, at the end of the 2016/17 academic year, two classes from Escola Conde Vilalva carried out a volunteering action in Montemor-o-Novo ecotrail. The objective was to get knowledge of other invasive plant species (e.g. *Acacia dealbata*) and to learn the techniques that can be adopted to control them (see information note in Figure 30)

10 Regional
TERÇA-FEIRA, 2 DE MAIO DE 2017

diário do SUL

Na ECOPISTA

Alunos da Conde Vilalva "controlam" espécies invasoras

Vários alunos de um Curso de Educação e Formação (CEF) e do Ensino Especial da Escola Conde Vilalva estiveram na passada sexta-feira de manhã a participar numa ação de voluntariado junto à Ecopista, no âmbito do projeto LIFE – LINES, procurando com a sua intervenção controlar espécies invasoras e melhorar esta infraestrutura.

O projeto LIFE-LINES, apoiado pelo programa LIFE da União Europeia no ano de 2015 e em curso até julho de 2020, visa ensaiar, avaliar e fomentar o uso de medidas destinadas a minimizar os efeitos negativos de infraestruturas lineares (rodovias, ferrovias, linhas elétricas) na biodiversidade. Para o efeito, entre outros trabalhos, o projeto prevê a criação, ao longo das infraestruturas lineares a intervencionar, de uma Infraestrutura Verde que apoie a conservação da biodiversidade do território em que atua. É um projeto coordenado pela Universidade de Évora e do qual a Câmara Municipal de Évora é parceira, a par de outras entidades públicas e privados.

A ação desta sexta-feira acabou por constituir o lançamento das atividades previstas para a Ecopista, que irão decorrer regularmente, e que visam, essencialmente o controlo/erradicação de flora exótica invasora e a subsequente renaturalização, com plantação de espécies nativas (árvores e arbustos) que, a médio prazo, promovam a existência de um corredor ecológico mais favorável à biodiversidade, contribuindo ainda para a adaptação às alterações climáticas e condições de uso deste espaço de lazer, tão utilizado pelos residentes da cidade.

Os jovens alunos da Escola Conde Vilalava estiveram a efetuar o controlo de canas e a renaturalização das áreas intervencionadas através da plantação de árvores como o sobreiro, medronheiro e loureiro, e arbustos como o medronheiro, pilriteiro e folhado.

Uma vez que esta já não é a época mais favorável para plantações, espera-se reforçar estes trabalhos no Outono, com a continuação da colaboração dos alunos e professores desta turma, que estarão ainda envolvidos em várias outras atividades de beneficiação da Ecopista.

Figure 30 - Information note from the Municipality of Évora about the volunteering action that took place on the Montemor-o-Novo ecotrail.

Removal of invasive plants with volunteers from the Canaviais Parish

Another task focusing on removing reeds (*Arundo donax*) in a water line located in the LIFE LINES intervention area with the participation of volunteers from the Canaviais Parish (Figure 31).

Figure 31 - Removal of *Arundo donax* from a water line in LIFE LINES intervention area.

Voluntary actions with TYCO company workers

Actions took place during 2019 with employees of the TYCO company. The activities focused on the installation of protections in the plantation areas of micro reserves and on the removal of *Arundo donax* in an area of the ecotrail that had not been previously intervened (Figure 32).

Figure 32 - TYCO volunteers working on the removal of *Arundo donax.*

In total, 43 events took place within CME actions, with a participation of 10 to 20 people each.

Action E.9 – Technical seminars to present the developments and results of the project

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/06/2016 – 31/06/2020 (31/01/2021 – after project amendment)
Actual start / end date:	01/06/2016 – 31/01/2021

In 2-3 June 2016, the LIFE LINES have organized the first project seminar ("1st LIFE LINES - Linear Infrastructure Networks with Ecological Solutions Project Seminar". It was attended by 102 participants from different entities and took place at auditorium of Alentejo Science and Technology Park, in Évora. The first LIFE LINES project seminar accounted with 14 presentations, from the LIFE LINES team and from several national and international invited speakers, most of them integrating the Scientific Monitoring Committee. On the second day is consisted in a visit to the project IA with members of the CG, CATG and CA.

The second project seminar was organized, in May 8, 2018, at the University of Évora - Auditorium of Colégio do Espirito Santo and accounted with 45 people. This seminar included eight presentations, mainly aiming to disseminate the first measures implemented and results obtained.

Meanwhile, another seminar entitled “25 years of LIFE program in South of Portugal” was organized and held on May 26, 2017, in the framework of the 25 years Celebrations of LIFE program. It included eight oral presentations about LIFE projects recently finished or ongoing in southern Portugal and was attended by 65 people.

The University of Évora, in the framework of the LIFE LINES project, and the Infrastructure and Ecology Network Europe organized the online event IENE International Conference, 2020 whose theme was “LIFE LINES – Linear Infrastructure Networks with Ecological Solutions”. The Conference took place from 12 to 14 of January of 2021, after being postponed due to the Covid-19 restrictions (Figure 33). Originally the Conference was planned to be an in-person event to take place in Évora between 6 and 9 April 2020 and at the time of the postponement, it had already 364 inscriptions with 266 oral and poster presentations. The LIFE LINES Final Seminar was included in this international event. The local organising committee of the IENE 2020 had contributors from several institutions including the Mediterranean Institute for Agriculture, Environment and Development (MED); REN (Redes Energéticas Nacionais); Infrastructures of Portugal; and the Municipalities of Montemor-o-Novo and Évora. The IENE International Conference accounted with 293 confirmed attendees from 40 different countries representing the five continents. This event involved researchers, practitioners, linear infrastructures operators and managers, NGO’s representatives, and policymakers. During three days, participants were able to assist to 115 full oral presentations, 36 lightning talks, and 13 workshops and chat with 40 posters authors, representing studies and projects worldwide. The event counted with 50 thematic sessions, running in five parallel sessions mixing live and pre-recorded interventions. The conference also accounted with four prestigious invited speakers: Niko Balkenhol presenting the usefulness of molecular approaches in assessing and quantifying the ecological impacts of Linear Infrastructures; Francisco Moreira, revealing the secrets of the long-time utilization of very high tension powerlines by white storks; Fernanda Z. Teixeira exposing the challenges and opportunities for promoting biodiversity on roads and railways worldwide, but particularly in South America; Jakub Wejchert presented the EU 2030 Biodiversity Strategy and the importance of EU Green Infrastructure for its implementation. The conference included two side events: (1) the LIFE LINES Final Seminar - Replicating Ecological Solutions in Linear Infrastructure Networks; (2) LIFE SAFE CROSSING workshop - Innovative techniques to mitigate transportation infrastructure impact on large carnivores. In addition, LIFE LINES and LIFE SAFE-CROSSING organized Training Session entitle Monitoring wildlife crossings and roadkill (LIFE LINES e LIFE SAFE CROSSINGS) with 13 participants.

Figure 33 - Local organization team of the LIFE LINES Final Seminar and IENE 2020 International Conference (Photo by Luis Guilherme Sousa, 2021)

Regarding the LIFE LINES Final Seminar held in 13 January of 2021, 150 participants attended it from three continents and 21 different countries such as Spain, the United Kingdom, Myanmar, Canada or Brazil, etc. The LIFE LINES Seminar had two sessions with speakers from the MED, Department of Biology and Conservation Biology Lab, University of Évora, CIBIO – InBio of the University of Porto, Infraestruturas de Portugal, and MARCA; and representatives of the Portuguese Environment Agency (APA), Portuguese Society for the Study of Birds (SPEA) and Liga para a Protecção da Natureza (LPN). This seminar highlighted the preliminary results of the LIFE LINES project, under which 35 actions were implemented over 5 years.

The project was also represented in a Virtual stand (Figure 34) where it was possible to see description of the project through a flyer,a rollup and a short presentation video This virtual stand also allowed direct chat between any IENE particpant and the project team. The stand was visited by a total of 115 participants from several countries like France, Brazil, Czech Republic and United Kingdom. Regarding the participants that answered to an inquiry, only two did not know of the previous existence of the project LIFE LINES.

In the scope of the IENE International Conference two documents were produced, the IENE International Conference Abstract (action deliverable – Annex E.9_I) and Programme Book, compiling all the information about the event, the communications and the authors (Annex E.9_II).

Figure 34 – LIFE LINES virtual stand at IENE Intenational Conference 2020.

Action E.10 – "Adopt a road", environmental educational / awareness program with local schools

Beneficiary responsible:	CMMN
Foreseen start / end date:	01/08/2015 – 31/12/2020 (after
Actual start / end date:	01/09/2015 – 31/12/2021

This action was designed to raise awareness among 3rd cycle of Basic Education level scholars and Secondary Education students (13 to 18 years old). After several working meetings between CMMN and UEVORA technicians to define the action plan, it was we decided to restructure the action's tasks since the applicability of the initial proposal was hindered by constraints related with school programs' organization, namely the coordination of extracurricular activities and the curricula covered by the final cycle exams, and also by reasons associated with security on road. For that reason, we were not able to pursue the initial target indicators, as most of the actions were developed for dissemination purposes, and almost no tasks regarding monitoring of roadkill could be performed.

Focusing on the objectives of the E10 action, the target audience was expanded and several actions were initiated aiming at schools, university students, youth groups through the Montemor-o-Novo Youth Center and general population. In these actions, we sought to arouse the interest of the target audience for the environmental issues of the project and promote better knowledge about biodiversity, disseminating and encouraging the use of the mobile application developed in action C.4.

In the scope of action E.10, a total of 51 activities were performed involving a total of 3056 participants from young to elder ages. The project was able to reach 699 students from 35 classes / schools from the Basic to Secondary Education level. We highlight the implementation of initiatives like the 'Quiet days' and the NIA which will continue further. Also some activities that complied with other actions previewed in the project (e.g., C.8 - control of invasive plants, C.8 - encouraging the use of the LIFE LINES App for registration of roadkill animals). In addition, CMMN made collaborations and contacts with other institutions to disseminate LIFE LINES (e.g., Municipality of Laranjeiro e Feijó, Herdade do Freixo do Meio, and several schools). All activities performed are listed in Annex E.10_I.

Among the main contributions of the project we highlight the implementation of an organizational structure that is able to deliver environmental and conservation strategies and better inform local communities, preparing the municipality for further challenges in this area. To accomplish this organizational level, it was essential the acquisition of equipment and logistics that now supply the municipality with the means to continue promoting environmental awareness in the after-LIFE period.

For instance, the definition of the EEP, adapted to the difficulties felt on the ground, aimed not only at the school context, but also at the entire population, has been an essential tool in the dissemination of the project and all other activities. In this sense, it is important to say that the educational project defined for 2021/2022 is anchored in the NIA, which constitutes an important resource for the development of activities.

Regarding the three predicted deliverables for this action, two were successfully completed (T-shirt of the program “Adopt a road” (Annex E.10_II) and Flyer for disclosure in Montemor-o-Novo and Évora – Annex E.10_III). Regarding the Mor Magazine - Edition about the program "Adopt a road", this was not able to be implement due to the discontinuation of this publication. However LIFE LINES several articles and news were published in Botetim Municipal (Municipal Bulletin) a journal periodically published by CMMN and freely distributed to all population of the municipality. Examples of this are in the two bulletins shown in Annex E.10_IV). In the first, page 7, two news regarding the restoration of NIA and the installation of amphiban passages; in the second, page 10, a “Quit Day” initative consisting in a a walk within LIFE LINES IA to observe project interventions and wildlife.

Action E.11 – Layman Report

Beneficiary responsible:	UEVORA
Status:	Concluded
Foreseen start / end date:	01/07/2016 – 31/07/2020 (31/05/2021, after project amendment)
Actual start / end date:	01/07/2016 – 31/05/2021

This Action was implemented by UEVORA. The Layman Report, a deliverable of the project, follows with this Final Report (Annex E.11_I) and can be downloaded from the project website (https://lifelines.uevora.pt/index.php/laymans-report/?lang=en). Until now, its dissemination was caried out in a digital way mostly for stakeholders and academics. However distribution will be enhanced and reach the largest possible audience. For citizens, the digital version of the report will be the privileged way to disseminate it. For institutions, the printed copies will the first option to deliver the document for it can be physically available in their libraries.

F. Project management and monitoring of project progress

Action F.1 – Project management

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/2021 – after project amendment)

Actual start / end date:	01/08/2015 – 31/05/2021

The coordinator and the operational administrative supervisor of the LIFE LINES were present at the LIFE14 Kick-off Meeting that took place on 4th November 2015 in Murcia and presented the project to the LIFE External Monitoring teams, EASME and other LIFE 14 beneficiaries.

Management structure including the Project Coordination (CP), Technical Committee to support project management (CTAG), Management Committee (CG), and Scientific Monitoring Committee (CA) were implemented at the beginning of the project,

The composition of the CTAG, CG and CA has been submitted to adjustments due to reorganisation of the departments and/or teams of some of the beneficiaries.

