LIFE Project Number

LIFE15 NAT/ES/000757

Final Report
Covering the project activities from 01/10/2016 to 31/12/2022

Reporting Date[1]
<30/03/2023>

LIFE PROJECT NAME or Acronym
LIFE TRITÓ MONTSENY

Data Project

Project location:	Barcelona
Project start date:	<01/10/2016>
Project end date:	<31/12/2020> **Extension date:** <31/12/2022 >
Total budget:	2.971.276 €
EU contribution:	1.782.764 €
(%) of eligible costs:	60 %

Data Beneficiary

Name Beneficiary:	Diputació de Barcelona
Contact person:	Mr. Daniel Guinart Sureda
Postal address:	Comte d'Urgell, 187, 08036, Barcelona, Spain
Telephone:	34 934 022 428
E-mail:	guinartsd@DIBA.cat
Project Website:	www.lifetritomontseny.eu

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

CHECK LIST

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*	✓
Index of deliverables with short description annexed, in English *In electronic version only*	✓
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*	✓
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.	✓
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)*	✓
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**	✓
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)	✓
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	
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)*	✓
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)*	✓
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*	✓
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	✓

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

1. Table of contents

2. List of key-words and abbreviations

LIFETM	LIFE Tritó Montseny (LIFE15 NAT/ES/000757
DIBA	Diputació de Barcelona (Barcelona Council)
DIGI	Diputació de Girona (Girona Council)
GENCAT	Generalitat de Catalonia (Autonomous Government)
FORCAT	Forestal Catalana (Catalan Forestry)
ZOOBCN	Zoo de Barcelona (Barcelona Zoo)
LIC Montseny	LIC Massís Montseny (ES5110001

BC	Beneficiary coordinator
BOE	Official State bulletin
BOP	Official Province bulletin
AB	Associated Beneficiary
ACA	Catalan Water Agency
CARIMED	Monitoring of Mediterranean Rivers
CORINE	Coordination of information on the environment
CPF	Forest Property Centre
CRARC	Amphibian and reptile recovery centre of Catalonia
CTFC	Catalonia's Forest Science and Technology Centre
CREAF	Ecological and Forestry Applications Research Centre
CSIC	Superior Council of Scientific Investigations
DOGC	Official Journal of the Generalitat de Catalunya
GBIF	Global Biodiversity Information Facility
GLM	Generalized Linear Model
ISIS	International Species Information System
IUCN	International Union for Conservation of Nature
LBOM	Large organic matter
FBOM	Fine organic matter
LIC	Llocs d'Importància Comunitària (Sites of Community Importance)
LCA	Land Custody Agreement
LTER	Long-term Ecological Research
MAES	Mapping and Assessment of Ecosystems and their Services
MAPAMA/MAGRAMA	Ministry of Agriculture and Fisheries, Food and the Environment
PN-RB MS	Montseny Natural Park and Biosphere Reserve
SILTM	LIFETM information system
SIMSY	Montseny information system and database
SDF	Standard Data Form
SPARKS	Single Population Analysis and Record Keeping System
UAB	Autonomous University of Barcelona
UdL	University of Lleida
ZGT	Supervised Management Areas

3. Executive Summary

Aims of the project:

The "LIFE Tritó Montseny" project (LIFETM) is aimed at improving the conservation status of the Montseny brook newt (*Calotriton arnoldi*), an endemic amphibian classified as 'critically endangered' by the IUCN and one which is facing a long list of challenges. The main objective of LIFETM is to not only improve the conservation status of the Montseny brook newt but also its riparian habitat.

Outputs and results:
Most of the project activities have been carried out according to the time schedule; however, there were some delays in the execution of some actions, which led to a two-year extension of the project. LIFETM's main achievements have been:
- The consolidation of actions that already existed before this project started such as captive breeding, the monitoring of the newt and environmental education
- The wide dissemination of the project's execution and the big expectations created
- The integration of several scientific and technical teams
- Establishing a good monitoring and research network
- The broadening of essential knowledge for the management and conservation of *C. arnoldi*.

The LIFETM project has had a direct impact on the riparian habitat where the Montseny newt resides, especially with regard to the quality of mountain streams and the river forest.

Captive breeding and the introduction of bred specimens has increased the number of populations and the Montseny newt 's home range.

The monitoring of the *C. arnoldi* population and its habitat's environmental variables has provided new scientific knowledge on the dynamics of its environmental requirements, on the use of the extraction of natural resources (such as water or wood) and its effect, as well as on the result of applying measures of regulation.

The environmental information and education programs developed within LIFETM (the training and rise in awareness of schoolchildren, visitors, forestry professionals and the scientific and university community) have had an indirect impact on the protection of riparian habitats and its biodiversity.

The specific operational objectives achieved are:

- Obj.1: **To ensure the conservation of *C. arnoldi*'s wild population**, **its genetic conservation and expand its geographic distribution**. The actions carried out have made it possible: to increase the number of newt populations, as planned, while new reintroductions have been carried out, creating and reinforcing five new populations in streams with better habitat conditions. Additionally, to consolidate breeding centres as genetic reservoirs and producers of newts for reintroduction. The three breeding centres are working properly, with 120 new aquariums. The three objectives linked to the breeding centre have been totaly achieved and others three realted to the distribution area the results have been partially satisfactory.
- Obj.2: **To increase the hydrological quality and ecological flow of streams with *C. arnoldi***. Actions such as the modification or removal of water catchments or the improvement of water tanks with closing buoys have made it possible to achieve this goal in five streams. Wàter catchments have been reduced and rain harvesting systems have

been implemented as foreseen, but could not be assessed the increase of environmental flow due to insuficient data and the improvement of wastewater becouse water tests in the streams concluded that no action was necessary.

- Obj.3: **To minimize threats to *C. arnoldi* within the riparian habitat**. Connectivity at the intersections between roads and six streams with *C. arnoldi* were improved; and there was an increase in the area of native riparian forest in these streams. Better than expected results obtain with the actions carried out.
- Obj.4: **To establish proper legal coverage, with the conservation plan for *C. arnoldi***. The Montseny Newt Conservation Plan (also called Recovery Plan) is available and is currently in the public exhibition phase. The new protection law for LIC Montseny (Act 127/2021, art.4.12b), and its specific citation for six-year reports on the conservation status of species referred to in art.4 of D. 2009/147/EC and listed in Annex II of Directive 92/43/EEC for LIC ES5110001 Massís del Montseny The recovery plan has failed to be approved although the technical document has been drafted.
- Obj.5: **To increase scientific and technical knowledge to ensure good management**. This objective has been achieved by expanding on the knowledge of *C. arnoldi* 's biology and its ecological requirements, getting an annual status population indicator and integrating all information into a GIS-Dbase, for global analysis purposes for LIFE TM and compatible with LIC Montseny information system. The population monitoring carried out tells us that the natural populations are in a critical yet stable condition. The abiotic monitoring stations (meteorology, hydrology, sedimentation) are providing data periodically. Thanks to LIFETM's experts commission and networking, the number of scientific collaborations increased. All result have been achieved except for the transfer of data to GBIF becouse It was decided NOT to transfer data due to confidentiality of the information.
- Obj.6: **To involve stakeholders and landowners in the conservation of the riparian habitat and its biodiversity**. Relations with owners have not been homogeneous but three Land Stewardship Agreement were established and two important properties for conservation were bought. The promotion and divulgation actions (web, conferences, promotion material, exposition, etc) have been working very well, as planned. The Website and Notice boards have been periodically updated. LIFETM's itinerant exhibition has reached all 18 Montseny towns, different municipalities around Montseny and big cities such as Barcelona, Girona, or Granollers. Teachers and environmental educators have been actively involved, and Barcelona's ZOOBCN educational classroom has welcomed more than 21.000 visitors. All result have been achieved excepte satisfaction surveys that have not been completed.

Comparing the results expected in the project proposal with the results obtained at the end of the LIFETM, we observe that 71,9% have been achieved and 15.6% have been partially achieved. Only 4 out of a total of 32 expected results could not be obtained.

Global EVALUATION of Result achived	
Better than expected result	28,1%
Result achieved	43,8%
Result not fully achieved	15,6%
Could not be assessed	9,4%
Result not obtained	3,1%

Summary of expected and achieved results

OBJECTIVE RESULT EXPECTED	RESULT OBTAINED	EVALUATION
Obj.1 To ensure its genetic conservation and expand its geographic distribution.		
90% genetic variability in ex-situ population	91% for Western Population and 97% for Eastern Population.	Better than expected result
No skeletal spermatic anomalies	No skeletal spermatic anomalies was detected	Result achieved
Larvae production x 4 . In 2017 was 151 (TF PS)	Production larvae in 2022: 1562 (TF +PS)	Better than expected result
Streams with C.arnoldi x 2. Inhabited stream in 2016: 12 km	length of inhabited feature in 2022: 18 km)	Result not fully achieved
6 new population	5 new locations created under the LTM	Result not fully achieved
Consolidated survival of existing wild populations.	Confirmed presence of individuals in 7 of the 8 natural populations,	Result not fully achieved
Obj.2 To increase the hydrological quality and ecological flow of streams in its range of distribution.		
Improvement or elimination of 90% of surface water catchment systems (action was planned in 16 water catchments)	13 surface water catchement systems has been improved (81% of the planned)	Result not fully achieved
Reduction of current water extraction	Water abstraction has been reduced with the elimination of 7 abstractions, the introduction of drip irrigation and the use of rainwater on 3 farms.	Result achieved
Increase in environmental flow	Theoretically, water capacity should have been increased. But not hydrological data is available before 2018 and currently data is still scarce.	Could not be assessed
Improvement of wastewater treatment in 75% (forecast to act in 5 houses)	Water tests concluded that no action was necessary. Only one campsite has been intervened to improve the purification system.	Could not be assessed
Installation of collection and reuse of rainwater and grey water in 50% (8 interventions are foreseen)	3 actions linked to rainwater harvesting have been carried out. The irrigation system of an ornamental plant nursery has been transformed.	Result achieved
Obj.3 To eliminate or minimize the threats that exist in the riparian habitat where the Montseny brook newt is currently found.		
Increase river connectivity in 90% Longitudinal maximum fluvial continuity in 2016 was 2,16km.	Longitudinal maximum fluvial continuity in 2022 is 6,2km.	Better than expected result
Increase area of native riparian forest by 50% Area under conservation forest management in 2016 was 285 ha	Area under conservation forest management in 2022 is 435 ha	Better than expected result
Obj.4 To establish proper legal coverage at national and European level and to have a plan for its management.		
Draft the Montseny brook newt conservation plan	The technical report has been drafted and approved by the legal services of the Generalitat de Catalunya.	Result achieved
approve the Montseny brook newt conservation plan	Public exposure of the document has started and legal approval is expected by the end of 2023.	Result not fully achieved
Complete procedures to give legal recognition to the C.arnoldi	C.arnoldi is explicitly cited in Article 17 checklist of D.92/43/EEC., and in DECRET 127/2021 of PN Montseny proteccion	Result achieved
Obj.5 To monitor its state of conservation regularly and increase scientific and technical knowledge for its conservation and management.		
Annual monitoring of the state of conservation	Each population was sampled two nights / year	Result achieved
Expand knowledge	21.080 residents within or near the project area improved capacity or knowledge due to project actions	Result achieved
Strengthen ecological monitoring stations	Meteorology, hydrology, riparian habitat, macroinvertebrates, environmental DNA programs have been established	Result achieved
Transfer 100% of data and reports to SIMSY	All project information developed includes (68.491 files, 9.722 folders, 176 GB)	Result achieved
Transfer 100% of data and reports to GBIF	It was decided NOT to transfer data to GBIF, due to confidentiality of the information.	Could not be assessed
Obj.6 To Involve and engage stakeholders in the conservation of riparian habitats, their biodiversity and specifically, of the Montseny brook newt.		
4 articles published in journals of impact	10 articles	Better than expected result
10 publications or articles.	25 publications	Better than expected result
15 lectures or presentations	54 presentations	Better than expected result
Participation in 4 international conferences	13 international conferences	Better than expected result
50,000 visits to the website	78.846 Pages viewed	Result achieved
Publish the ten commandments of good practice	4 ten commandments of good practice have been published	Result achieved
Commitment of good practices from 10 professionals.	12 professionals	Result achieved
presentation in 90% of the municipalities in Montseny	Exposition installed in the 18 municipalities (100%)	Result achieved
Active participation in educational programmes (min. 12 schools and colleges)	>12 Schools in Montseny and Zoo Educational program	Better than expected result
A 90% response to requests for information or documentation	100% of the requests for information or documentation have been solved	Result achieved
Have records and satisfaction surveys carried out during workshops	No satisfaction surveys have been carried out	Result not obtained

Problems and difficulties:

The main problems and difficulties faced can be divided into three types: administrative, social and technical.

Administrative

In general, the difficulties encountered have been related to the partners' internal organization such as issues with the lengthy administrative processes within DIBA, DIGI and ZOOBCN. For instance, the impossibility, in the first two years, of hiring a senior technician that was totally dedicated to the project. There were important changes in the organisational chart within ZOOBCN and LIC Montseny (DIBA) that affected the board and technical staff. The lockdown caused by Covid 19 resulted in a considerable delay, affecting many administrative processes and meetings with the property owners involved. The introduction of electronic administration processes (applied according to Act 39/2015) and the passing of Act 9/2017 (with regard to Public Sector) also led to a delay in adjusting the legal precepts in contract specifications and therefore in the awarding of works projects.

Technical

The damage to infrastructures caused by the storm 'Gloria' (22-24/01/2020), with accumulated rainfall reaching up to 400mm/m2 and with wind gusts reaching more than 140km/h.in Montseny. The same storm caused major damage to LIC Montseny's garage-warehouse roof, the site where all the logistical material for the personnel involved in LIFETM is stored. In addition, during the repair works, asbestos contamination occurred throughout the facilities, which led to the closure of the building and until October 2020, personnel access and the use of all the material in the facilities was prohibited, including LIFETM's instruments and tools.

Social

Difficulties stemmed from some landowners' distrust when dealing with hydrological and forest resources. Another major issue has been the ability to convince owners of the need to sign Land Stewardship agreements.

4. Introduction

Background, problems and objectives

- General and specific objectives

LIFETM's main objective is to improve the conservation status of the Montseny brook newt and its riparian habitat. The operational objectives are:

- Obj.1: To ensure the conservation of *C. arnoldi*'s wild population, its genetic conservation and expand its geographic distribution
- Obj.2: To increase the hydrological quality and ecological flow of streams with *C. arnoldi.*
- Obj.3: To minimize threats to *C. arnoldi* within the riparian habitat.
- Obj.4: To establish proper legal coverage and approve the conservation plan for *C. arnoldi.*
- Obj.5: To increase scientific and technical knowledge to ensure good management.
- Obj.6: To involve stakeholders and land owners in the conservation of the riparian habitat and its biodiversity.

Sites that are involved & habitat types and/or species that are under study

The scope of the project covers the entire LIC Montseny although the majority of actions are focused on the geographical area of the Montseny brook newt *(Calotriton arnoldi)* as well as on the breeding centres of Torreferrussa, Pont de Suert, and ZOO of Barcelona. LIC Montseny is a mosaic of Mediterranean and central European landscapes located near large metropolitan conurbations. Its extraordinary biodiversity and the cultural richness that man has left behind throughout the world have a universal value that has inspired artists, intellectuals and scientists.

The Montseny brook newt, endemic to LIC Montseny, is listed by the IUCN in the category of 'critically endangered'. Its population is estimated at less than 1,500 adults. Its area of distribution is small and fragmented, being less than a linear 10 km and less than 8 km^2 in total. Seven populations have been identified which appear to be stable nowadays. *C. arnoldi* is adapted to mountain streams and requires a pristine habitat, which is affected by conservation problems linked to climate change and certain human activities. The habitats that are essential to preserve *C. arnoldi* are: Alluvial forests with Alnus glutinosa and Fraxinus excelsior (AlnoPadion, Alnion incanae, Salicion albae) (91E0 *), Salix alba and Populus alba galleries (92A0), Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion) (9120), Quercus ilex and Quercus rotundifolia forests (9340).

Main conservation issues being addressed (including threats)

The LIC Montseny Conservation Plan establishes an action programme based on minimising or eliminating the threats detected to Montseny's biodiversity, and especially those affecting the conservation of priority species or habitats. Among all the threats detected, those most likely to affect the Montseny newt and the riverside habitat are reduced hydrological flow, ecologically inadequate forest management, habitat fragmentation due to communication pathways, water pollution, climate change, emerging infectious diseases, and low genetic variability.

Among all threats detected in LIC Montseny, the ones that particularly affect *C. arnoldi* and its habitat the most are the decrease in ecological flow, bad practices in logging activities, stream habitat fragmentation, climate chance, and emerging infectious diseases.

The project is significantly climate-related: the effects of climate change (such as rising temperature and decreasing water resources) could worsen the Montseny brook newt's current conservation status. The critical state of its few small populations, low dispersion capacity and dependence on pristine riparian habitats requires an effective management plan and broad legal coverage that can protect the species from the effects of climate change, all within a global context.

Despite the actions taken, the threats are still present in the upper basin of the river Tordera, which is the distribution area of *C. arnoldi.*

Surface water diversion is one of the most dramatic and immediate threats to this species since large amounts of water are being extracted from LIC Montseny for human consumption and livestock along all the river secondary basins. It is likely that water overexploitation is a severe threat because of the species' ecological requirements. In fact, the current environmental legislation is not being enforced efficiently about the maintenance of ecological flows and their monitoring and this constitutes a significant difficulty when dealing with this threat.

Wood plantations and, more specifically, those that consist of fast-growing allochthonous conifers, may be behind the waterflow reduction in the La Tordera basin. They require large amounts of water and take up 11.40 ha (12%) within the natural range of *C. arnoldi.*

Global warming and other severe climatic or weather events outside the natural range of variation are other threats currently affecting the species. For instance, the beech (*Fagus sylvatica*) forest, an excellent habitat for *C. arnoldi*, has shifted upwards by 70 m at the highest altitudes (1600–1700 m) since 1945, and it is being replaced by a holm oak (*Quercus ilex*) forest at lower altitudes (800–1400 m). The recent appearance of an isolated focus of *B. salamandrivorans* very close to the *C. arnoldi* populations, forces us to be very strict with regard to preventive biosecurity measures.