In total, 30 CTAG, 277 CP, 2 CG meetings and 3 CA meetings were performed. Moreover, at least 250 small meetings involving the project coordination and subgroup of CTAG, CG and CA have taken place. Indeed, very often, whenever discussing specific issues involving only a few beneficiaries, large CTAG and CG meetings proved to be inefficient and were replaced by partial/ meetings involving only the directly interested parties. Also, when needed scientific consultancy, we performed restricted meetings with only the CA members specialized in the issues being discussed or needing a decision. This proved to be more efficient and productive than ordinary CG and CTAG meetings despite having lowered the performance indicators predicted in the project application

Most of the time CG members in CG meetings were represented by member(s) of CTAG with their superiors being available to be contacted, if needed, for any decision. Because CG meetings often overlap in composition and issues to be discussed with CTAG meetings, since September 2018 most CTAG meetings started to include CG issues, and corresponded, when this happened, to joint CTAG/CG meetings.

The first meeting of the CA was held at 2nd and 3rd of June 2016 and included the 1st LIFE LINES Seminar open to the general public and a field visit to project intervention area. The second was held on 7 and 8 of May of 2018 (foreigner members met online) together with the 2nd LIFE LINES Seminar and the third, during the LIFE LINES Final seminar, on 13 January 2021, that took place online due to Covid-19 restrictions. 83,3% of members of CA were present in the first meeting, 58.3% in the second and 66.7% in the last.

In total, LIFE LINES had ten visits or monitoring meetings from the NEEMO team. The first with João Salgado took place at 12-13 April 2016. The others were with Sara Barceló and took place on 23-24 of March 2017, 4-5 June 2019, 30 June and 1 July 2020 (online), 24 of July (online with UEvora and Quercus), 17 December 2020 (online, an EASME financial officer was also present), 22-23 June 2021. On 1 and 2 of July 2021 took place (online) the final joint monitoring virtual visit with NEEMO and CINEA, the last being represented by Silvia Donato. On 9 and 16 July 2021 we had additional online meetings to discuss financial matters. LIFE LINES beneficiaries were represented in most of those meetings.

Three Project Managers have been sequentially hired, due to moving to other jobs of the managers previously employed.

Meeting records (action deliverables) are compiled in Annex F.1_I

Action F.2 – Compilation and Structuring the Indicators of Development of the project

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/2021 – after project amendment)
Actual start / end date:	01/08/2015 – 31/05/2021

A list of indicators to be achieved for each action along the project development was included in the original LIFE LINES proposal. These indicators were incorporated and used in the frame work of Action F.2. Since 2016, the list was updated and included in the reports and since 2017 in the LIFE LINES website. During the project, six updates have been done. Table 15Table 15 shows the predicted quantity and the executed indicators per action.

Table 15 - List of progress indicators showing the evolution of indicators between the beginning and the end of the project, presenting the difference between the expected and the achieved results

Action	Indicator	Predicted quantity	Executed until March 2016	Executed until August 2017	Executed until April 2018	Executed until August 2019	Executed until June 2020	Executed until May 2021	Difference
A. Preparatory actions, elaboration of management plans and/or of action plans									
A.1 - Completing and updating of baseline characterization (concluded 31/03/2018)	Data information layers integrated into GIS database	Nº, O=79	49	388	388	388	388	388	309
	Occurrence records integrated into GIS database	Nº, O=25.000	88000	79819	79819	79819	79819	79819	54819
	Species covered by wildlife database	Nº, O= 7 Amphibians, 8 Reptiles, 25 Mammals and 80 Birds	13 Amphibians, 14 reptiles, 44 mammals and 116 bird	254, 14 Amphibians, 17 Reptiles, 53 Mammals and 170 Birds	254, 14 Amphibians, 17 Reptiles, 53 Mammals and 170 Birds	254, Amphibians= 14, Reptiles=17, Mammals=53, Birds=170	254, Amphibians= 14, Reptiles=17, Mammals=53, Birds=170	254, Amphibians= 14, Reptiles=17, Mammals=53, Birds=170	134, Amphibians= 7, Reptiles= 9, Mammals= 28, Birds= 90
	Connectivity maps generated	Nº, O=2	1	6	6	6 (5)	6 (5)	6 (5)	4(5)
	Fraction of intervention sites covered by detailed data / maps in GIS database	%, O=100		100	100	100	100	100	0
	Animals tracked with GPS/GSM system	Nº, O=12	2	6	12	12	12	12	0
	Number of wildlife crossings and culverts mapped	Nº., O=50	303	307	307	307	307	307	257
	Invasive species with new approach of remote sensing methodology	Nº, O=4		6	6	6	6	6	2
A.2 - Compilation, structuring and implementation of national database and	Number of persons / organizations that contributed with GIS data information layers	Nº, O=16	2	3	5	12	16	16	0

multi-user web platform (concluded 31/05/2021)	Roadkill data incorporated into GIS database	Nº, O=50.000	42000	50076	73809	81104	93672	121532	71532
	Species incorporated into GIS database	Nº, O=120	190	199	208	208	225	230	110
	Nº of Institutional users registered and with a regular use of the platform	Nº, O=4	NA	NA	3	3	3	3	-1
	Nº of academic users registered and with a regular use of the platform	Nº, O=6	NA	NA	8	8	8	8	2
	Nº of professional users registered and with a regular use of the platform	Nº, O=8	NA	NA	3	3	3	3	-5
	Nº of NGO´s registered with a regular use of the platform	Nº, O=4	NA	NA	NA	NA	NA	NA	NA
	Nº of citizens registered with a regular use of the platform	Nº, O=20	NA	NA	NA	NA	NA	NA	NA
	Average number of new records send in a regular basis to the platform	Nº/month, O=600	1070	877	612	745	NA	703	103
	Records send by mobile application	%/total, O=10%	NA	NA	NA	NA	13%	24,60%	14,60%
A.3 - Project implementation, licensing, procurement of permits and contracting procedures necessary to actions C (concluded 31/12/2018)	Execution projects (Forestry and civil engineering / Landscaping) produced	Nº, O=12	5	10	13	13	13	13	1
	Authorizations, licensing and procurement of permits necessary to actions C obtained	%, O= 100		100	100	100	100	100	0
	Procedures of public contracting launched	%, O=100		50	100	5	100	100	0

A.4 - Development, testing and evaluation of automated systems of monitoring and / or deterrence (concluded 31/06/2019)	No. of monitoring prototypes developed	Nº, O=2	1	1	2	2+1 (3)	2+1 (3)	2+1 (3)	1
	No. of dissuasion prototypes developed	Nº, O=3		0	5	4+2+1 (7)	4+2+1 (7)	4+2+1 (7)	4
	Effectiveness of automated prototypes comparing with traditional methods	%, O=150	NA	NA	NA	78,10%	78,10%	78,10%	-71,90%
	Records of approach to powerlines obtained with the monitoring prototype	Nº	NA	NA	50	13	13	13	NA
	Records of passerines mortality obtained with the monitoring prototype	Nº	NA	NA	NA	32	32	32	NA
A.5 - Installation of autochthonous plant nursery for conservation actions (concluded 31/12/2016)	No. of created nurseries	Nº, O=1	0	1	1	1	1	1	0
	Area of produced plants created	m2, O=5.000		5000	5000	5000	5000	5000	0
	Plots to seeds production installed	m2, O=1.000		1000	1000	1000	1000	1000	0
	Number of woody species in growth	Nº, O=4		22	22	22	22	22	18
	Number of bulbous species in growth	Nº, O=1		2	5	5	5	5	4
	Growing plants to conservation tasks (Actions C)	Nº, O=1000		3000	3000	3000	3000	3000	2000
A.6 – Development of prototypes for deterring avifauna in	Prototype solutions developed for reducing bird kills	Nº, O=1	NA	NA	NA	1	1	1	0

medium voltage lines (concluded 15/5/2019)	New device produced to reduce simultaneously bird electrocution and collisions	Nº, O=85	NA	NA	NA	91	91	91	6
	Selection/extension of the total length of medium tension lines with the new typology for the poles and new anti-collision signalization	km, O=13	NA	NA	NA	14,8	14,8	14,8	1,8
A.7. Development and adoption of internal guidelines to support post-project management (concluded 31/12/2020)	Internal standards proposed/approved in IP associated with internal guideline	Nº, O=1	NA	NA	NA	NA	NA	2	1
	Internal standards proposed/approved in IP associated with hiring guidelines	Nº, O=1	NA	NA	NA	NA	NA	2	1
	Effectiveness of the Internal Standards approved at the end of the project	%, O=100	NA	NA	NA	NA	NA	NA	NA
C. Concrete Conservation actions									
C.1 - Integrated Mitigation of the reduction of conductivity and permeability of the landscape in national and principal roads (concluded 30/09/2020)	Dry ledges for fauna installed on culverts.	Nº, O=5	NA	NA	6	6	6	6	1
	Structural improvement of culverts to prepare mitigation work	Nº, O=1	NA	NA	1	1	1	1	0
	Restauration of fences and plantations to lead to culvert paths.	Nº, O=7	NA	NA	6	6	6	6	-1
	Total length of national roads (EN) and main	km, O=37	NA	NA	2,4	6,3	6,3	37	0

	itineraries (itP) covered by mitigation measures								
	Total length of national roads (EN) and main itineraries (itP) covered by complementary measures to support mitigation measures	km, O=104	NA	NA	154	157	157	314	210
	Number of typologies of innovative solutions	Nº, O=4	NA	NA	2	4	3	4	0
	Number of typologies of demonstrative solutions	Nº, O=5	NA	NA	3	4	5	5	0
C.2 - Potentiation of the verges and marginal parcels of roads infrastructures as shelter areas, refuge, food and / or displacement (concluded 31/12/2020)	Micro-reserves installed /established	Nº, O=2	NA	NA	2	2	2	2	0
	Favourable habitat increase to target butterflies populations.	ha, O=4	NA	NA	NA	5,5	5,5	5,5	1,5
	Occupied area for invasive species subject to initial control actions.	%, O=100	NA	NA	29,2	100	100	100	0
	Occupied area related to the initial, by invasive species subject to monitoring control actions.	%, O=75	NA	NA	NA	NA	NA		-75
	Occupied area related to the initial, by invasive species subject to following control actions.	%, O=25	NA	NA	NA	NA	NA		-25
	Control methods of reeds tested and evaluated as effective.	Nº, O=2	NA	NA	NA	NA	NA	2	0

	Protocols to prevent, detect and control of invasive species along the IP roads.	Nº, O=2		1	1	1	1	18	16
	Mortality reduction of Tawny Owl by installing shrub screens	%, O=10	NA	NA	NA	NA	NA	NA	NA
C.3 - Development and installation of vertical road traffic signs (concluded 31/06/2018)	Vertical signals created	Nº, O=1	1	1	1	1	1	1	0
	Vertical signals acquired and installed.	Nº, O=10		0	10	10	10	10	0
C.4 - Mobile Application to promote the collect of mortality data (concluded 31/03/2021)	Mortality records validated in GIS database by mobile application.	Nº/month, O=600	NA	NA	NA	NA	72	73	-527
	Records send by mobile application	%/total; O=10%	NA	NA	NA	NA	13%	24,60%	15%
	Validation time (between entry and validate the data)	days, O=4	NA	NA	NA	NA	4	4	0
C.5 – Testing devices for deterring avifauna landing in medium voltage lines (concluded 31/03/2021)	Anti-electrocution/collision devices installed	Nº, O=85	NA	NA	NA	NA	NA	49	-36
	Extension of medium voltage lines with the new type of prototypes installed	km, O=13	NA	NA	NA	NA	NA	13	0
	Effectiveness of new anti-electrocution devices (% reduced mortality)	%, O=80	NA	NA	NA	NA	NA	100 elect	20
C.6 - Development, essay and application of biodiverse grasslands to promote biodiversity in linear infrastructures	Species evaluated in preselection	Nº, O=20		1064	1064	1064	1064	1075	1055
	New protocols of species germination with conservation interest	Nº. O=5		NA	8	8	8	8	3

(concluded 31/12/2020)	Species with harvested seeds	Nº, O=20		153	153	153	153	165	145
	Selected species	Nº, O=10		50		NA	50	50	40
	Intervention essay areas	Nº, O=10		NA		23	23	50	40
	Quantity of seeds collected by volunteers	%, O=25		30	30	30	30	30	5
	Rehabilitated greenhouses for conservation objectives	Nº, O=1		0	1	1	1	1	0
C.7 - Mitigation measures and potentiation of roads in Évora municipality (concluded 31/06/2020) ** only Arundo donax was controlled, as it was also the only well represented exotic invasive species along the Ecotrail*	Total length of municipal roads parts covered by mitigation measures.	km, O=9	NA	NA	9	9	9	9	0
	Total length of disabled railways covered by mitigation measures.	km, O=21	NA	NA	21	21	21	21	0
	Endemic flora species target of potentiation work.	Nº, O=6	NA	NA	NA	7	7	7	1
	Butterflies species target of habitat potentiation	Nº, O=4	NA	NA	NA	6	6	6	2
	Invasive plant species target of control/eradication	Nº, O=6		1	1	1	1	1	-5
	Reduction of mortality records in EM529	%, O=20%	NA	NA	NA	NA	NA	38,80%	18,80%
C.8 - Mitigation measures and potentiation of roads in Montemor-o- Novo municipality (concluded 31/08/2020)	Total length of municipal roads parts covered by mitigation measures.	km, O=15	NA	NA	15	15	15	15	0
	Total length of disabled railways covered by mitigation measures.	km, O=13	NA	NA	13	13	13	13	0