Threats to newt populations as described and as they already existed in the past decades, continue to exist at the end of the LIFETM, even though some may have been eliminated or reduced in certain streams. All threats that *C. arnoldi* continues to suffer, are set out in the table below.

Threat Typology	Negative impacts	Medium & long-term consequences
Intrinsic threats to the specie or habitat		
Inbreeding risk	Low genetic variability	Reduction of birth rates, reduction and loss of populations
Emerging infectious diseases	Amphibian infection and population extinction	Extinction of the species
Ecological specialisation	High vulnerability to environmental change	Low or no adaptation to habitat changes
Specific torrent typology	Low availability of suitable habitat	Low possibility of increasing geographic distribution
Extrinsic global threat		
Climate chance		
Increase in temperatures	Physical and chemical habitat changes	Change in ecological processes and loss of populations
Reduction of the hydrological flow	Lack of water flow	Death due to lack of water
Extrinsic local threat		
Natural resources exploitation		
Use of natural water	Reduction or removal of surface water flow	Death due to lack of water
Release of wastewater	Water authorisation	Respiratory distress due to water pollution
Forestry management	Destruction of the riparian habitat and the watershed	Trophic change disruption due geomorphological changes in the stream, loss of tree cover, increase sunstroke and temperature
Fisheries management	Introduction of exotic predators (as *Salmo truta*)	Predation and competition on food resources
Communication routes		
Timber activity roads	Fragmentation of the river course	Isolation of populations
Roads network	Elimination of ecological connectivity	Isolation of populations
Human Frequency		
Visitors	Amphibian manipulation. Disease introduction	Stress, reduction or disappearance of stocks
Sports	Habitat degradation	Stress, lost of habitat and disappearance of stocks
Education & divulgation	Amphibian manipulation. Disease introduction	Stress, reduction or disappearance of stocks
Naturalist & photojournalist	Amphibian extraction. Disease introduction	Stress, reduction or disappearance of stocks

Socio-economic context

With regard to the socio-economic situation, 86% of the land in LIC Montseny is private. *C. arnoldi's* home range is inside a dozen properties and only two of them are public (DIBA). The main socio-economic sectors are services (52%) especially of hotels and restaurants,

industry (35%), construction (10%) and agriculture and livestock (3%). The logging activity is a traditional and important activity in the area and 45% of private land has a Forest Management Plan.

Long-term expected results

Although the LIFETM project was implemented in a very specific river basin to safeguard a specific endemic species, the actions proposed are aimed at solving a global problem, one that has possibly serious consequences and which are being felt throughout the Mediterranean ecosystem, such as the exploitation of aquifers, degradation of riverside environments and loss of biodiversity. Therefore, the implementation, monitoring and evaluation of the actions proposed in the LIFETM project have a demonstrative vocation, directed to other Mediterranean sites with similar problems.

The expected results of the LIFETM have already been set out in the table above in "Outputs and results". The expected long-term results After LIFE remain very similar, because the threats are still very much the same. From now to the future, the expected results are:

- Obj.1. To consolidate the survival of existing wild populations and improve its conservation status, double the number of streams with *C. arnoldi* and consolidate breeding centres as genetic reservoirs and producers of newts for reintroduction.
- Obj.2. To reduce current water extraction and thus increase the environmental flow and to encourage rainwater use as well as improving the sustainability of water exploitations in *C. arnoldi*'s home range.
- Obj.3. To increase river connectivity in 90% of intersections between roads, tracks and streams with *C. arnoldi*; and increase the area of native riparian forest for these streams.
- Obj.4. To implement the Conservation Plan and complete all legal and bureaucratic procedures for *C. arnoldi* to be given legal recognition, both at national and European levels.
- Obj.5. To increase the knowledge of *C. arnoldi*'s biology and ecological requirements, have status population indicators, and integrate all information into a GIS-Dbase for global analysis purposes.
- Obj.6. To continue establishing custody arrangements within the territory, publishing results in articles, giving presentations in conferences as well as exhibitions, developing a social incubator, promoting good environmental practices, involving the local educational group and actively participating in networks.

The project's consequences and benefits will be diverse. Having a captive and reproductive population ensures the possibility of future introductions to suitable habitats and makes a viable gene pool available. The reduction of water stream catchment and promotion of rainwater will be a good adaptation measure to climate change adaptation measures. The restoration of native riparian environments will increase resilience and adaptation to a possible rise in temperature. The Information, education, training and raising awareness will be essential activities to build synergies, encourage actions by local society and local actors, which will be essential to mitigate the effects of climate change.

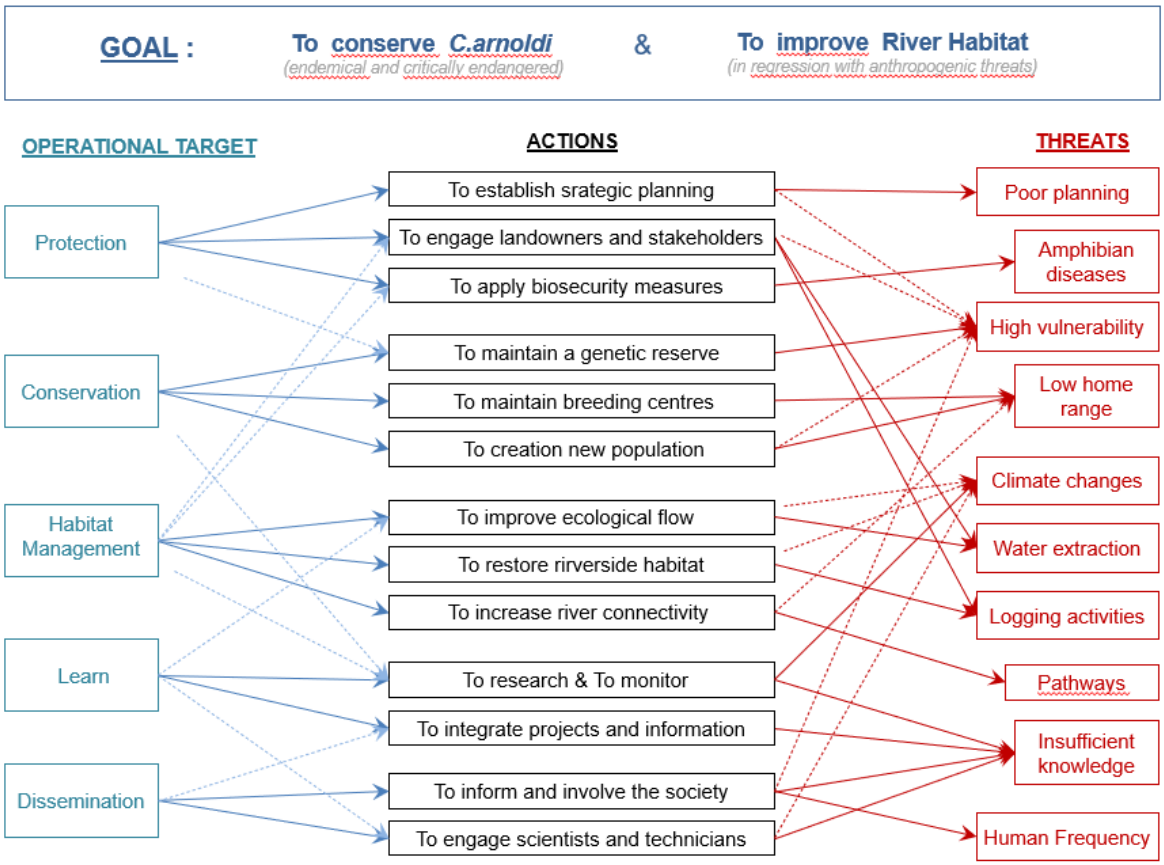
The results of the LIFETM project help to reach objective 1 of the Habitats Directive, as it is aimed at improving the priority habitat's conservation status which are those habitats linked to the aquatic environment (alder, laurel and ash groves, and vegetation near springs, wetlands, ponds and underwater). The project also ensures the effective management of LIC Montseny and promotes the use of best practices linked to natural resources (particularly for water and forest-based products). The project will contribute to objective 3 of the Habitats Directive since it will improve forest management plans and promote mechanisms to involve

private owners. Finally, it contributes to objective 6 of Habitats Directive as it promotes measures against biodiversity loss, addressing the causes linked to natural resource consumption, such as the reduction of water extraction and its link to the Montseny brook newt's critical status. LIFETM is basically a demonstrative project which aims to minimize the negative effects of climate change in the Mediterranean area and improve the resilience of river habitats. In the mid-term, results will be replicated especially in all the Montseny Biosphere Reserve (*50.166,63* ha), thanks to the involvement of its technical staff and DIBA's environmental law subsidies.

The Montseny Brook Newt Breeding protocol is currently in the process of being adapted to the EAZA Best Practice Guideline, to be used as a guide for the breeding of the Montseny brook newt, as well as a reference for breeding projects with other similar species.

The European Biodiversity Strategy has been the reference the guideline to achieve the objectives during the LIFETM. Fulfilling our objectives will depend on how ill depend on how we act as project managers, while being aware of what it means to solve problems through action-oriented approaches. The actions outlined and implemented in the project have been the aim of reduce or eliminate, directly or indirectly, the threats in order to achieve the established objectives. The two main objectives remain the same as in LIFETM, to protect and preserve C. arnoldi and to improve its River Habitat.

The following diagram shows the operational targets to achieve, the actions required to reach them and the threats addressed by these actions. As observed in the diagram, this is not a linear pattern, but rather a much more complex one. Each operational objective requires several actions to achieve the expected results, while these actions also act on several objectives and threats at the same time.



5. Administratibe part

Project management description

Coordinating beneficiary (BC) is DIBA: Diputació de Barcelona (Barcelona Council)

Associated beneficiaries (AB) are DIGI: Diputació of Girona (Girona Council), GENCAT: Generalitat of Catalonia (Autonomous Government), FC: Catalan Forest and ZOOBCN: ZOO of Barcelona.

The project management has been carried out by the staff at the coordinating beneficiary, DIBA, and weekly, working group meetings have been taking place. There is a partners meeting, between the AB and the BC every two months. These meetings take place at the headquarters of the different partners on an alternative basis. To facilitate the exchange of information we are working with a job platform (Dropbox), which is linked to the Montseny database and its information system.

Num of meetings

Committee	Composition	Number of meetings (Oct2016-Dec 2022)
Partners	One or more representatives of AB and BC	26
Technical	Technical representatives of AB and BC	8
Communication	Communication & education representatives of AB and BC	17
Administrative & Financial	Administrative and financial representatives of AB and BC	3
Total		54

Table 5.1.1 Working groups by committee and composition (see number of meetings).

Problems encountered, the partnerships and their added value

The biggest administrative problem has been the adoption of Act 9/2017, with regard to Public Sector Contracts, which has caused a delay in adjusting the legal precepts in contract specifications and therefore in the awarding of works projects. The introduction of electronic administration processes at DIBA in 04/2017, applied according to Act 39/2015, entailed an introduction of new protocols which have caused a long delay in case processing (in some cases by more than 18 months).

On the other hand, there have been no significant deviations in the work plan.

Communication with NEEMO and EASME

The project has had two visits from the NEEMO Monitoring Team (January 2017, June 2018, June 2020, May 2021, June 2022 and February 2023) and an EASME auditor (September

2019). The BC has been in frequent and fluid contact with the external NEEMO monitoring team. Throughout the project, there have been some personnel changes (with 4 different EASME auditors and 3 different NEMO monitors).

The changes due to amendments to the Grant Agreement.

Action A3 Technical development of naturalised aquariums switched partners, from DIBA to FC. Before the change was made, the NEEMO external monitor was consulted and informed that it was not necessary to request an Amendment. The budget did not move from one category of expenditure to another, nor did it lead to any substantial changes in the project.

A project extension was requested in July 2020 so as to extend it to December 2022. The project monitor was consulted and kept informed. The extension was granted in Letter Amendment Nr. 3 to Grant Agreement LIFE15 NAT/ES/000757 - LIFE Tritó Montseny (December 2020)

6. Technical part

6.1. Technical progress, per Action

Below is a brief summary of all the actions carried out under LIFETM.
Deliverables and annexes for each action are listed at the end of chapter 6, including a list of all documents linked to each one of them.

A1. Genetic evaluation of the breeding program

Foreseen start date: 4T 2017- Actual start date: 1T 2017
Foreseen end date: 1T 2020 - Actual end date: 4T 2020

The objective has been to evaluate the genetic status of the captive breeding program by genotyping 23 microsatellite markers. Genetic diversity indices of both captive breeding lines and their paternity have been assessed. Additionally, some reintroduced individuals were genotyped at least 5 years after their introduction into the wild. Over 200 samples of wild populations were sequenced to keep the genetic status updated for this species in the wild.

A total of 1149 new tissue samples (of the tail's distal end) have been sampled for their genetic evaluation. DNA was extracted and 23 microsatellite polymorphic markers already described for the species were genotyped. All laboratory work was contracted to the Veterinary Molecular Genetics Service (SVGM-UAB). Of the 887 samples from the captive breeding program, 447 belonged to the eastern sector while 440 belonged to the western sector. Samples from the species' four breeding centres were included. From the breeding captive lines, 438 eastern offspring were included in the genetic parentage analysis, belonging to 8 distinct cohorts (2007, 2010-2016). From those, a total of 390 mothers and 419 fathers were assigned. From the 430 western offspring included in the genetic parentage analysis, 8 were from distinct cohorts as well (the same as above). All mothers except for two and all fathers except for one were assigned**.** Regarding the overall genetic results, polygamy and sperm storage were ensured for *Calotriton arnoldi* females. These aspects are also relevant for the breeding management of this critically endangered species. Only 13 samples in total were obtained from three reintroduced populations. Parentage from these individuals was also assigned. This allowed us to determine their year of release and thus their survival time. Reintroduced individuals survived at least eight years in the wild and a longevity of eleven years has been observed. For the wild samples, results confirmed that population B3 is still the one presenting the lowest diversity indices, as stated before in the literature.

Some delay in genotyping has occurred due to the technical issues in the microchipping of individuals. New microchipping techniques had to be tested and were successfully implemented. In the end, all expected individuals (except those small from 2017-2018) were genotyped in time.

Genetic assessments are crucial to be maintained and monitored in order to better implement and adequate the reintroduction project of this critically endangered species. Thus, it is expected that subsequent captive breeding generations will be genotyped, and reintroduced populations will be genetically assessed.

The correct assignment will enhance their pedigree and will help towards the better conservation of the maximum genetic variability and minimum inbreeding in the captive breeding lines.

A2. Determination of the causes that produce defects in bone tissue and study of sperm quality

Foreseen start date: 1T 2017 - Actual start date: 1T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2020

The aim was to determine the causes of low fertility, establish osteological Health, detect possible conduct abnormalities and to improve on husbandry and feeding protocols**.**

Sperm quality analysis: Spermatophore samples of 17 adult males were collected. No highlightable anomalies were observed. According to the results obtained, in captive conditions, the sexual maturity of males seems to be reached at the age of 5-6 years, although from the age of 4 they physically look like adults. An increase in reproductive behaviour has been observed as more specimens reach adulthood while no generalised sperm malformations have been detected. In spite of the fact that in these 4 years a large number of captive-born males have already successfully reproduced, the hatching percentage of all eggs is only 20% (22% Western, 13% Eastern).

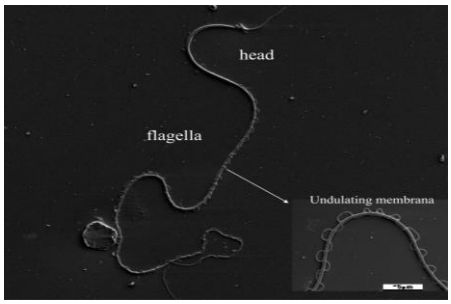
Effect of diet and substrate on larval development: Within the western population, the best growing taxa have been obtained with live prey and natural habitats (Figure 3 and Figure 4). The absence of effects found in the eastern population could be attributed to there being a small amount of data. We detected significant differences between the two populations such as western larvae being larger and fatter than the eastern ones.

Osteology analysis: We wanted to determine possible diet-related ossification problems. Osteology analysis results indicate that the bone woven is optimal in all individuals independently of their diet and substrate. No bone malformations were observed. The osteology analysis indicates that the current diet is adequate, providing a good dose of essential nutrients to the newts. However, taking into account the better growth of specimens fed on live food, it is necessary to consider incorporating certain species of live food.

Effect of larvae density in aquarium**:** While analysing the effect on the group, a higher larval density associated with a smaller larval size was observed. Chemical communication in the aquatic environment affected newt size, even though the specimens were in different yet connected aquariums sharing water. As a result, a new nursery has been built at the Torreferrussa facilities and after that, the different breeding centres adopted this measure.

Determination of lipid metabolites: Results showed a differentiation in the metabolomic profiles of the individuals according to group type and different concentration levels for some metabolites. The metabolites found, such as cholesterol, could be related to a low variety in the individuals' diet at breeding and possible signs of stress. By incorporating live food, a more varied diet, the stress was reduced.

Osteology's analysis (Xray imatge)



Scanning electron micrographs

A3. Technical development of naturalized aquariums

Foreseen start date: 4T 2016 - Actual start date: 1T 2018
Foreseen end date: 4T 2020 - Actual end date: 4T 2020

The aim of this action was to investigate how changes in environmental conditions may affect captive breeding and their implications for the future of wild populations.

Landscaped aquariums: Four aquariums (with video monitoring systems) have been landscaped with designs recreating the streams inhabited by the species. Image analysis confirmed the newts' use of spaces outside the body of water (holes with abundant vegetation and a slight flow of water)

Analysis of the effect of temperature and UVb on breeding success. The results showed that an increase in temperature (2-3 degrees) on this magnitude has had positive effects on breeding success. The number of eggs shows that there is a slight increase at higher temperatures, although this is not statistically significant. A statistically significant increase in the egg fertility is observed at warmer temperatures. No influence of UVB radiation has been detected.