* Only 8400m2 are adequate for intervention	Endemic flora species target of potentiation work.	Nº, O=2	NA	NA	NA	7	7	7	5
	Butterflies species target of habitat potentiation	Nº, O=3	NA	NA	NA	10	10	10	7
	Small mammal species target of habitat potentiation	Nº, O=2	NA	NA	NA	2	2	2	0
	Invasive plant species target of control/eradication	Nº, O=7		4	5	1	4	4	-3
	Invasive flora area species target of control/eradication	m2, O=32000	NA	NA	8400	NA	NA*	8400	-23600
C.9 - Operations in plant nursery to the conservation actions (concluded 31/05/2021)	Plant Production area installed	m2, O=5000		5000	5000	5000	5000	5000	0
	Plots of production of seeds installed	m2, O=1000; Nº=10		1000	1000	1000	1000	1299	299
	Woody species propagated with the action	Nº, O=9		22	22	22	22	56	47
	Herbaceous species propagated with the action	Nº, O=11		NA	25	25	25	43	32
	Produced plants vs necessary plants to the conservation works	%, O=100		NA	NA	NA	NA	100	0
C. 10 - Promotion of "islands" of Biodiversity along the power lines (concluded 31/12/2018)	Experimental plots installed to create Biodiversity Islands	Nº, O=3	NA	NA	15	15	15	15	12
	Total area covered	m2, O=300	NA	NA	720	720	720	720	420
	Installed fence	m, O=75	NA	NA	420	420	420	420	345
D. Monitoring of the impact of the project actions									

D.1- Monitoring / evaluation of socio-economic effects of the project (concluded 31/05/2021)	Adopted indicators to monitoring the effects	Nº, O=20		18	34	34	34	17	-3
	Trimestral update of the indicators	Nº, O=15		1	11	11	11	13	-2
	Produced and sent reports	Nº, O=1	NA	NA	NA	NA	NA	1	0
D.2 - Monitoring / evaluation effects of the project on ecosystem functions (concluded 31/05/2021)	New permeability maps produced	Nº, O=2	NA	NA	NA	NA	NA	6	4
	Produced and sent reports	Nº, O=1	NA	NA	NA	NA	NA	1	0
D.3 - Monitoring / evaluation of the effects / impacts of conservation measures (concluded 31/05/2021)	Update of data information layers integrated into GIS database	Nº, O=20	NA	NA	2	0	0	69	49
	New occurrence records integrated into GIS database	Nº, O=10000 to 20000	NA	NA	7598	7598	20280	23000	3000
	Update of fauna species mortality records covered by the fauna database (10 amphibians, 10 reptiles, 35 mammals and 85 birds).	Nº, O= 10 Amphibians, 10 Reptiles, 35 Mammals and 85 Birds	NA	NA	10 amphibians, 9 reptiles, 26 mammals, 64 birds	210, Amphibians= 16 Reptiles=17 Mammals=51 Birds=126	210, Amphibians= 16 Reptiles=17 Mammals=51 Birds=126	230, Amphibians= 17 Reptiles=20 Mammals=59 Birds=134	90, Amphibians= 7, Reptiles= 10, Mammals= 24, Birds= 49
	New permeability maps produced	Nº, O=15	NA	NA	NA	18	18	18	3
	New functional connectivity maps produced	Nº, O=2	NA	NA	NA	6	6	6	4
	Animals tracked with GPS/GSM system	Nº, O=12	NA	NA	3	13	13	18	18

	Monitored of power lines supports	Nº, O=60	NA	NA	NA	40	20+20+20 (2018+2019+2020) – Flora	64	64
	Seeds plots of biodiverse mixtures monitored	Nº, O=20	NA	NA	NA	23	23+23 (in situ; 2019+2020)	44	24
	Monitored sites of successful invasive species control	Nº, O=20	NA	NA	NA	31	81 (2019)	88	68
	Invasive species target of remote sensing methods of analysis	Nº, O=4	NA	NA	NA	NA	5	5	1
E. Public awareness and dissemination of results									
E.1 - Communication Plan - Project Website (concluded 31/05/2021)	Content update frequency	Nº of updates, O=20	4	24	100	118	208	268	248
	Monthly average users	Nº, O=200		148	211	237	236	223	23
	Statistics on numbers, average session time (AST) and geographical provenience of users	AST (min)		3,11	2,42	0,36	2,45	2,3	NA
	Downloads from the website	Nº, MB		NA	NA	NA	NA	NA	NA
E.2 – Communication Plan – Placards/Outdoors in intervention area (concluded 31/05/2021)	Placards of medium size installed in sites of C Actions interventions	Nº, O=50		3	18	52	52	64	14
	Large Outdoor installed as part of C.1 Action intervention	Nº, O=1		NA	NA	1	1	1	0
E.3 - Communication Plan - Public disclosure sessions and contacts	Press releases/schedule emitted or written throughout the project	Nº, O=30	0	3	29	41	601*	727*	697

with the media (concluded 31/05/2021) * NEWS (Instead of Press releases)	Press conferences organized during the project	Nº, O=10		NA	NA	0	0	1	-9
	Public seminars organized (annual)	Nº, O=5		2	3	3	3	4	-1
	Average of participants in the public seminars	Nº, O=80		102	84	72	72	91	11
E.4 - Communication Plan - Complementary works and materials (concluded 31/05/2021)	Short teasers (about 1 minute) produced and distributed on the Internet throughout the project	Nº, O=20	1	6	8	10	15	20	0
	Thematic videos of medium duration with audiovisual supporting content for specialized media visits	Nº, O=20	1	6	8	11	11	20	0
	Radio spots produced/broadcasting	Nº, O=10		1	3 (including 2 events)	19	19	72	62
	Project documentary	Nº, O=1	NA	NA	NA	NA	NA	1	0
	Tutorials videos	Nº, O=2	NA	NA	NA	NA	NA	2	0
E.5 - Awareness and involvement of the academic community in collecting information/data (concluded 31/05/2021) **not possible to be sure who is student*	Researchers of UEVORA, FCUP and UA With credentials to the national platform	Nº, O=14	NA	NA	NA	8	8	8	-6
	PhD and Master Thesis concluded	Nº, O=6		2	2	4	6	6	0
	Students of UEVORA, FCUP and UA registered in mobile application	Nº, O=200	NA	NA	NA	NA	1*	4*	-196
	Researchers of UEVORA, FCUP and UA registered in mobile application	Nº, O=80	NA	NA	NA	NA	46	54	-26

	Collected data by academic community of UEVORA, FCUP and UA	Nº, O=8000	NA	NA	NA	NA	208	568	-7432
E.6 - Training / dissemination among stakeholders (concluded 31/05/2021)	Organized workshops	Nº, O=8	NA	NA	NA	3	4	12	4
	Total participants in workshops	Nº, O=160	NA	NA	NA	85	122	697	537
	Requests for workshops	Nº, O=10	NA	NA	NA	0	1	5	-5
	Applied knowledge by participants	%, O=50%	NA	NA	NA	64	64	64	14
	Good practices guidelines	Nº, O=3	NA	NA	NA	NA	NA	4	1
	Downloads good practices guidelines	Nº; O=200	NA	NA	NA	NA	NA	NA	NA
E.7 - Networking with other LIFE and not LIFE projects (concluded 31/05/2021)	European experts invited to visiting the project	Nº, O=4		4	5	5	5	5	1
	LIFE and non-LIFE projects visited by members of the project team.	Nº, O=4		4	5	8	8	8	4
	Presentations of the project in Green Week editions	Nº, O=2	NA	NA	NA	0	0	0	-2
	Presentations of the project in European seminars/events	Nº, O=4		2	5	12	14	16	12
	Ideas of network projects to integrate the Communication and Conservation Post-LIFE Plan.	Nº, O=2	NA	NA	NA	NA	NA	2	0
E.8 - Volunteer Program for young	Average number of young people participants in the program	Nº, O=30		22	23	31	38	20	-10

people (concluded 31/12/2020)	Associations and IPSS participants in the program	Nº, O=12		2	11	11	14	19	7
	Enterprises/institutions participants in the program	Nº, O=8		4	8	13	20	20	12
	Habitat area beneficiated by voluntary work	ha, O=2	NA	NA	0,71	0,71	3,78	3,97	1,97
	Species of flora beneficiated by voluntary work	Nº, O=10	NA	NA	11	11	11	11	1
	Species of fauna beneficiated by voluntary work	Nº, O=8	NA	NA	5	8	8	8	0
E.9 - Technical seminars to present the developments and results of the project (concluded 31/03/2021)	Professional participants in the initial seminar	Nº, O=50		102	102	102	102	102	52
	Professional participants in the middle seminar	Nº, O=120	NA	NA	45	50	50	45	-75
	Professional participants in the final seminar	Nº, O=200	NA	NA	NA	NA	NA	293	93
	Power Point presentations	Nº, O=80		22	27	27	27	39	-41
	Abstract book edited in digital form.	Nº, O=3	NA	NA	NA	NA	NA	2	-1
E.10 - “Adopt a road", environmental educational/awareness program with local schools (concluded 31/12/2020)	Young people involved by municipality in vacation camps	Nº/year, O=9	20	11	22	22 / 5851)	22 / 585a)	22 / 5851a)	13
	Total of young people involved by municipality in vacation camps	Nº, O=72	20	22	22	22 / 1503	22 / 1503b)	22 / 1503b)	-50

	Juvenile Center use by young people between regular activities	Nº/municipality, O=9	NA	NA	7	7	7c)	7	-2
	Juvenile Center use by young people involved by municipality	Nº, O=9	NA	NA	7	NA	NAd)	7	-2
	Identified roadkilled animals	Nº, O=1000	NA	NA	NA	NA	NA	450	-550
	Adopted sections of roads	Nº, O=2	NA	NA	1	1	1	1	-1
	Surveys at stretches of roads adopted	Nº, O=24	NA	NA	16	16	16	17	-7
	Mortality records of fauna in the mobile app by section of road	Nº, O=100	NA	NA	NA	NA	NA	NA	NA
E.11 - Layman Report (concluded 31/05/2021)	Report submission requests received	Nº	NA	NA	NA	NA	NA	NA	NA
	Reports distributed by mail to national addresses	Nº	NA	NA	NA	NA	NA	NA	NA
	Reports distributed by mail to European addresses	Nº	NA	NA	NA	NA	NA	NA	NA
	Diversity of entities/publics covered by the distribution	Nº	NA	NA	NA	NA	NA	NA	NA
F. Project management and monitoring of project progress (obligatory)									
F.1 – Project management (concluded 31/05/2021)	CP team members present in the kick-off meeting	Nº, O=2	2	2	2	2	2	2	0
	CG meetings accomplished	Nº, O=20	0	2	2	2	2	2	-18
	CTAG meetings accomplished	Nº, O=60	4	16	21	25	28	30	-30
	CP meetings accomplished	Nº, O=240	20	88	114	218	218	277	37

	CA meetings accomplished	Nº, O=6	0	1	2	2	2	3	-3
	CA members present in meetings	%, O=90		83.3	70,8	70,8	70,8	69,43%	-20,57
F.2 – Compiling and Structuring the Indicators of Development of the project (concluded 31/05/2021)	Regular update of the progress indicator´s list	NA	NA		3	3	5	6	NA

Analysing the indicators, we can conclude that 40 indicators of the 170 occurred as predicted, 74 with higher numbers than predicted, 34 with least numbers than expected and finally 8 were not possible to quantify or were not initially predicted. There were different reasons with it was not possible to quantify these 8 indicators (represented in the table by NA), like the platforms, were not prepared to quantify it, difficulties in assessing the downloads of documents from the site (E.1 and E.6); the action was applied recently, like the effectiveness of the Internal Standards approved at the end of the project (A7); or because initially the quantity was not predicted, as the records of passerines mortality obtained with the monitoring prototype (Action A.4).

Regarding the indicators that occur in the quantity predicted, it covers all the groups of actions and beneficiaries responsible. From these actions, it is important to highlight that all the indicators of the E.4 were executed as predicted, except the Radio spots produced/broadcasting that exceeded the predicted. In addition, structural improvement of culverts to prepare mitigation work (C.1), extension of medium voltage lines with the new type of prototypes installed (C.5), total length of disabled railways covered by mitigation measures (C.7 and C.8), the PhD and Master Thesis concluded (E.5) and the species of fauna beneficiated by voluntary work (E.8) occured as initially predicted in the quantity of the indicators.