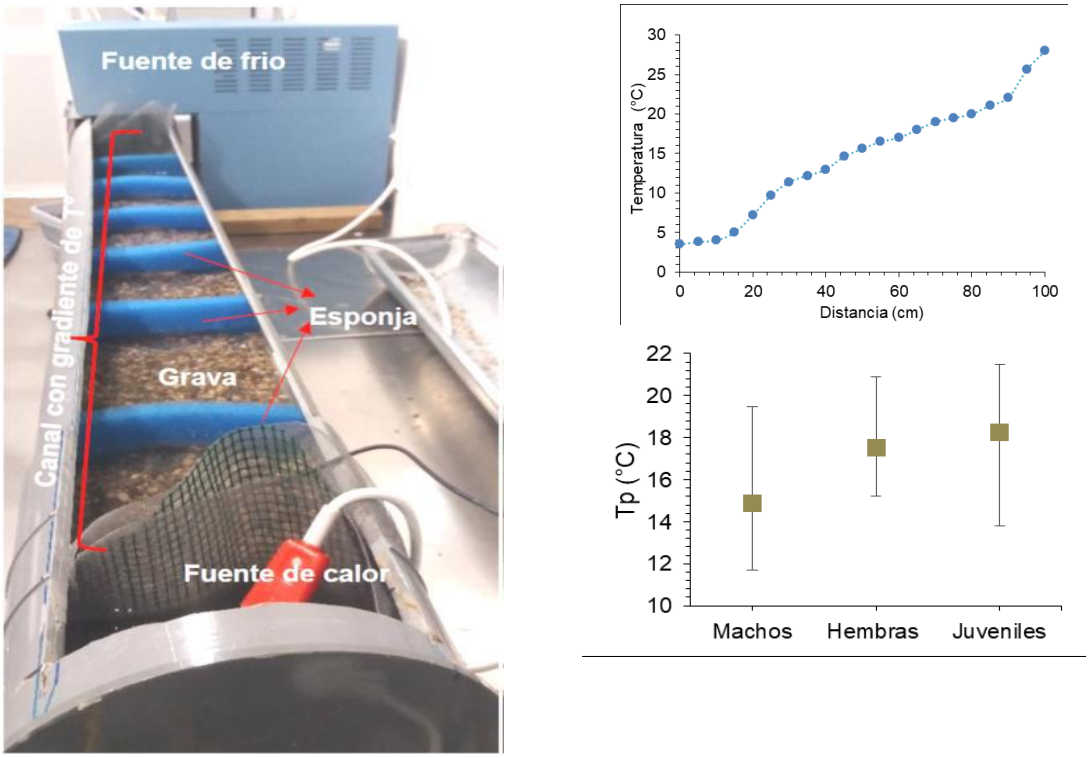
Thermopreferendum and Critical Temperatures: It was determined that *C. arnoldi* has a wide thermopreferendum range (under laboratory conditions), ranging from cold temperatures of 11.7°C to warmer temperatures of 21.6°C. The maximum temperature at which individuals show first symptoms of discomfort is around 26ºC while the minimum is 2ºC.

Physicochemical water properties. The use of an osmosis water system allowed for breeding centres to be provided with water which was more similar to that of inhabited brooks.

Improvement of the lighting system in the breeding centres: A Mimesis lighting system has been installed in the aquaria of the three breeding centres. This has meant a significant improvement in breeding aquarium conditions, as the light intensity is now regulated through a photosensitive cell that maintains a daily light cycle similar to that of the species' habitat.

8 Mimesis lighting system

Landscaped aquarium



Temperature gradient canal, Thermopreferendum range.

A4. Information to potentially involved private owners

Foreseen start date: 1T 2017 - Actual start date: 2T 2017
Foreseen end date: 2T 2019 - Actual end date: 4T 2022

Informing landowners with newt populations has been the goal, as well as improving the collaboration between owners and DIBA staff to find synergies and therefore achieve the river habitat's conservation. It has also been an objective to obtain their authorisations in order to execute actions as well as getting them involved in the LIFE project.

All 18 mayors of the municipalities were informed of the need to involve the local population and owners during LIFETM, and individual meetings were held with four municipality mayors in the area where the actions were planned. An information meeting was held with all landowners who own properties in the newt's geographical area. All landowners with the newt in their property and 75% of land owners with potential habitats to be used for introduction were informed. More than 80 private meetings have taken place with 12 different owners. Individual meetings with owners have been held during the project's six years to coordinate actions and keep them informed.

The results have not been fully achieved as planned in the proposal. The milestone for this action was to get agreements with 90% of landowners with natural newt populations and this was only achieved with half of them, although they are the most important ones to ensure the conservation of Montseny brook newt populations.

Some landowners have been very difficult to locate because they have forestlands with old and poorly-registered segregations. More than half of the land properties are managed by several generations of families that have always lived in Montseny and, in general, there is distrust in the administration's management. Only two technicians, with more than twenty years of service in LIC Montseny, are trusted by traditional owners to propose possible changes in the exploitations of natural resources such as water or wood.



Examples of diferents meeting with lanowner in order to involve them in the LIFETM

B1. Purchase of land or compensation for rights of use

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 2T 2022

Once the private properties with Montseny newt were evaluated, two land properties were chosen to be acquired, to guarantee good management and the conservation of the river forest. The economic valuation of the land purchased was carried out by employing the method of analytical valuation of rent capitalisation on forest land (Act 7/2015 and 1492/2011). The purchased lands are:

- Property Inv-Orient (57 ha), on the eastern side, has an important water collection that should be reformed to ensure an ecological flow. It was bought in May 2021.

- Property Rei-Occident (30ha), on the western side, has a very good river forest with the best population of the Montseny newt in its stream. It was bought in November 2021. The cost of this purchase has not been charged to the LIFETM, it has been taken over by DIBA

Regarding compensation for rights of use in private lands with newt populations, the areas of supervised management (ZGT) have been delimited. The goal of these areas is the protection and improvement of the river forest. The profitability of the ZGT was evaluated in order to negotiate compensation for the landowners and obtain their commitment not to log this forest during the duration of the land stewardship agreement (Action B2).

The results have been as foreseen in the proposal, the purchase of two lands and the signature of three Custody Agreements where there were rights of use, included in the ZGT, has been and will be agreed between the property and the natural park managers. The documents proving the purchase of the two farms and the map of the purchased land are attached to this report.

The milestone of this action was to purchase or compensate for use in 90% of the areas of the ZGT, with a natural population of newts, and without Land Stewardship Agreements. In the end, only 13% of this land has been purchased, although they are the most important to ensure the conservation of *C. arnoldi* populations.

The economic valuation of the land was a problem that was resolved by employing an expert valuation based on current legislation. The purchase of the Rei-Occident land was complex because it was a seized farm and DIBA had to use the right of first refusal in a public auction. In general, Montseny inhabitants do not want to sell their families' lands. The management of a land purchase process has never been a quick one and it requires the ability to convince the current ownership that you will not be able to profit economically from its exploitation, as there is a very protected species on that land. Therefore, it takes time to negotiate a price that is suitable for both the buyer and the seller.

The land swap has been agreed and it is of great interest in connection with LIFETM's objectives in two properties but it has not been possible to finalise and sign within the project. While a third one is currently being negotiated. An agreement is expected to be reached in After LIFE.

The following table shows the involvement of the landowners in the project, according to their individual participation and considering the surface of the particular lands based on different kinds of implication, includes information of land sale (B1) and Land Stewardship Agreement (B2). The direct participation of 5 of the 12 landowners (with means 41,70% of owners with newt stoks) of the newt distribution area has been achieved. Considering the surface area affected (in ha), we have achieved the involvement of 23,2% (152 of 655 ha) of the total area of distribution of the species in private properties.

Involvement of the landowners in LIFE TM	October 2016			December 2022		
	nº	ha	%	nº	ha	%
Individual owners in the project intervention area						
Total number of owners involved	0			5		
Total number of landowners in the project intervention area	12			12		
% of owners involved with regard to total number of owners			0,0%			**41,7%**
Land surface area of private owners according types of involvement						
Land sale		0		2	87	13,2%
Compensation of the right of use		0		0		0,0%
Establishment of Land Stewardship Agreement		0		3	65	10,0%
Land swaps		0		0		0,0%
Total surface area linked to the different types of involvement		0			152	
Total area linked to all the land of private owners		655			655	
% of surface area associated to the different types of involvement compared to the total surface area			0,0%		-	**23,2%**

An additional clause in the official Land Register on property purchased has been carried out, in reply to the Project Manager notifying the modification to the letter Ares (2023)2116338, where it was required to include the 'Nature Conservation' clause as per the Grant Agreement, Art. II.19.(2)(i)

B2. Implementation of Land Stewardship agreements with Private Owners

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 3T 2022

The purpose of the action was to generate shared responsibilities between the owners and LIC Montseny managers in order to preferentially preserve biodiversity and to use natural resources in an environmentally sustainable manner. This objective has been partially achieved with the approval of three Land Stewardship Agreements (1- signed 4th april, 2022 with Area: 65 ha.; 2- singed 31st july, 2020 with Area:10,8 ha.; 3- signed 4th april, 2022 with Area: 147,06 ha.)