On the other hand, either some indicators were overvalued in the initial proposal or its implementation did not occur as expected due to several reasons. These could be the effectiveness of an action or actions that were dependent from the response of the public or media. It is the example of the effectiveness of automated prototypes compared with traditional methods (A.4) that although it had a good performance, it was not as high as predicted. The number of press conferences (E.3) predicted was also in this group since its realization was dependent on the media response. The “Adopt a road", environmental educational/awareness program with local schools (E.10) was also an action that had to be adapted during the project, since it had little participation from the students. The indicators regarding the mortality records validated in GIS database by mobile application (C.4) were initially overvalued but the percentage of records sent by mobile application regarding the entire database was higher than planned.

Nevertheless, it is important to highlight that most of the indicators were accomplished in higher numbers than predicted. Such are the number of monitoring and dissuasion prototypes develop (A.4), growing plants to conservation tasks (A.5), the species evaluated in preselection (C.6), endemic flora species target of potentiation work (C.7 and C.8) and total length of national roads and main itineraries covered by complementary measures to support mitigation measures (C.1). The involvement of the team in the dissemination actions also resulted in the overachieving indicators related to the E actions, as E.2, E.6, and E.7 among others. Action D.3 also presented several indicators with higher values than expected initially.

In addition, the COVID-19 pandemic affected the realization of some actions after 2020, decreasing the number of young people participating in the volunteering program (E.8).

Action F.3 – External audit (ver comentário da Sara)

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/08/2015 – 31/07/2020 (31/05/21, after project amendment)
Actual start / end date:	01/09/2015 – 31/05/2021

Th terms of Reference for the External audit repost are in annex F.3_I and the audit report in Annex F.3_II

The Financial Statement was examined and all procedures for auditor engagement were carried out. To our knowledge no signifcant issues were found in the audit, and the only factual findings reported are:

- All documentation and accounting information to enable us to carry out these procedures has been provided to us by the Beneficiary.
- The exception referred in 11, is from a miscalculation in one employee salary costs (327,53€).
- The exception referred in 13, are from a miscalculation on the exchange rate of 2 expenses (210,59€).
- The exception referred in 16, are from an incorrect value insertion on the excel cell (255,20).
- Some categories were over budget, but globally compensated by both beneficiaries.

Action F.4 – Conservation Plan and After-LIFE Communication

Beneficiary responsible:	UEVORA
Foreseen start / end date:	01/01/2020 – 30/06/2020 (31/05/21, after project amendment)
Actual start / end date:	01/01/2020 – 31/05/2021

After-LIFE report (see Annex F.4_I) was prepared following the guidelines and good practices given by the European Commission. The document reports a SWOT analyses identifying the strengths, weaknesses, opportunities and threats of the project and further developments in the after-LIFE period.

The project was able to produce monitoring and reporting tools that will contribute to investigating and promoting the envisaged actions at a national scale by several institutions, namely: (1) implementation and concession of roadkill data to feed the NRDb through the establishment of several protocols (IP and other sub-concessionaries, GNR, ICNF, IMT); (2) encouraging citizens to report roadkill data at a national scale through the LIFE LINES App and a multi-user web platform; (3) providing automated systems of monitoring for stakeholders (FCUP); (4) adoption of roadkill mitigation measures on road infrastructures (IP); (5) installation of anti-electrocution and anti-collision structure in medium voltage lines (QUERCUS, E-REDES, CTALEA); (6) road verge vegetation management (CIMAC and several municipalities); (7) habitat creation in power lines poles (REN); and (8) control of invasive plants (IP, CME, CMMN). Also, significant contributions regarding the awareness of the public to linear infrastructures effects on wildlife will continue, such as: (1) at least a second broadcast of the LIFE LINES documentary on the national TV channel; (2) disclose documentation and devices produced in the project (all beneficiaries); (3) provide

educational and environmental awareness services to the community (CMMN, UEVORA); (4) organize workshops and training sessions to capacitate people and institutions (IP, UEVORA).

It is expected that the results of this project will also reach policy and decision-makers under the CTALEA group and Wildlife Roadkill Monitoring Program. Synergies will be seeked to integrate project research and tools in a Trans-European Network replicating the successful interventions of the LIFE LINES project.

The main weaknesses of the project concern the difficulties in gathering funding to ensure the maintenance and dissemination of the developed tools. In this regard, we already have applied to several financing sources at a national scale, and are actively seeking other stakeholders abroad for trans-national projects. PhD thesis building upon data and outputs of the LIFE LINES project are still ongoing and will further contribute to project dissemination and update of conservation actions. Many other actions will be maintained by own funding/budget from beneficiaries. Additionally, the lack of a national strategy associated with the low importance attributed by political and social circles to issues related to nature conservation and environment, hamper the adoption of practical and applied actions. Several beneficiaries will maintain actions of dissemination, awareness and training to capacitate local populations and workers. The inclusion of several beneficiaries and collaborators in governmental programs regarding conflicts between wildlife and linear infrastructures (UEVORA, IP, QUERCUS and E-REDES) will be seen as an opportunity to lobby for these issues and further expand the areas of intervention replication project actions.

In all, the actions proposed and evaluated in the LIFE LINES project are expected to have an impact on reconciling both grey and green infrastructures, extending the intervention area to a national scale; reaching citizens, academy or technicians as well as stakeholders and decision-makers; and providing tools that build the bridge between applied research and effective conservation.

Main deviations, problems and corrective actions implemented

The main problem associated with LIFE LINES development was, in our opinion, the administrative procedures and superior authorizations needed to perform some tasks. Among these, the procedures to hire persons or acquired equipment and services by public entities (all beneficiaries except MARCA and QUERCUS) were particularly relevant. These were increasingly complex and demanding, in part to fulfill UE requirements (e.g. DL 111-B/2017 of 31 August). Delays in several tasks associated with conservation actions C.1 and C.2 were a consequence of this procedures, as explained in the Technical part of this report. The Road Maintenance Contract to be made by IP, in which the LIFE LINES tasks were included, had to wait for Court of Auditors authorization, which led to delays in regard to beginning of some actions that were dependent upon the season. Despite this, most of the conservation actions did not suffer significant delays, and were accomplished on-time.

Fire prevention legislation is also of concern. DL 10/2018 of 14 February was published after the wild fires of June and October 2017 in Portugal, where over 100 people died. The DL clarifies the fuel management criteria in the secondary bands of fuel management, reinforcing and amending DL 124/2006 of June 28. The reinforcement of this legislation can limit the full potential of roadsides and other marginal areas associated with LI for biodiversity conservation. This had implications to the full achievement of some LIFE LINES objectives (micro-reserves and biodiversity refuges; control of alien invasive plants with non-cutting techniques). Particularly important are obligations included in points

C- “shrub height cannot exceed 50cm” and D –“ grass height cannot exceed 20cm” of paragraph 1 (DL 10/2018), if they are followed in an extensive and unweighted manner. The issue was debated in a Scientific Monitoring Meeting (7 May 2018) and one of the members highlighted the possibility of asking for legal exceptions aiming conservation proposes, in locations where fire risk is not so high (as in most of LIFE LINES IA). The project team is aware, from the beginning of the project, of the need to take into account fire risks in vegetation management. However, in the region where the project takes place, the historical record shows that fire spreading risk is often low due to the characteristics of the dominant forest type which often lacks a bushy stratum and present variable and often large distances between tree canopies.

In this context, the project is finishing the production of a document with best practices management guidelines for roadside vegetation considering this legislation, and to support exceptions and adaptations requests in vegetation cutting. These requests have already been done and accepted by some municipalities (Montemor-o-Novo and Arraiolos). Later, UEVORA in collaboration with CIMAC (element of the Scientific Monitoring Committee) improved this document (Annex F.4_II) to extend it further to all municipalities of Central Alentejo. The document produced results weighing the risks associated to fire hazard, road safety and concerning biodiversity conservation and ecological function. This document intends to be used by road managers and agencies of Central Alentejo region to support exceptions and adaptations requests in vegetation cutting framed within the legislative proceedings. This document was shared with the “Municipal Committees of Forest Defence” and “Forest and Nature Conservation Institute” (ICNF) at the end of the project.

Preparatory action A.1 lasted longer than predicted but no delays in conservation actions were due to this fact. Additional work was needed mostly to complete some field surveys and map important landscape features (all permanent water bodies), which also justifies a 22% increase in personnel expenses action A.1, comparing with the original proposal.

Action D.3 started on the predicted date. However, initially only the effect of road verges vegetation cutting and mowing on roadkill were observed. Monitoring of other conservation actions started after each measure has been completed. For the measures for which implementation was delayed for several reasons, the monitoring period is inevitably shorter than the predicted in the project proposal. This is particularly evident for a few measures included in actions C.1, C.2 and C.5 (see technical part of this report) that only finished only in 2019 or 2020. Taking into account this constrains, the strategy adopted is to start monitoring the efficacy of each conservation measure as soon as possible after each its implementation and performing the monitoring as long as possible. The spring season is, for the most of the target groups (for amphibians the autumn will be also an important season), the more appropriate season to perform the surveys. For some tasks like L-shape net (C.1) and of ECO- HAL A2S (C.5) are only available for one season. However monitoring the efficacy if this ations will continue in the afyer-LIFE, which will allow later an inter annual evaluation. Whenever possible, we compensated partially the shorter period of monitoring with a more intensive evaluation, i.e., more surveys in shorter time. Moreover, roadkills (an important indicator for evaluating the success of several conservation measures) are being monitored by IP on intervened national roads on a weekly basis since October 2016 (to monitor the effect of road verges vegetation

cutting and mowing on roadkills) and by UEVORA, on a daily basis, between October 2017 and January 2021.

A major deviation from the original project plan concerns the control of alien invasive vegetation for two reasons: (1) a misunderstanding of the application proposal or misspelling may have led to the interpretation that all target invasive plants would be eradicated on stretches of national roads that are intervened in the project framework. Indeed, in the 3 roads that were predicted to be intervened in the project, the invasive control has been made with improved vegetation cutting a regular and systematic procedure, and, in selected with more complex and specific techniques. But eradication by 100% was not the goal, due to the well know difficulty in assuring the full eradication of these species. The indicator is intervention on 100% of the area, which is happening. (2) Complex governmental/administrative procedures, that caused the delay in starting the new Road Maintenance Contract (that includes the improved techniques to control AIS).

Other changes that are worthwhile to highlight are:

A full-time person aiming to support Project Management was hired. Instead of the service acquisition proposed in the LIFE application, this technician was hired through an open public call. This procedure, although involved higher personal costs, are balance by the lower service acquisition required for project assistance. So, it did not involve any additional costs for the project.

The monitoring of the socio-economic effects revealed to be a particularly complex task. A simplified list of socio-economic indicators was used instead. Nevertheless, some indicators were still hard to fill because they required information on individual costs (e.g. persons/day on service acquisition) that were not easily available in a such detailed way.

A new automatic camera (photographing every 10 seconds), not predicted in the LIFE application and used for the first time in Portugal, was acquired to monitor the use of small culverts by small fauna (amphibian, reptiles and small mammals) as well as a service to run an algorithm that automatically identifies the species/group photographed. We used the money left from the acquisition of the regular trapping cameras and, thus, there are no additional costs for the project.

COVID-19 effects

The emergence of the Covid-19 pandemic in Portugal since March 2020 did not affect greatly the objectives of the project has most conservation actions were already implemented, except for a few ones (e.g., installation of L-shaped fence and ECO- HAL A2S, which had some considerable delays). Some monitoring and inperson awareness actions had to be re-scheduled mainly due to mandatory lock-down policies. Nevertheless, and above all regarding dissemination actions, the project beneficiaries adapted to the new constraints imposed by Covid-19, and resorted, wheneber possible, to on-line meeting platforms as means of dissemination, especially for workshops and the LIFE LINES final seminar.

In addition, the 6th and 7th CINEA monitoring visits had to be carried out on-line due to travel constraints from COVID-19, so no *in situ* field visits were performed on this regard. The same happened for the Thrid CA meeting.

Overall, the impact of Covid-19 on the project was not very significant, but in specific cases it has affected the timing of monitoring and dissemination actions, as well as the management of the project, causing some delays related to the re-scheduling and re-planning of the actions due to the adoption of approaches that would be in-line with current national health system recommendations.

Evaluation of Project Implementation

The LIFE LINES project accomplished most of the expected objectives and in many actions it even surpassed the expected execution indicators. There were setbacks in some interventions that will need to adjustments, but they do not hinder the achievement of most of the expected outputs and deliverables.

Evaluation of project accomplishments concerning conservation interventions was done, whenever possible, through a Before-After-Control-Impact (BACI) approach to isolate the effects of the project from those related to other factors that may influenced the results. For some dissemination and awareness actions the impact on participants was assessed through inquires. Moreover we carried out a detailed comparison between the initial objectives and expected results foreseen in the proposal and the achieved results (Table 16).

Project implementation was slower than predicted in the original proposal due to the reasons already explained in the previous section (Main deviations, problems and corrective actions implemented). Even so, most of the times we were able to adapt our outputs and proceed with the dissemination in online platforms.

Amendments to the Grant Agreement, namely the extension of the project after the initial the proposed date were essential to successfully achieve all project objectives, because due to delays in carrying out some conservation actions, a minimum monitoring would not be possible for some actions without this extension.

Regarding conservation actions, over 25 methodological approaches, sampling techniques and assessments were deployed aiming the evaluation of 31 proposed solutions (see details in annex D.3_I).

A total of 19 solutions revealed to be favorable or high favorable meeting the purposes of implementation. Some solutions require a longer period of time to obtain more robust evidence as the data collected is still relatively scarce (e.g., roadkill data for medium-sized animals) or have equivocal results. The fact that animal may need time to adapt to new structures; and the interannual differences in weather conditions between reference and monitoring periods, which affect animal activity and detectability may have contributed to some unforeseen results. It is expected that for some interventions we only be able to retrieve evidence for some actions after the accumulation of data over longer periods.

Replication of dissuading and automatic monitoring devices is now being negotiated with Ascendi, a major highway operator in Portugal. Also E-Redes aims to install the ECO- HAL A2S pole frame in new projects remodulating projects of medium voltage power lines due to its high success in preventing electrocution. This is intended to be done country wide and abroad (e.g. Cabo Verde). IP already includes vegetation management and measures aiming to reduce roadkill and enhance connectivity in the new maintenance contracts for all Portuguese districts. However, none of those actions are have already being implemented and no results of the replication efforts are available yet.

Awareness and dissemination actions were a benchmark of this project. We were able to reach a wide variety of societal circles, either through environmental awareness actions, workshops and training, technical-scientific outputs and seminars ant incorporation of the project Final Seminar in a large international event – IENE 2020 International Conference on the theme "LIFE LINES- Linear nfrastructure Networks with Ecological Solutions". Also, a great effort was deployed in regularly deliver news in several media platforms, reaching a wide public. For that highly contributes the emission of radio spots, video teasers and a documentary to be broadcasted in national television in July 2021. When enquires were made a large majority of enquired people acknowledge the importance of conserving biodiversity and of the project actions to achieve this.

As a drawback we acknowledge that more enquires should have been done. Additionally actions predicted to be done in-person but changed to online due to Covid-19 restrictions, although in some circumstances allowed for a larger audience, we fell that we recached this persons less deeply.

The number of products and technical-scientific deliverables produced along the project was outstanding, with relevant contributions to policies and decision-making processes. Among these we highlight the Best Practice Guides that have been produced, Internal Standards for stakeholders, along with the almost finished Road Verge Management report that arose from an unexpected change in reinforcement of fire control legislation. We expect these outputs to be further disclosed and publicized in the After-LIFE period, and integrated and reproduced following IP normative, the CTALEA group, the Wildlife Roadkill Monitoring Program and the Municipal Committees for the Defense of Forest Against Fire under the coordination of CIMAC. Along these, other useful tools produced during the project will also be adopt and fostered by these groups, such as the National Roadkill database, the LIFE LINES App, the multi-user platform, and other devices.

The theme of wildlife roadkill and the need to minimize reached the National Parliament after LIFE LINES interventions and awareness actions. Since 2018, to meet the proposals from three different political parties a "Multidisciplinary Working Group" was created by the Portuguese Government (Resolution 42/2018, 28 February) to develop a "Program for Monitoring and Minimizing Wildlife Roadkill on the National Road Network". Some members od the LIFE LINES team are represented in this group and are already preparing proposals for (1) using the NRDb developed in the framework LIFE LINES to identify priority locations to interve and (2) a program for roadkill monitoring and application of project solutions to mitigate it. Many other after-LIFE actions, including a diversified portfolio of awareness and dissemination actions at the local, national and international levels are also predicted. Please see Annex F.4_I for further details.

Table 16 presents a balance of project execution, taking into account the proposed objectives and tasks, with an evaluation of each action.

Table 16 - Comparison between the initial objectives and expected results foreseen in the proposal and the achieved results. A brief description of the evaluation resuming actions' implementation is provided weighing both expected and achieved results.

Action	Objectives and results	Achieved results	Evaluation
A.1 – Completing and updating of baseline characterization	*Objectives:* 1. Systematization of information and complement of ecological characterization to inform conservation work *Expected results:* 1. Construction of the project database 2. Two functional connectivity maps 3. Remote detection of invasive plants	All main goals and expected results were achieved. Most indicators have been exceeded.	This action was successfully accomplished during project execution. Despite the delay, and higher costs all the information needed for further actions (mostly C) was gathered in advance and was used do define or make adjustments to conservation actions. (see deliverable "Action A.1 non-technical report)
A.2 – Compilation, structuring and implementation of national database and multi-user web platform	*Objectives:* 1. Identification and characterization of existing databases 2. Definition of database technical specifications using free software 3. GIS database and computer platform online *Expected results:* 1. Creation of a National Database of fauna mortality 2. Development of an online multiuser platform 3. Database users: 4 institutions, 6 academic researchers or students, 8 professionals, 4 NGOs, 20 regular citizens 4. Partnerships with at least 2 other biodiversity data platforms 5. Dynamic link to the app 6. At least 50 000 mortality records introduced	Main goals were reached. Expected results 1, 2, 5 and 6 results have been fully achieved or exceeded. Expected result 3: the platform does not allow to identify institutional users of the NRDb, but we gathered that information for App users (see C.4), which generally complies with expectations. Expected result 4: contacts were iniciated to share data with national and international platforms, we expect this task to continue in the After-LIFE period. App is fully operational and linked to NRDb. NRDb totalizes 121 532 records	The database and core related structures were successfully accomplished. However this is a dynamic and ever in progress database that is predicted to be regularly updated, and efforts to add other already existing data (from entities and external experts to the Project) are continuously being made. Data from road sub-concessionaries were included after joint meetings with UEVORA, IP and each entity. We will still work in expected result 4 in the After-LIFE period to share data at least with "Biodiversity for All" and "Global Biodiversity Information Facility"
A.3 - Project implementation, licensing, procurement of permits and contracting procedures necessary to actions C	*Objectives:* 1. Make the inventory, compile and obtain all technical, legal and administrative documentation necessary to actions C *Expected results:* 1. All technical and legal documents necessary to launch the execution of actions C were compiled 2. All the documents necessary for actions C were available at	Goals and expected results have been achieved, although with some delay comparing to the initially proposed date.	The heavy administrative work and government authorizations that were required to fulfil this action are the main cause for the delays. This was a major drawback to accomplish some of the project deadlines. Despite this, the expected conservation actions' contracts were granted and conservation actions were finished at time to allow for monitoring actions, not hampering the

	the granting stage or contracts had already been granted.		achievement of C actions objectives.
A.4 - Development, testing and evaluation of automated systems of monitoring and/or deterrence	*Objectives:* 1. Development of a mobile mapping system to automatically detect dead animals on roads 2. Development of fixed systems for detection and monitoring of large birds in power lines *Expected results:* 1. One new and one improved mobile system to map small fauna road-kills 2. Three automatic ultrasonic deterrent devices for rodents, owls (to decrease roadkills) and large birds (do avoid electrocution) 3. Replication of at least some devices created with possibility of production/ commercialization, in post-project period	All the hardware and software for the automated systems were built, developed and tested. Dissemination and promotion of the devices was performed in several scientific and technical meetings, but with scant adhesion from stakeholders. This tasks will continue further during the After-LIFE period.	The 3 deterrent devices were built and tested and improved when necessary. A new prototype of smaller dimensions and higher autonomy was developed during the project to automatically monitor small birds and amphibian roadkills. Automatic identification is based on machine learning algorithms. Among the devices, we believe that the automatic roadkills and the deterrent for large birds have potential to be replicated and thus have a higher probability of production/ commercialization, in the After-LIFE period.
A.5 - Installation of autochthonous plant nursery for conservation actions	*Objectives:* 1. Installation of nursery for production of plant material (plants and seeds) necessary for the conservation work provided in actions C. *Expected results:* 1. Adaptation of a building for installation of plant nursery 2. Training of rural workers for operational activities in the nursery 3. Production of woody and bulbous plants necessary for conservation work	Objective and expected results attained.	This action was successfully accomplished during project execution. A new location had to be found, since the proposed one in the initial project was no longer available. However, this did not hinder the accomplishment of the action in due time.
A.6 - Development of prototypes for deterring avifauna in medium voltage lines	*Objectives:* 1. Test and develop a new typology of support for medium voltage power lines to minimize collision and electrocution by birds *Expected results:* 1. New typology of support for medium voltage lines, "Eco horizontal treadmill" 2. Cooperation between various entities with intervention in the thematic area of work (partners, collaborators and	Associated beneficiary Quercus and collaborator E-REDES developed an innovating pole frame called ECO- HAL A2S which aimed to reduce the mortality from electrocution and collision at the same time	The implementation of this action was delayed due to the withdrawal of the initial beneficiary from the project; an amendment was made to include QUERCUS as Associated Beneficiary. We were, however, able to comply with the previewed objectives and accomplish the desired results.

	entities of Monitoring Committee)		
A.7 - Elaboration and approval of Internal Standards of guidance to support management in post-project	*Objectives:* 1. Develop and internally approve a set of standards, involving both guidelines for internal teams and subcontracting *Expected results:* 1. Existence of a set of internal rules that bind IP technical bodies to apply good practices of the project 2. Future implementation of a set of standards that ensure the sustainability, maintenance and replication of investments made	Internal Rules Approved, which include the measures applied in LIFE LINES project that have been considered efficient. Terms of reference for the actual and future Road Maintenance Contracts (of all districts) have integrated better practices in what concerns vegetation management and invasive species control.	The deliverable "INSTRUÇÃO TÉCNICA GR.IT.AMB.001 - MEDIDAS DE PROTEÇÃO DA FAUNA" was produced. The extent of the project beneficiated this action since we were able to integrate monitoring results in the norms and guidelines for future projects and management plans. Dissemination among collaborators was and will continued to be performed through workshops and training sessions
C.1 - Integrated Mitigation of the reduction of conductivity and permeability of the landscape in national and principal roads.	*Objectives:* 1. Mitigation of the identified roadkill hotspots with solutions of different types and adapted to each target group 2. Mitigation of the impact caused by linear infrastructure on landscape connectivity. *Expected Tasks/Results:* 1. Dry ledge installation in five culverts 2. Fence installation/ rectification for guiding fauna on 7 culverts 3. Placing L-shaped fence in about 16 km of roads 4. Installation of light reflectors to dissuade owls from approaching the road 5. Cutting / harvesting of vegetation on verges and to deter the presence of small mammals 6. Installation of amphibian roadkill mitigation measures (barriers and culverts) 7. Design and installation of barriers to elevate flight height 8. Placing and affixing tight mesh metal grids on road slopes 9. Installation and operation of two electronic devices for deterring owls' and small mammals' presence 10. With the previous measures/structures we predict a 20% reduction of fauna roadkills at the IA and 10% at the SA.	All tasks were accomplished: Task 1: Dry ledges were implemented in 6 culverts, instead of 5. Task 2: Fences installed/ repaired in 6 culvert locations, after site evaluation. One of the sites already had one private fence. Task 3: About 32 km of existing fences at IP2 were replaced and a complementary L shape net was installed. Task 4: 100 wildlife warning reflectors were installed along a 1200 km-long segment of road in EN4 Task 5: Road Maintenance Contract started in 2019 and included the LIFE LINES specifications Task 6: amphibian barriers and the culvert adaptations installed in EN114 Task 7: Barriers were installed at two sites in EN114. Task 8: Nets were applied in two 500 m of EN4 stretches on both sides. Task 9: The devices were developed and installed. Task 10: Monitoring results show a reduction for amphibian species at the location of mitigation measures, overall reduction	A large delay in this action is mostly due authorizations and long administrative process required to perform some actions. E.g., the new Road Maintenance Contract was approved by the Government very late. Despite the delays and changes we keep the same expected results concerning the reduction of roadkill. All tasks were deployed in time of monitoring. The extension of the project was essential to accomplish that.

		for birds, bats, owls, and some carnivores.	
C.2 - Potentiation of the verges and marginal parcels of roads infrastructures as shelter areas, refuge, food and / or displacement.	*Objectives:* 1. Control and eradication of exotic plants with improved techniques on national road verges 2. Promote specific training to the elements of the internal IP monitoring team detect and inform invasive alien plants 3. Use of areas owned by IP near the roads to promote autochthonous flora and butterflies with the use of biodiverse seed mixtures developed in C.6. 4. Installation of a strawberry tree hedge to elevate owl flight *Expected results:* 1. Two areas totalizing 4 ha, managed as biodiversity (flora and butterflies) refuges 2. Successful control of invasive woody alien plants with multiple interventions 3. Prevention of introduction and rapid detection and control of new nuclei of invasive alien woody species 4. Evaluation of the efficiency of the strawberry tree hedge in owls roadkill mitigation	Selection of all sites to intervene was done. Task 1: intervened plots for micro-reserves totalized 5.5ha. Task 2: Plan to Control Invasive Species was implemented, previewing the application of multiple improved techniques to control invasive species. Initial control was applied in 58 plots at EN4 and EN114, in a total amount of 7.073 m2. After budgetary restructuring, 53 additional plots, (6.565,7 m2) were added to the initial area. Task 3: The 2nd and the 3rd phases of the Plan were performed to control new shoots that appeared in some plots. Task 4: Strawberry tree hedge planted. A reinforce of the plantation had to be performed after a drought year.	Although this action was accomplished, with indicators being outperformed, was delayed by complex administrative procedures. The new Road Maintenance Contract, was authorized too late and most of the works dependent of a specific season for implementation were delayed. Only strawberry trees did not achieve the desire dimensions to test their effectiveness.
C.3 - Development and installation of vertical road traffic signs	*Objectives:* 1. Creation and installation of vertical road signals in amphibian roadkill hotspots 2. Installation of vertical road alert signals for wildlife at two new places *Expected results:* 1. Installation of vertical road signals at five new roadkill hotspots 2. Creation and installation of vertical road signals for amphibians at roadkill hotspots 3. Evaluation of the efficiency of the new installed signals	Authorization from Road Safe National Authority for the new amphibian sign was granted and signs were placed.	Despite the delay the action the results were achieved
C.4 - Mobile Application to promote the collect of mortality data	*Objectives:* 1. Planning and development of a Mobile Application for Android to record animal roadkills *Expected results:*	The app is available to any user that uses android operating system. Since it started operating the App has 935 registered users 36 institutional users, 20 academics, 10 professionals,	Despite the delay, this action was successfully accomplished during project execution, and will continue to be maintained in the After-LIFE period.