The sum total area of the 3 farms with agreement is 222,86 ha., representing 34% of the total area of the 12 private landowners (655 ha) in the *C. arnoldi* range area. The agreements have legal standing (Act 3/2017). Owners are committed to implementing good practices of habitat management for the benefit of the Montseny newt. Currently, 5 of 7 streams with a natural population and its riverside habitat, (total of 155 ha) are protected, where all human activity is restricted except those aimed at improving the riverside habitat. 90 ha of this habitat is public land and the remainder (65 ha) is private property protected by the Land Stewardship agreement, where the property is committed to maintaining its natural state. These 65 ha represent 10% of the total surface area of the 12 12 private landowners in the *C. arnoldi* range area.

The results have not been as planned. Deliverables have been attached to this report. The milestone was to get a signed agreement with 90% of owners with a natural newt population. Currently, 3 agreements have been signed while 2 are still being negotiated but yet to be signed, although current negotiations are expected to result in a purchase or a signed agreement. Therefore, there is still work to be done with the other 9 properties.

In most cases, the unsigned agreements have been caused by disagreements among heirs to the lands and by issues related to territorial boundaries between the lands and DIBA's public property, issues which are still to be resolved. The lockdown caused by Covid 19 resulted in a considerable delay in many administrative processes, as it proved to be impossible to hold meetings with the property owners involved in such agreements.

Examples of diferents times to establish agreements with three landowners

C1. Montseny brook newt Conservation Plan

Foreseen start date: 4T 2017 - Actual start date: 1T 2018
Foreseen end date: 4T 2018 - Actual end date: 4T 2022

The technical document for the the Montseny newt's Conservation Plan has been completed. It analyses what is known about the species, its situation and threats to it, and establishes the actions to be taken to reverse the current situation of being in danger of extinction (EN in UICN)

Following the legal regulation established in article 5.5 of Catalan Edict 172/2022 in the Catalogue of threatened wildlife native species, the files for the approval of recovery and conservation plans must include a technical document that contains, at least, the following issues:
a) The identification of the species or subspecies and the diagnosis of the state of conservation.
b) The geographic area of the plan (areas of presence, critical areas and of potential expansion)

c) The identification of the limiting or threatening factors, actions for their mitigation and difficulties.
d) The identification of possible impacts on other activities, the measures to minimize them.
e) Evaluation of the plan with a system of check indicators.
f) Information, education and awareness measures to be carried out.

In addition, some specified actions have been attached to the technical document, such as Cartography, a Monitoring program, a Captive breeding program, a Habitat management program and the Creation of new populations program.

There has been a great delay in finishing these documents due to various factors already specified in the mid-term and progress reports. Among these reasons were the little information available about the species, the lack of confirmation on the main threats, the processing of the edict on Catalan threatened species (published in September 2022), in which not only was the species catalogued as being in danger of extinction in Catalonia (where the Montseny newt is included, just as it also was in the Spanish threatened species catalogue), but it established the guide of what the recovery plans should be, as well as the technical documents that were to accompany them, and all their processing. It should also be noted that the governmental department has undergone significant structural changes, which has caused a significant administrative backlog of many actions, and especially of legislative procedures, as is the case in this instance.

The Montseny newt conservation plan will be published in the Official Journal of the Generalitat of Catalonia as a resolution. It has a lower normative rank, but will allow the document to be more dynamic and open to updates as the evolution of the species is seen and as more new technical information is generated. While the technical documentation and the resolution proposal draft are already available, we believe that the processing of all this will be carried out during the first part of the current year.

Although the Conservation Plan is not yet approved, from June 2021 *C. arnoldi*, its habitat and associated biological elements are strictly protected thanks to the new protection law for *Montseny Natural Park* (DECRET 127/2021 , *art.4.12b).*

C2. Steps to include the Montseny Brook Newt in the Habitats Directive

Foreseen start date: 1T 2018 - Actual start date: 2T 2017
Foreseen end date:2T 2020 - Actual end date: 4T 2020

This action has been developed in two main axes. Firstly, actions have been taken to legally include the species in the Habitats Directive.Secondly, we have completed and submitted, for the first time, the file corresponding to the Montseny newt, to be sent to the Commission within the “Report on the main results of the surveillance under Article 17 for Annex II, IV and V species (Annex B)", as it is foreseen for all species included in it.

On April 24th 2017, we received the reply from the Spanish Ministry indicating that, as soon as inclusions could be made to Council Directive 92/43/EEC, the proposal for inclusion would be made.

In addition, we undertook the administrative procedures to include the target species *Calotriton arnoldi* in the official Standard Data Form (SDF) of the SAC Massís del Montseny (ES5110001).

In January 2019, the Government of Catalonia (Generalitat de Catalunya) sent the file corresponding to the Montseny newt to the Ministry MITECO, a file that was, in turn, to be sent to the Commission as part of the "Report on the main results of the surveillance under Article 17 for Annex II, IV and V species (Annex B)"

At the beginning of December 2020, the Government of Catalonia submitted a fully-updated version of the SDFs, including the SAC Massís del Montseny (ES5110001), which the Ministry MITECO sent to the European Commission on December 15th. The European Commission should validate the information given by February/March 2021 and then the new SDF will be updated in the official Natura2000 web site.

Although the European Commission will not update the list with a new Annex IV, *Calotriton arnoldi* is listed as an individual species in the current Article 17 checklist and a specific report has been submitted already.

The European Commission will not modify the Habitats Directive's Annexes in the short or mid-term, and therefore *Calotriton arnoldi* species will not be individually listed. However, since the populations were already protected as *Euproctus asper*, they cannot be unprotected because of a taxonomical change.

The main problem found was that this action could not be achieved exactly as proposed due to issues that were out of our hands. Nevertheless, we can assume that the species is protected by the Habitats Directive because 100% of its populations were already protected and this protection cannot be lifted because of a taxonomic issue. With this in mind, this action is considered to be fully achieved.

C3. Information system and biodiversity database

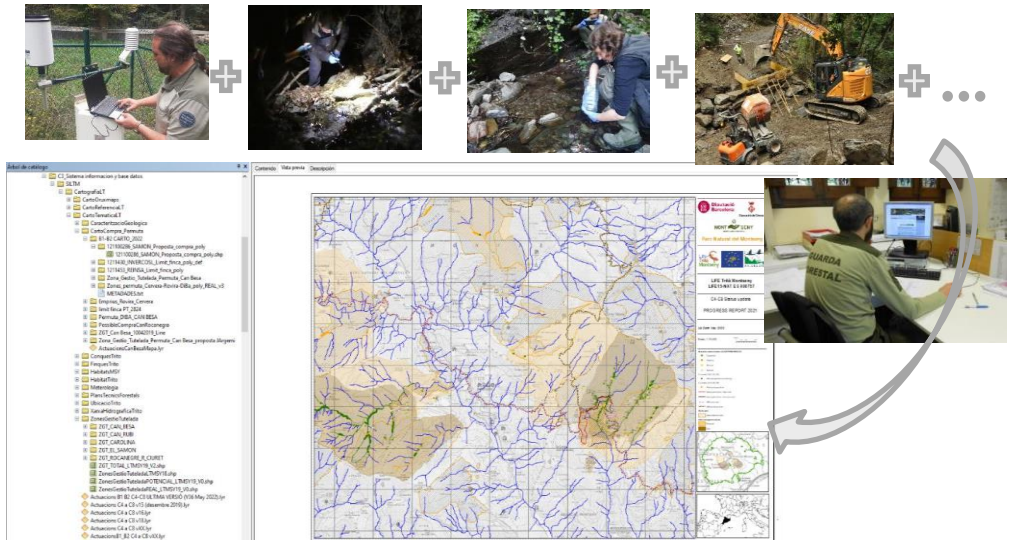
Foreseen start date: 4T 2017 - Actual start date: 4T 2017
Foreseen end date: 3T 2020 - Actual end date: 4T 2022

A LIFETM Information System (SILTM) was developed to integrate all the technical, scientific and promotional information linked to the project. The SILTM currently contains more than 4.000 files distributed in 134 directories and includes the information from the actions developed since the beginning of the project in 2016. These files were catalogued according to the type of information contained (documentary, cartographic, database). In order to simplify and improve the consultation of the files, a table of contents was developed.

All of the Montseny newt's geolocations are being included in the current Montseny Biodiversity Database, although its access is restricted to authorized technical staff due to the extremely sensitive data stored in it. An application (using the Arcgis software) to visualize, consult and analyse the project information efficiently was developed on an interactive map, which can be dynamically updated as new information is obtained from each of the project's actions. The OruxMaps application was chosen to create and visualize data on both tablets and mobile phones.

Nowadays, all of project information developed is comprised in 68.491 files (in 9.722 folders, 176 GB). Of these, 36.896 files (in 3.782 folders, 266 GB) belong to LIFE technical ACTIONS, including the C3 action. The SILTM (C3) contains more than 4.190 files in 134 folders, doubling the amount of information integrated since the mid-term report. During the last period (2021), databases and cartographic information related to the project have been developed and updated. All of it is available on the project server by consulting the SILTM

Information system directly (for documentation, databases) or by opening the updated cartography through the interactive map.