	1. Working Mobile Application to record animal roadkills by any user 2. Using the APP regularly: at least 4 institutional users, 20 academic users, 10 professional users, 4 non-governmental organizations users, 100 individual users 3. At least 600 records for month	12 environmental NGOs and 40 regular citizens; and a total 1524 valid records, which are 24.6% of new roadkill records added to the RNDb.	
C.5 - Testing devices for deterring avifauna landing in medium voltage lines	*Objectives:* 1. Test and evaluate the new typology of support developed at A.6 *Expected results:* - Reduced mortality by electrocution and collision by birds	49 new pole frames named ECO-HAL A2S were installed along 9 km of medium tension power lines in Évora municipality. Results point out to significant redcutions in mortality.	The implementation of the action was delayed due to initial Associated Beneficiary withdrawal. Action was set into course later than expected. However, the objectives were achieved in time, mainly because of the extension of the project.
C.6 - Development, essay and application of biodiverse grasslands to promote biodiversity in linear infrastructures	*Objectives:* 1. Develop mixtures of seeds of native plant species with conservation interest for sowing in slopes of linear infrastructures in order to increase the plant diversity of these structures. 2. Promote butterfly habitats. *Expected results:* 1. Identify the specific composition of the seed mixture best suited for conservation actions; 2. Identify criteria to select best plant species to sown; 3. Creation of a database of plant species suitable to be used in verges and slopes of LI. 4. Identify plants that need to be raised in nurseries to avoid their collection in nature 5. Improve plant biodiversity in the intervened sites 6. Creation of micro-reserves with habitats favourable to the installation of new populations of target butterfly species and that can be useful for other small fauna species 7. Develop new germination protocols for species of high conservation interest	Action proceeded as expected. Task 1, 2, 3: A set of 1075 flora species registered in the project's intervention area was initially tested and included in the database to include in road and ecotrails seed mixtures following specific criteria on plant traits. Task 4, 7: Procedures for collecting, sowing and germinating the selected plants were tested and evaluated. Results are reported as annexes of this report. Task 5, 6: Micro-reserves were created in roads and ecotrails as previewed by C.2, C.7 and C.8. Plant diversity, small mammal and butterfly communities were monitored to attest benefits for flora and fauna.	Despite the delays associated with the green house installation, was possible to fulfil all required tasks. Several reports and deliverables were produced in the scope of this action.
C.7 - Mitigation measures and potentiation of roads in Évora municipality	*Objectives:* 1. structural adjustment of 9km the road to reduce roadkill including specific passages for	Action accomplished. Task 1: 7 specific ACO tunnels and 666 m of barriers on each side of the	This action was successfully accomplished during project execution, outperforming some indicators.

	amphibians and one barrier to raise owl flight 2. enhancement of road verges in the decommissioned railways (21km) for biodiversity, through the control of invasive alien plants and promotion of bushy and herbaceous vegetation; *Expected tasks/results:* 1. Installation of 5 amphibian tunnels 2. Installation of one wall for owls and other flying fauna t 3. Installation of 10 micro-reserves to promote autochthonous flora and butterflies 4. Removal, control and monitoring the woody invasive alien nuclei present along the disable railway. 5. Critical analysis of the implemented solutions evaluating its potential to be done in other locations	road were installed at two locations. Task 2: One barrier to elevate owl flight was installed in EM529 Task 3, 4: ten micro-reserves were placed in Évora ecotrail, that summed up a total of 2.15 ha. Task 4: Along the Évora ecotrail, several dense and almost monospecific nuclei of *A. donax* were selected, considering 8 control areas (0.66 ha). The control of invasive flora species was also carried out inside the area of some micro-reserves. Task 5: A report was produced to evaluate cost-effectiveness of the measures deployed at Évora municipality.	Barrier to elevate owl flight in EM529 suffered a delay due to difficulties with public tender procedures and provider negotiations. Invasive species control only possible for *Arundo donax* since it was the most prevalent species; not all initially planned plots could be intervened due to security reasons. Seeding and plantations were destroyed due to vandalism in two locations, nearer the urban areas.
C.8 - Mitigation measures and potentiation of roads in Montemor-o-Novo municipality	*Objectives:* 1. Structural adjustment of 15 km of municipal road with installation of low cost or traditional solutions (barriers and passages) to reduce amphibians and small mammals' roadkill 2. Essay new practices of vegetation management on verges; 3. Enhance the habitat for several small mammals and butterflies in a decommissioned railway. 4. Invasive alien plants control and promotion of autochthonous shrub and herbaceous in a decommissioned railway. *Expected task/results:* 1. Installation of barriers to guide small fauna to road safe-crossings (existing culverts); 2. Development of new practices of vegetation management on verges making compatible reduction of fire risk and conservation of biodiversity 3. Installation of ten micro-reserves to plant and seed	Action accomplished. Task 1: 4.300 m of newly designed concrete barriers, two ACO tunnels and two new concrete tunnels were installed. Task 2: new legislation reinforcing fire prevention measures implied heavy restrictions to vegetation in verges. Recommendations were produce in the document "Guide for Promotion of Biodiversity in Roadside Areas". Task 3: 10 sites along the Montemor-o-Novo ecotrail were selected to settle micro-reserves for the promotion of native flora species, and several butterflies and small mammal species, with a total area of 1.58 ha Task 4: 22 patches totalizing 0.84 ha were selected to control four woody invasive species present in the CMMN ecotrail.	Structural adaptation associated with task 1 exceed the original proposal because three new tunnels (two for amphibians and one for small mammals) not predicted on the proposal were built on low connectivity or high roadkill risk areas. Canvas barriers were put in place annually to reduce roadkill risk for small fauna, particularly amphibians. Task 2 implementation was delayed due to the new fire control legislation, but a new document was produced for Alentejo municipalities identifying recommendations on verge management accounting for specific road and fire hazards, while beholding their ecological functions. Task 4: The intervened area is smaller than that foreseen in the project, since some plots were located on high step slopes and private property.

	autochthonous and improve habitat for butterflies and small mammals. 4. Remove, control and monitoring the woody invasive alien nuclei present in about 17800 m^2 along the disable railway.		
C.9 - Operations in plant nursery to the conservation actions	*Objectives:* 1. keep the nursery in operation to assure all the needs for the project, replication after project and potential commercialization as ornamental plants *Expected results:* 1. Regularly meet all the needs for conservation actions of at least 9 woody and 11 herbaceous species	Objectives and expected results have been achieved and exceeded. The plant nursery was able to provide the foreseen conservation actions project needs and to build stock to sell or to support conservation activities. Project implementation allowed to produce, by the end of the project, 93 plant species, of which at least 80% of these species belong to project area natural habitats. By the end of the project, the plant nursery had in stock 13 210 plants of 93 species	This action was successfully accomplished during project execution. The nursery is fully operational and will continue production in the After-LIFE period.
C.10 - Promotion of "islands" of Biodiversity along the power lines	*Objectives:* 1. Promotion, through seeding and plantation of autochthonous vegetation of areas under the poles of power lines as "islands" of biodiversity. This will act as refuges or stepping stones for the movement of small fauna. *Expected results:* 1. Installation of at least three small "islands" covering a total area of 300 m^2 of biodiversity 2. Increase vegetation, butterflies and small mammals diversity in the intervention sites and their surroundings.	Objectives were achieved and surpassed. Installation works were completed in the predicted time. Micro-reserves in small "islands" were installed in 20 plots, including fencing and sowing in selected plots. Monitoring actions have involved sampling of both vegetation structure and composition, and diversity of small mammals and butterflies' communities.	The action was done in collaboration with REN. The action exceeded the proposed goals and indicators.
D.1 - Monitoring / evaluation of socio-economic effects of the project	*Objectives:* 1. Evaluate the socio-economic effects of the project on the local economy and population. *Expected results:* 1. Collecting data and updating on a quarterly basis of a grid of indicators that allows the evaluation of socio-economic effects	A list of 17 socio-economic indicators reflecting the direct and indirect impact of the project in the region was defined in CTAG meetings. A regular update of the indicators was made every three months.	Action started later than predicted. The delay was due to the necessity to find a consensus about the list of indicators and the procedures to measure them. After its definition, the action proceeded regularly.
D.2 - Monitoring / evaluation effects of the	*Objectives:*	Action accomplished with the elaboration of the	This action was successfully accomplished. Some

project on ecosystem functions	1. Evaluate the effects of the project conservation actions on ecosystem functions *Expected results:* 1. Increase landscape connectivity in the IA and thus increase the delivery of the main ecosystem services associated with it; 2. Increase the perception of locals and visitors about local faunal and floristic values as well as the existing threats posed by LI and the presence of invasive plants	Technical Report of Action D.2. Tasks involved the compilation of information concerning ecosystem functions and services in the context of project actions, namely on the following three main indicators: (1) ecological connectivity, (2) biodiversity and (3) people awareness	challenges were faced during the planning and execution of the action, namely regarding the quantification of ES.
D.3 - Monitoring / evaluation of the effects / impacts of conservation measures	*Objectives:* 1. Evaluate the efficiency of project conservation actions, whenever possible with a BACI methodology *Expected results:* 1. Project database updated with all the information generated during the monitoring 2. Updated cartography of at least 4 invasive species in the areas intervened for control 3. New (after conservation) maps of landscape/permeability for at least 15 species for comparison with maps produced before conservation (A1); 4. Specific reports about the efficacy of each type of conservation action.	Action accomplished. Monitoring involved several tasks aiming at (1) measuring the mitigation effects over animal mortality; (2) assess the use of specific structures to improve connectivity; (3) detect changes in behavior near deterring devices; (4) determine plant and animal responses to native and invasive vegetation management; (5) estimate overall biodiversity trends; and (6) developing and testing platforms for reporting data. During the project these tasks have accomplished to deliver the expected results, namely: 1. Compilation and update of database information; 2. cartography for 5 invasive species; 3. Landscape connectivity maps for 6 species, and permeability maps for 18 species; 4. Disclosure of specific reports and other deliverables based on monitoring data (Road verge management report, Best Practice Guides)	The delays in C actions lead to shorter monitoring periods than proposed for some measures. Also, restrictions from Covid-19 sanitary measures also hampered the fulfilment of some monitoring tasks. We tried to overcome this with a more intense monitoring (more surveys in a shorter time). A BACI approach was used most of the times, but in some cases it was not possible to envisage control areas with the same environmental conditions. The extension of the project was essential to accomplish the expected results.
E.1 - Communication Plan - Project website	*Objectives:* 1. Creation of the website of the project. *Expected results:*	Main goals and results were achieved as expected, with the disclosure of the main actions and tasks of the project. A total of 268 updates were performed.	The web page is operational and will remain in the After-LIFE period to allow the dissemination of the project outputs. Page updates were performed whenever needed,