Process of data collection, incorporation into the information system and GIS data exploitation

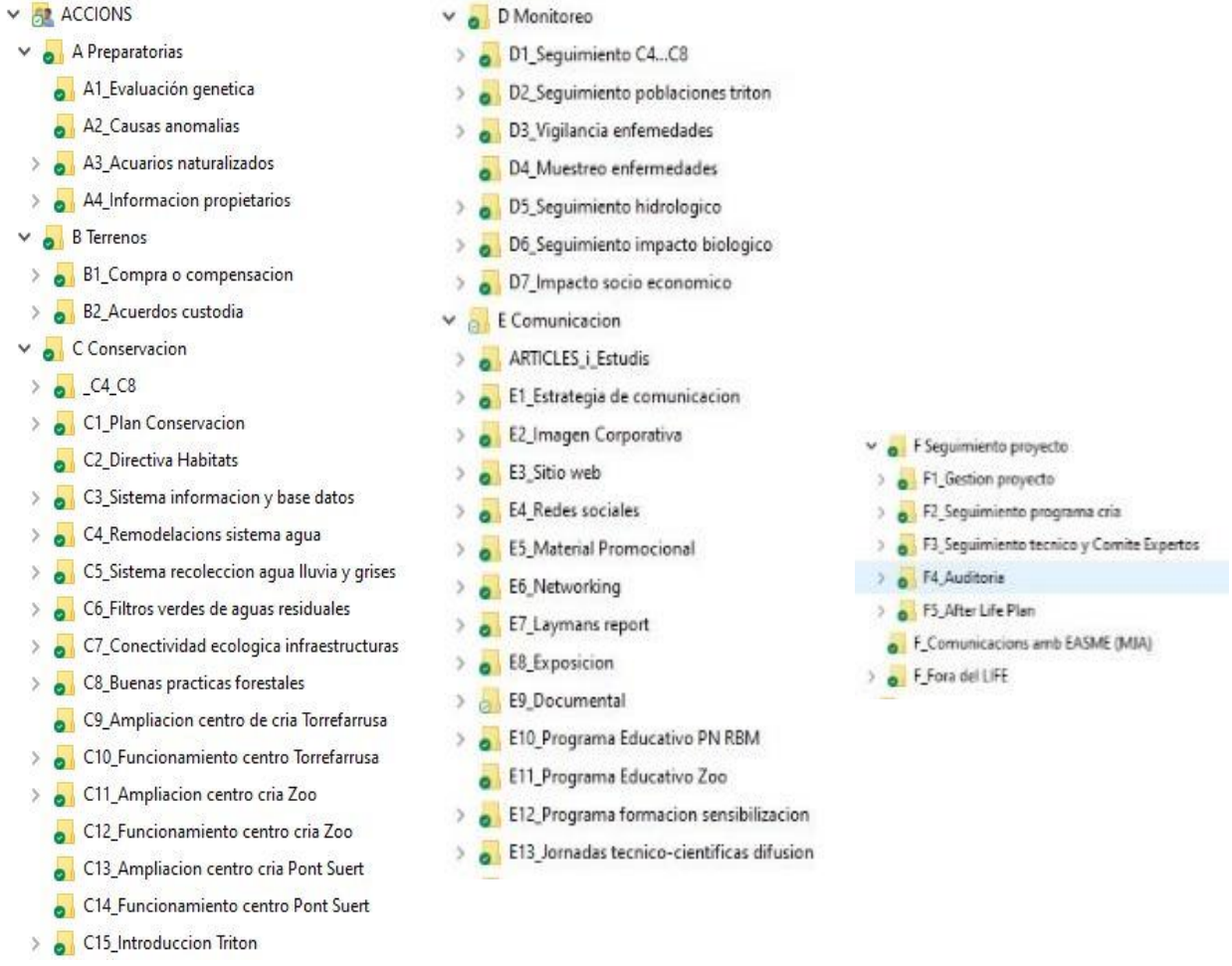


Diagram LIFE Tritó Montseny Information System (SILTM).

C4. Remodelling of the water catchment and distribution systems

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 4T 2022

The goal of this action was to upgrade a water catchment, storage and distribution systems, with the aim of increasing the ecological flow of the streams. The action planned, in 2016, was to intervene in 16 surface water catchment systems (8 planned and other 8 not specified). In 2018 the Montseny catchment inventory was updated, with a total of 45 catchments and a new prioritisation system to update them. During the implementation of LIFETM, 18 actions have been executed, linked to the modification or removal of water catchments, the improvement of water tanks, the installation of tank with shut-off valves, as well as fixing water pipeline.

Actions executed:

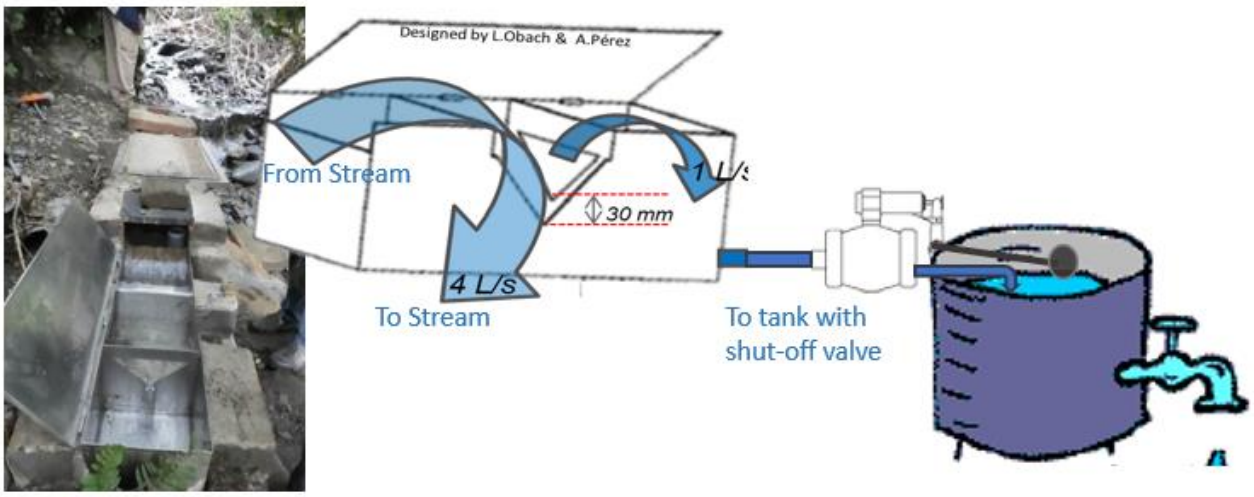
- Agreements between ACA (Catalan Water Agency) and DIBA were reached to process and speed up the legalisation or eliminate water concessions.
- Interventions were carried out in 6 streams to reduce the water abstracted by catchments
- The elimination of 7 illegal or abandoned water catchment of the streams
- The restoration of 2 natural water circuits, conducting the waters from their source to the stream
- 9 water collection and storage facilities have been reformed to increase the ecological flow, with the installation of a water shut-off valve and ecological water distributor
- Due to this action being executed well, the collaboration between LIC Montseny managers, ACA and landowners is improving, which means they have to update their catchments in order to comply with the law (MAH/2465/2006, Act 1/2017) and to prioritise an ecological flow.

This action was directed by LIC Montseny's technicians (biologists and engineers), and it was executed by LIC's operators, by external companies or by the owners themselves.

The expected results have been achieved, although we will have to wait for the hydrological monitoring results over the coming years in order to confirm the increase in ecological flow. Deliverables have been attached to this report.

The owners express doubts and fears with regard to LIFETM's proposal to eliminate or reduce current catchments, and they are reluctant to modify the current catchments and improve the water supply and storage systems. LIFETM has found distrust and a lack of willingness to collaborate. Between 2017 and 2022 there have been structural changes in LIC Montseny's personnel. Of 5 engineers involved in the LIFETM, only 1 was permanent during this period, and he had to invest time in the national park's daily tasks while having to train new colleagues. The biggest issue has been the long delay in many administrative processes (see 6.2 Main deviations and problems)

The owners are obliged to maintain an ecological flow (MAH/2465/2006, DECRET 1/2017). The managers at LIC Montseny will continue to inform owners about the legislation, and they will continue to advise them to implement the necessary procedures and reforms. The Montseny Natural Park has a line of subsidies for homeowners to implement good practices such as the C4 action.