	1. Presentation, dissemination of the activities developed and publication of various materials produced	The page views accounted 78 743 from 13 804 registered users, and visits from 112 countries.	which happened more frequently than the trimestral basis initially predicted.
E.2 - Communication Plan – Outdoors in the intervention areas	*Objectives:* 1. Ensure greater visibility to the areas involved in project works. *Expected results:* Installation of medium-sized placards in all areas of conservations actions (Actions C.)	Main goals and results were achieved as expected. One large outdoor and 64 medium size outdoors were installed in the intervention area	This action was successfully accomplished during project execution. Outdoors were placed at Actions C location as predicted. Due to vandalism, 13 medium sized outdoors had to be replaced.
E.3 - Communication Plan - Public disclosure sessions and contacts with the media	*Objectives:* 1. Define and approve graphic image of the project 2. Ensure broader communication and dissemination of project objectives, developments and results. *Expected results:* 1. Regular editing of press releases, organising press conferences and visits of media to the project activities. 2. Emissions of radio spots; 3. Organizing seminars to the general public.	Action objectives accomplished. Graphic image was defined and used since the beginning of 2016. Communication with National Coverage Media (press releases) was lower than expected. Organization of seminars is going as proposed. Overall, the project produced 727 news, including 15 in national TV, 175 in journals, 145 in communication websites, 308 Facebook posts, six radio interviews, 72 radio online news, and additionally, 72 radio spots.	Despite the lower coverage than desired in press releases, a visibility of the project has been achieved due to the efforts realized in producing news for several media platforms, granting access to different age and social groups. Key communication events associated with important project outputs boosted the project visibility: app release, documentary broadcast at the national television, the final LIFE LINES Seminar (associated with the 2020 IENE Conference).
E.4 - Communication Plan - Complementary works and materials	*Objectives:* 1. Production of a set of audio-visual materials that, in a transversal way, contribute to the dissemination of project objectives, developments and results. *Expected results:* 1. One project video documentary 2. 20 teasers to put online 3. 2 tutorial videos to support the app (action C.4) and roadkills and training actions 4. 10 radio spots	The general goals of the action were achieved. 20 teasers were put online, 72 radio events were transmitted in the radio. A documentary was also produced and an agreement with the SIC broadcasting channel was achieved in order to transmit it. Two tutorials were produced but the themes changed for the Tutorial APP LIFE LINES and the Project Summary, presented during the IENE 2020 International Conference. In addition, 20 thematic videos were produced and putted online.	All the materials produced during this action will continue available in the LIFE LINES site and will be used in future dissemination action in the After LIFE. The documentary was already transmitted in the SIC and is predicted to be transmitted at least one more time.
E.5 - Awareness and involvement of the academic community in collecting information/data.	*Objectives:* 1. Raising awareness of other professional researchers and other researchers for the use of the platform and app;	Several efforts were made regarding the raising awareness to collaborate more actively in the data collection to the national	The action was generally accomplished regarding the previewed objectives, but the initial expected indicators were not entirely fulfilled.

	2. Introduction of contents related to the project in curricular units of the Masters in Conservation Biology of the University of Évora; 3. Recruitment of UEVORA and FCUP students to validate data from mobile automatic monitoring prototypes. *Expected results:* 1. The creation of habits and routines, to contribute to changing mentalities of members of the academic community (students and researchers) in order to collaborate more actively in the data collection the national mortality database (A.2).	mortality database of the academic community. The project team presented a total of 9 lectures in different Portuguese Universities, orientated 6 concluded master thesis and 5 ongoing PhD, as well as all the dissemination efforts of workshops and seminars.	The action efforts will continue in the After LIFE were the importance of the thematic will still be disseminated by the team. The PhDs will still be developed.
E.6 - Training / Dissemination with the stakeholders	*Objectives:* 1. Enhance replication of project results and thus contribute to their demonstration objectives (thematic workshops) *Expected results:* 1. Ensure training and the dissemination of project results to stakeholders through the organization of 8 workshops production of 3 Good Practice Guides. 2. Adoption of good practices by at least 50% of workshop participants	The main goals of the action were fulfilled, since 12 workshops were organized and the team participated in other 10 by request. In the organized workshops, about 700 participants attended. Four Best Practice Guides were produced. Nevertheless only 12% of the participants that answer to inquiries admitted to adopt the good practices.	Material and program for the workshops and Good Practice Guides will be available in the site. The public have access to the recordings of 4 of the workshops, the presentations, support material produced and Best Practice Guides.
E.7 - Networking with other LIFE and not LIFE projects	*Objectives:* Ensure a set of contacts with the respective beneficiaries (LIFE projects), in order to exchange experiences and information *Expected results:* 1. The visit to the LIFE LINES of European experts 2. Visit of team members to projects (LIFE and non-LIFE) outside Portugal; 3. Participation of team members in Greenweek issues and other related European seminars / events; 4. Establishment of durable relations with the possibility of future enlargement; 5. Application / replication of project results to other	Action developed as predicted. The project was visit by 5 European experts, the team members visit at least two LIFE projects outside Portugal. In addition, the team participated in the Greenweek 2020 issues and other 16 related European seminars / events. The project already established two durable relations with the possibility of future enlargement. Until the end of the project, we were not able to identify the application / replication of project results to other geographic and socio-economic contexts, at least in the European area.	Objectives and results were mostly achieved. Strong net working with other projects and involvement with other European experts and teams was undertaken. This accomplishment previewed the establishment of networks with other teams and projects and the application / replication of the project results to other contexts.

	geographic and socio-economic contexts, at least in the European area.		
E.8 - Volunteer Program for young people	*Objectives:* 1. Involve local communities as well as groups of external entities in the pursuit and execution of conservation works. *Expected results:* 1. Creation of a Volunteer Program directed to different publics / groups, including a Youth Volunteer, another of Volunteer Associations and another of Corporate / Institutional Volunteering.	Action concluded as predicted. The Volunteer Program supported 151 volunteering activities and 3122 volunteers. The target audiences of the activities were Youth, NGO's, enterprises and mixed audience. Overall activities ensured the support native species propagation, invasive alien species control; seed collection, composting, reforestation activities, and plant nursery infrastructure works.	Action development as predicted. The Volunteer Program was complemented with other volunteer activities as the control of invasive species in Ecotrails and E.10 activities.
E.9 - Technical seminars to present the developments and results of the project	*Objectives:* Ensure communication, technical-scientific discussion and dissemination of project objectives and results. *Expected results:* Organize and promote three high-quality technical-scientific seminars.	Action concluded. Three technical-scientific seminars were organized, as well an international conference (IENE 2020). The Seminars had 440 participants attending it, 39 power point presentations and two books were produced.	Action developed as predicted. The book of abstracts of the first two seminars were not produced due to reduce number of presentations. Nevertheless, two books were produced in the scope of the final seminar.
E.10 - "Adopt a road", environmental educational/awareness program with local schools	*Objectives:* Public awareness of the school's public to the mortality of fauna on roads of two municipalities (Évora and Montemor-o-Novo) and adoption of a section of a road collect mortality data to the application of C.4 action. *Expected results:* 1. Involvement of young people in implementation of mitigation measures; 2. Regular use of the mobile mortality platform / application by young people.	This action suffered some changes in regard to the initial proposal. The environmental program was extended to several activities involving participants from young to elder ages. Environmental awareness actions at NIA - Environmental Interpretation Center were a benchmark of this action.	This action suffered a restructuration of the tasks deployed, managing to still comply with the main objectives of the action. The applicability of the initial proposal was hindered by constraints related with school programs' organization, and also for security reasons associated with traffic related risks. Nevertheless, the involvement of young people was a stronghold of this action. In addition, environmental programs were extended to other age groups which further contributed to a broader outreach of the project. Covid-19 pandemics had a relevant impact on the execution of the action, impeding further activities to take place.

E.11 - Layman Report	*Objectives:* 1. Creation of the Layman Report, which aims to ensure the communication and dissemination of the objectives, developments and results of the project, to a vast and non-specialized audience. *Expected results:* 1. It is expected that the results of the LINES project will be widely and effectively disseminated as well as the support given to it by LIFE program.	The layman's report is produced and published on the site. It summarizes the work of the LIFE LINES project for a general audience.	Action was delayed to accommodate the relevant results from the evaluation of actions effectiveness. Dissemination will continue in the After-LIFE period
F.1 - Project management	*Objectives:* 1. Creation and operation of a management structure that guarantees the proper execution of the project. *Expected results:* 1. Management structure that guarantees the proper execution of the project.	Main objectives and results were be achieved. In total, 30 CTAG, 277 CP, 2 CG meetings and 3 CA meetings were performed, and other 240 small meetings involving the project coordination and subgroups were made. LIFE LINES had seven visits of the NEEMO monitoring team.	The action complied with the proposed goals and indicators. Some adjustments on the composition of the CTAG, CG and CA had to be made due to reorganization of the departments and/or teams of some of the beneficiaries
F.2 - Compilation and Structuring the Indicators of Development of the project	*Objectives:* The grid of indicators to be used will include not only those provided for in the "Project Output Indicators" table, but also an additional selection of indicators to evaluate the evolution of each action. *Expected results:* Create and keep up-to-date a list of project development indicators that will allow an assessment of their appropriate development.	Action concluded. Objectives and results were achieved during the execution of the project; six updates were made.	40 indicators of the initially 170 met the target as predicted, 74 exceeded the predicted, 34 below expectations and 8 were not possible to quantify or the target value was not set previously.
F.3 - External audit	*Objectives:* Verification of financial compliance of the project with LIFE + requirements. *Expected results:* 1. Writing and sending to the Commission, within the anticipated timings, of the External Audit Report; 2. Verification of eligibility of 100% of the expenses incurred and presented; 3. The financial implementation / execution of the project as planned in the application.	Objectives and results were achieved	The Verification of financial compliance of the project with LIFE + requirements were fulfilled.

F.4 - Conservation Plan and Post-LIFE Communication	*Objectives:* 1. Writing of a "After-LIFE Communication and Conservation Plan" which will also respond to the obligations of any beneficiary of a project. *Expected results:* 1. The joint and participated writing of the After-LIFE Conservation and Communication Plan, and its submission to the Commission, within the expected timings; 2. The implementation of the provisions of the Plan by the various partners and in line with the agreement already in the post-project period.	Action proceeded as planned. A document reporting conservation and dissemination activities in the After-LIFE period was produced. The document identifies the tasks in which each beneficiary will be involved following the outcomes and products produced during the project.	Action was successfully accomplished. It is expected that the results of this project, through a strategically planned dissemination in the "After-LIFE Communication and Conservation Plan", will endure by extending its impact to a national scale by reaching stakeholders, policy and decision-makers.

The project impacted conservation policies because it will focus on strategic issues concerning biodiversity and related ecosystem services. The focus on EGI is particularity important. The project contributed to the implementation, at a regional level, of conservation actions based on sound science and rigorous planning that will promote ecological connectivity (and the many associated ecosystem services) affording benefits for both people and nature. These are key elements of the EGI strategy. Moreover, the project was major vehicle to inform stakeholders and the general public about what is a GI and what are its importance and benefits. The project interventions included solutions to reduce fauna mortality, promote fauna movement and provide refuges, which will contribute to the achievement of several goals of National and European and world Biodiversity strategies, including:

- The “National Strategy for the Conservation of Nature and Biodiversity for 2030 (Resolução do Conselho de Ministros nº 52/2028). The project contributes directly to the achievement 13 out of 30 goals. The goals are distributed among all the three main axis of the Strategy : i)improve the state of nature conservation (7 out of 11 gols); ii) promote recognition of the value of nature (3 out 5 goals); iii) foster the appropriation of natural values and biodiversity by society (3 out 14 goals);
- The European Green Deal and the new European Biodiversity Strategy for 2030, which stresses the need to develop a resilient Trans-European Nature Network supported by ecological corridors allowing the free flow of genes and individuals. The main input of LIFE LINES to the targets of EU 2030 Biodiversity Strategy is mostly through the support to the implementation of a Green Infrastructure. The following actions will directly contribute to this goal: reduction of road mortality and of barrier effects in the IA and among the 2.000 sites of Monfurado and Cabeção (Actions C.1, C.3, C.7 and C.8); (ii) promotion biodiversity refuges for small fauna and flora (C.2, C.7, C.8 and C.10); (iii) promotion of habitat corridors and patches that will act as stepping stones for small fauna movement (C.2, C.7, C.8 and C.10);

- The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) strategy that reports transportation infrastructure as a main driver of biodiversity loss, and the need to revert it;
- UN SDS goals, with emphasis on Goal 15 – "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss",
- The forthcoming United Nations "Post-2020 Global biodiversity after the recognized failure of the Aichi Target 5, associated with the loss and fragmentation of natural habitats.

Analysis of benefits

Within the scope of LIFE LINES project, more than 748 000 € were invested in more than 180 local companies; 27 direct jobs were created; about 20 collaborations and protocols were signed; nearly 300 people were trained and qualified to perform conservation, 15 academic works were produced; about 4000 persons and 62 institutions were involved in volunteering work; more than 60 talks were presented in scientific events; and about to 300 awareness and training actions were carried out. The project had a high public visibility through social networks and the website, reaching more than 370 000 people and more than 78 000 views of our contents. All of those actively contributed to the development of local nature conservation, economy and tourism, helping the effects of LL networks to be included in local, national and international agendas.

The project contributed, direct or indirectly to enhance nine Ecosystem Functions/Services including seed dispersal; pollination; biological control; security and road safety; creation of habitat for species; promotion of genetic diversity; outdoor recreation and tourism; learning and inspiration for culture and science; and spiritual experience and sense of place. This was mostly done through enhancement of habitats, species diversity and ecological connectivity an through aware and dissemination events.

Regarding the key component, i.e. conservation actions, LIFE LINES grounded on three important strategies: (1) use and demonstrate the efficacy of low budget already established solutions that can easily be generalized and replicated in similar systems in other areas or transferred to other systems (dry ledges, fences, canvas barriers, vegetation management); (2) test innovative solutions of different types (robotics, mechanical devices, reflectors aiming other groups different from the ones originally target, etc.), that if successful have the potential to be adopted all across the EU; (3) compare efficiency of different solutions (e.g. measures aiming to reduce owl roadkill and barriers of different types for amphibians) in a cost-effectiveness framework and advice on future use of these solutions. A critical analysis of the methods and devices tested in each intervention, based on pre-and post-intervention monitoring was done in the framework of action "D.3 - Monitoring/evaluation of the effects/ impacts of conservation measures" (annex D.3_I). With this we were able to identify/select interventions susceptible of replication to other locations/territories for the resolution of identical problems, based on an assessment of their ecological effects and cost-effectiveness evaluation, as well as unfavourable solutions whose replication should be avoid at this stage. We also recognized interventions or devices that need further testing and monitoring before being confidently recommended for implementation elsewhere. Most assessments were reverted to Best Practices Guidelines, which will help stakeholders to know and decide about best solutions to replicate in the future.

Most existing linear infrastructures in the EU and worldwide were built before the legal requirement to perform an Environmental Impact Assessment, and often do not took into account conservation needs. Moreover, many marginal vegetated areas associated with LI have a high potential as biodiversity refuges or corridors whose value was assessed and demonstrated in the LIFE LINES. This will help to suppress caveats associated with LI and, will inspire the use of these solutions across most linear infrastructures network. Thus, the replicability potential across Europe and worldwide is very high. Most solutions are policy-dependent. However, public awareness of the problem and pressure for their solution is rising inside and outside the project area, which hopefully will lead to new conservation legislation and decisions.

The project also supported, indirectly Natura 2000 conservation through the benefit of several species included in Annex I (*Bubo bubo, Ciconia ciconia, Milvus milvus, M. migrans, Circaetus gallicus,Hieraaetus pennatus, Alcedo atthis, Lulula arborea, Sylvia undata*,….) of Birds Directive or Annexes II/IV (*Lutra lutra, Felis silbvestris, Microtus cabrerae, Rhinolophus* spp, *Pipistrellus* spp; *Miniopterus schreibersii; Discoglossus galganoi, Alytes cisternasii, Coluber hippocrepis, Chalcides bedriagai, Emys orbicularis, Mauremys leprosa, Euphydryas aurinia*…) of Habitats Directives.

Key Project Level Indicators

The Key Project Indicators were one of the hardest tasks to carry out . The platform is not user friendly and criteria to choose indicators in often subjective. Also, for some indicators there only limited range of values were possible , despite in some indictors LIFE LINES surpassed this values. We acknowledge that this part the report may not fulfil the Commission expectations, but we did our best and we are available to improve it, if necessary.

The excel file directly downloaded from the KPI European Commission's page is in Annex KPI_I.

FINANCIAL PART

Comments on the financial report

For the reasons explained previously, complex and slow, administrative procedures required by law to hire people and acquire goods and services, despite the efforts to speed them up, have been the main forces delaying the project implementation. After March 2020, in the critical final phase of the project, Covid-19 restrictions also were a strong drawback leading to deferring or adaptation of some actions. For those reasons an amendement requesting and extension of 10 months, until 31 May 2021 of the project was sent to and authorized from EASME.

Table 17 summarizes all the expenses for the entire length of the project.

Table 17 - Summary of project expenses by category comparing with proposed budget. The last column shows the percentage of execution

Budget breakdown categories	Budgeted costs in €*	Costs incurred from the start date to 30/04/2018 in €	% of Budget
1. Personnel	2 061 181.00	2 444 308.60	118.59
2. Travel and subsistence	270 821.00	122 380.24	45.19
3. External assistance	1 309 611.00	1 302 819.14	99.48
4. Durable goods			
Infrastructure	852 485.00	739 018.66	86.69
Equipment	165 612.00	70 494.60	42.57
Prototype	56 606.00	50 639.28	89.46
5. Land purchase / long-term lease			
6. Consumables	371 551.00	91 896.61	24.73
7. Other Costs	106 740.00	65 331.96	61.21
8. Overheads	345 878.00	325 971.67	94.24
TOTAL	**5 540 485.00**	**5 212 860.76**	94.09
60% Co-financing	3 324 291.00	3 127 716.46	

Of the applied budget, 94 % have been executed. Only the costs in personnel are above the applied (about 19%). These can be partially explained as reported previously and accepted from EASME, 93500 Euro UEVORA External Assistance were moved to Personnel to hire a project Manager that simultaneously supervised communication. Moreover, the project extension implied also the continuation of additional staff contracts because a lot od monitoring work still need to be done. Also, the value of the grants paying additional personal were updated in 2020 by national law in about 10%.

Also, the budget proposed to be used from FCUP in the contracts with Universidade do Minho in action A.4, was moved to Personnel Costs category, in the same action, because the prototypes were directly developed in FCUP without necessity of acquiring services to Universidade do Minho. Additional personal budget was for updating the grants of FCUP technicians (Diana Guedes and Hélder Ribeiro) for testing and improvement of the prototypes. Those changes were already reported in the midterm report.

The equipment costs correspond to about 43% of the proposed budget. The main reason for the low spending is that some equipment (e.g, automatic monitoring cameras) were acquired through other sources of financing and the that part allocated to LIFE LINES was lower than predicted.

Travel is one of the categories with a smaller rate of expending (45%). Part of this can be explained by the following reasons: (1) many in-person missions within the country and abroad, were replaced by online events due to Covid-19 restrictions; (4) some beneficiaries due the particularities of their accounting systems (e.g., CMMN) cannot allocate most travel expenses to the project

The spending rate of consumables is very low because many tasks associated with these expenses have been included in Road Maintenance Contract of IP which already comprise the works and materials

necessary to perform conservations actions C.1 and C.2. Thus about 183542 Euro were moved from onsumable to External Assistance.

The consolidated financial formmand detailed budget executions for each of the project beneficiaries are shown in Annex Finance_I.

Summary of Costs Incurred

Table 18 Inform about the expenses per category by project beneficiary

Globally expenses are within the predicted in the application. The main exception is UEVORA expenses which are about 6% (108 964 €) above the predicted. On the contrary IP expenses are 25% (229 551 €) below the requested value. A transference of budget between both beneficiaries (108964 Euro from IP to UEVORA) to cover the UEVORA surplus have already been agreed, after informing the monitoring team, among both institutions to cover those differences. The over budget UEVORA expenses refer to inscreased expenses in personnnel and travel which were needed to cover the higher work than predicted in monitoring ativities that were extended for 10 months). This expenses also cover the hiring of a person to assist the secretariat of The final LIFE LINES Seminar whose changing to an online format implied a huge work in contacting and negotiating with companies organizing onlibe events and with participants to make new arrangements for their participation. This person also assisted in the final report writing facing the massive work that was needed to accomplish it.

Minor over budget execution by other beneficiaries (FCUL. MARCA, QUERCUS) are covered by lower execution from others (e.g. .CME, CMMN, UA).

Table 18 - Expenses per category and by project beneficiary comparing with the proposed budget.

Participant's short name	DIRECT eligible costs with non-recoverable VAT (€)									OVERHEADS (€)	Total ELIGIBLE costs with non-recoverable VAT	Proposed in the application (€)
	Personnel	Travel	External Assistance	Infrastructure	Equipment	Prototypes	Consumables	Other direct costs	Sub-total direct eligible costs			
UEVORA	1 300 361.96	92 942.93	203 483.81		41 369.62		25 553.95	46 372.85	**1 710 085.11**	119 704.44	**1 829 789.55**	1 720 825
CME	268 290.16		20 910.00	371 004.13					**660 204.29**	46 210.70	**706 414.98**	825 504
CMMN	182 362.30		33 927.01	344 314.23			13 406.27		**574 009.81**	26 061.22	**600 071.03**	685 237
FCUP	191 169.46	12 563.80			3 608.71	19 439.28		11 981.57	**238 762.82**	16 713.40	**255 476.21**	207 228
IP	273 968.09	4 807.81	819 325.29				14 497.98		**1 112 599.17**	77 076.69	**1 189 675.86**	1 489 227
MARCA	78 055.53	1 143.96	37 288.07	23 700.30	25 516.27		23 623.35	5 185.55	**194 513.03**	12 435.83	**206 948.86**	199 696
QUERCUS	75 365.65	10 640.99	104 000.00			31 200.00	691.62		**221 898.26**	15 532.28	**237 430.54**	223 524
UA	74 735.45	280.75	83 884.97				14 123.44	1 791.99	**174 816.61**	12 237.11	**187 053.72**	189 244
TOTAL	2 444 308.60	122 380.24	1 302 819.14	739 018.66	70 494.60	50 639.28	91 896.61	65 331.96	**4 886 889.09**	325 971.67	**5 212 860.76**	5 540 485

During project implementation Marca – ADL, as other beneficiaries, requested some budget adjustments to ensure better accomplishment of project objectives, but no formal changes were made. Regarding Marca, all former requests in EASME and CINEA letters were attended to in the best possible way.

Regarding FCUP budget changes, which were substantial despite the value only slightlty increase, the explanations are as follows: :

- Action A.1 Necessity to repair the spectrophotometer, damaged during a field trip of the project
- Action A.4. In the original proposal, the University of Minho was indicated as the main provider of materials to the project. The University of Minho was substituted by the FCUP in order to maintain the final costs of Task A4 as previously planned. Changes were introduced in the budget of Action A.4 related to hiring personal. The original grants were organised as follow:
    1. One external service between 21/10/2016 and 21/02/2017 for Hélder Ribeiro.
    2. One grant between 1/3/2017 and 28/02/2018 for Hélder Ribeiro.
    3. One grant between 1/1/2017 and 31/03/2017 for Mark Franch.
    4. One grant between 1/1/2018 and 31/03/2018, further extended until 31/3/2019 for Diana Guedes.
    5. One external service between 01/03/2018 and 31/03/2018 for Hélder Ribeiro.
    6. One grant between 1/4/2018 and 28/02/2019, further extended until 30/4/2019 for Hélder Ribeiro
- Action D.3. After finishing successfully the Actions A.1 and A.4, the FCUP team did not expend totally the budget allocated to Action A.4 because:
    1. The prototypes resulted cheaper than expected previously, as we found better technology for the monitoring prototypes at cheaper prices. The technology in camera devices evolve very fast and every year new solutions are available at better costs.
    2. We manage to perform all our tasks with shorter fieldwork periods.
    3. Fieldwork was also cheaper as FCUP uses its own rules which result in lower expenses. For example, subsistence allowance is only €20 for MSc grant-holders.
    4. In consequence, we introduced two additional changes in the budget of Task D3:
        - We hired a new MSc grant-holder (Joana Silva) to help in monitoring prototypes for more six months (1/11/2019 – 31/04/2020), further extended until 30/06/2020.
        - We bought a workstation for analysing the images collected with the MMS3 prototype (more than 3 millions). We had used during the project a workstation kindly provided by University of Minho, but unfortunately this workstation was needed for other purposes.

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Accounting System

Following the “Financial and administrative Guidelines (Annex X to the Grant Agreement), the partnership defined since 14th September 2015 some procedures to adapt during LIFE LINES project. UEVORA as beneficiary coordinator is the responsible for all the communications with EASME/CINEA, each team member sent a “Allocation statement” completed and signed for the legal representative. Each team

member sent monthly a worksheet completed with hours for action dedicated to the project with day registration.

Each beneficiary creates a Center of Cost in their own accounting system to allow a clear monitoring of the expenses and revenues associated with the project. All the beneficiaries maintain the originals of the documents, to a period of 5 years. The financials documents of all the beneficiaries (invoices, receives, etc.) are in a Google drive created for LIFE LINES and regularly updated. All the procedures with personnel costs, travel, equipment, consumables, external assistance, other costs have the reference of the project LIFE14 NAT/PT/001081. In the first meeting of CTAG (14th September 2015) these procedures were approved and applied since then..

The University of Évora uses an integrated management system, called SIAG - AP (Integrated Management Support System - Public Administration). This system has a Center of Cost clearance module, where each of the University projects is created individually. In this Center of Costs all the revenues and expenses of the project are imputed.

All expenses are authorized higher, in accordance with the delegation of powers inside the University, even though they are carried out under funded projects. Each expenditure of UEVORA is sent by the project coordinator. Expenses from other beneficiaries are sent by them to UEVORA LIFE LINES administrative supervisor every three months and are included in the project cost center. Regarding to personnel costs, the timesheets of each researcher, in the approved and current model, are sent monthly to the University Administrative Services.

The same procedures are utilized by IP and other public organisms (municipalities and universities) that are regulated by the same mandatory procedures. With the exception MARCA-ADL and QUERCUS that have their own internal rules.