Scheme of ecological water distributor to improve an ecological flow

Action Type	ID_ACCIÓ	DESC-ACT (ENG)	Execution Year
Improvement of water tank			
	C414FO	Adaptation of old water tanks to acumulate rain water	2021
	C478CI	Water filter and storage tanks	2022
	C422CI	Water storage tanks to be extended.	2021
Modification of water catchment			
	C417FO	Fix the catchement at the source	2020
	C457SA	Fix the catchement at the source	2020
	C408CI	Remodeling of water collection. Intalling distribution box	2022
	C402BS	Remodeling of the water collection. Installation of a counter.	2020
Removal of water catchment			
	C403BS	Eliminate and remove pipes of Illegal water collection. To be monitored periodicaly	2022
	C406BS	Eliminate and remove pipes of Illegal water collection. To be monitored periodicaly	2022
	C418FO	Eliminate the old water catchment of the campsite	2020
	C410RU	Removal of iligal water collection and distribution system	2022
	C474BS	Removal of water collection	2022
	C473BS	Removal of water collection	2022
	C470BS	Removal of water collection	2020
Tank shot-off valve			
	C443FO	Install closing buoy and improve canalizations	2020
	C458SA	Prevent water spillage by menas of shut-off valves	2020
Water pipeline			
	C415FO	Connection of the surplus water with the stream	2020
	C459SA	Connecting surplus water to the torrent	2020

Actions executed during the LIFETM.

C5. Installation of the rainwater collector and greywater system

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 4T 2022

The objective was the installation of rainwater harvesting and transformation of irrigation systems in order to diminish water catchments from the stream.

The planned action, in 2016, was to intervene in 5 properties. After negotiations with the owners, analysing the status of the newt population and reprioritising interventions, only 4 properties were prioritised. The rainwater collection project for the 4 properties was drafted, but could only be fully execute in one of them. In others two it has been possible to execute the project partially, and both will be fully completed in 2023 (After LIFE). On the fourth property, Land Stewardship agreement was signed 4th april, 2022, and there hasn't been enough time to finalize the contracting of the project and must be awarded and executed in 2023 (After LIFE).

Actions executed:

- The transformation of the irrigation system in a nursery. The renovation of the water filtration and pump systems. The automation of irrigation control based on rainfall and the different plantation sectors. The change from sprinkler irrigation to trickle irrigation with the installation of 65.000 drippers in an area of 6500 m2, with a reduction in water consumption from 20,000 m3/year to 8,300 m3/year.
- LIFETM is promoting rainwater harvesting by reconditioning roofs and roads that cover 5830 m2 in total. This adaptation may retrieve 4110 m3/year to tanks, which have been installed in three properties at lower altitudes while owners also use electric or solar-powered pumps to move water to other tanks placed at higher altitudes, so that it can used for gardening purposes, to fill swimming pools and for livestock. Overall, we have installed tanks which has led to a storage of 895 m3 in total, which will result in economizing 4000 m3/year of water from the streams inhabited by Montseny brook newts

The expected results have been achieved, and it is even estimated that for property with a plant nursery, where rainwater is collected and stored in three tanks (total capacity 314 m3), complete hydric autonomy with rainwater will be achieved for 6–8 months per year. Similarly, it is estimated that in a camping area, the system may meet all of the camping area’s water demands.

Deliverables have been attached to this report. The milestone of improving has been achieved with the adaptation of 5 rainwater tanks and transformation of the irrigation system.

Grey water use has been ruled out because of the difficulty in constructing new wastewater systems which are separate from toilets, and because of the landowners’ refusal to exploit this water. After advice from a nursery installation expert, a new action (C501RU) has been included to improve irrigation efficiency.

Problems have been the same as the ones explained in Action C4. The many hours spent at meetings with owners have been essential to reach agreements and to execute action C5. Before agreeing on the final project, several preliminary drafts have been prepared. Before implementing the actions, it was essential to have a signed agreement.

Because of the consequences of climate change and the reduction in water availability, LIC Montseny managers will continue to offer owners technical and financial assistance for the use of rainwater. The park’s engineers will promote the installation of renewable energy-based systems to pump rainwater from the new reservoirs.

Rainwater harvesting cycle (collection, filtering, accumulation, pumping)

Action Type	ID ACCIÓ	DESC-ACT (ENG)	Execution Year
Irrigation system			
	C501RU	Changing the nursery irrigation system, to drip irrigation	2022
Rainwater harvesting			
	C504RU	Improving concrete ditches for rainwater collection.	2022
	C502FO	Collection of rainwater from the road inside camping	2020
	C514CI	Improving concrete ditches for rainwater collection.	2021
Rainwater tank			
	C505RU	Bulding a water storage tank	2022
	C503FO	Remodeling tanks to store rain water	2020

Actions executed during the LIFETM.

C6. Implementation of green filters of sewage waste in isolated houses

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 3T 2020

In June 2018, a mass campaign was carried out to collect water samples from the Montseny brooks to analyse the water's chemical components. There were no cases in which the results obtained indicated the presence of significant concentrations of toxic elements or contaminants. Actions have only been carried out in the land public installations, where the discharge after secondary purification was improved with a new tertiary treatment.

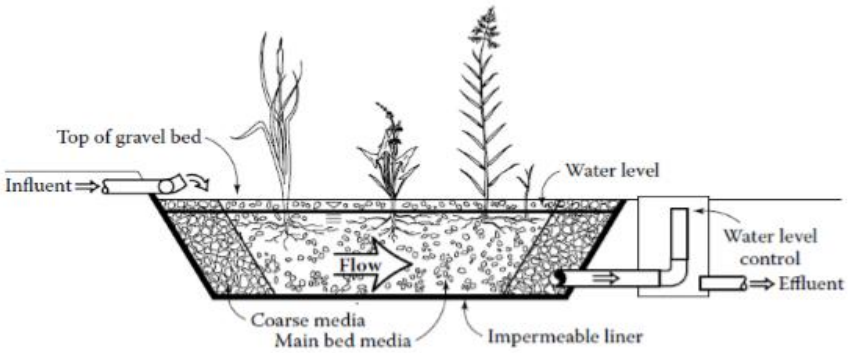
An artificial wetland was built, by means of a small lake (20 x 1.5 m.) with shallow depths (< 40 cm), with vegetation typical of wetlands (70% *Phragmites australis* and 30% *Iris pseudacorus*) and where decontamination processes take place through interactions between water, solid substrate, microorganisms and the vegetation.

The wetland's slope must be practically zero in order to guarantee the correct retention time for the water in the system and that the purification processes can take place. Once this symbiotic relationship between algae and bacteria is established, the processes that occur favour, among other things, the fixation of N and therefore, reduce the concentration of certain elements in the water, thereby improving conditions for reuse or for their return to watercourses while generating the minimum possible impact.

Once the survey of the chemical components of the water had been carried out and no spills directly affecting the newt populations were detected, the actions in the five farmhouses initially proposed in the project were discarded. The C6 actions have only been carried out in the land public facilities, due to the campsite's increased activity in summer and the fact that the discharge occurs in a section of the stream where the newt lives.

In order to take advantage of existing primary and secondary debugging facilities, it has been difficult to find the location for the tertiary purification raft and its design (because of the slopes in the area). Even so, due to the decrease in actions to be taken compared to those initially envisaged in the project, there has been no delay in their completion.

The tertiary purification raft will be an example to replicate in other tourist infrastructures (camping, rural houses, youth camp houses, etc.) in LIC Montseny, due to its efficiency in terms of purification and also as an educational tool and a means of raising environmental awareness. The data obtained by monitoring the physico-chemical quality of the discharged water will be the objective basis to demonstrate the usefulness of tertiary purifications and the effectiveness of this intervention to improve the conservation status of the coastal habitat



Sistema de flux subsuperficial horitzontal (HSSF)

Font // Robert H.Kadlec. & Scott D. Wallace // Treatment Wetlands // 2009

Horizontal surface water flow system

Waste wàter treatement cycle by tertiary treatment by lagooning.

C7. Ecological connectivity in streams across road infrastructures

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 4T 2022

This action's main goal was to improve the ecological connectivity along the streams that cross road infrastructures.

The planned action, in 2016, was to improve 22 road crossings for 8 streams. After rethinking priorities and obtaining permission from the owners, 26 actions were executed, in 7 different streams. Of all necessary connectivity interventions, 10 intervention should be done After LIFE, because they are in torrents with natural population of *C. arnoldi* and because not all the projects could be drafted and processed

Actions executed:

- The agreements between ACA and DIBA have been reached and we have the authorisation to execute all C7 actions.
- The closure of some of the existent path trails and the restoration of the stream's previous orography (that will be the chosen option when possible). Some of the trails are no longer in use.
- On other pathways, small bridges have been built (with vaults, wood, platform or stone) to allow for vehicle mobility and foster newt mobility in the chosen trails
- One of PN-RB Montseny 's signposted paths, which is a GR, crosses a stream with a newt population. To facilitate the passage over the stream without getting wet and to deter passers-by from entering it, the route has been changed and elevated walkways have been built that do not facilitate access to the stream bed.
- Very significant work was done in two of the eastern streams, which had sections with under 50 lineal meters of connectivity and this was improved to more than 6 km without any barriers.

The expected results have been achieved, and it has been found that newts are using these stretches of restored connectivity. Deliverables have been attached to this report.

Problems have been the same as the ones explained in Action C4. Moreover, the implementation of these actions was avoided during the spring due to the amphibian's vulnerability in its reproductive period. It is also when the streams are more plentiful, so it is advisable not to intervene because of the contribution of sediments and the possibility of water contamination due to the movement of machinery. Work was done in the summer, once the flow of the stream decreased.

The managers at LIC Montseny will continue to offer owners and town councils, technical and financial assistance to improve stream ecological connectivity. The park's engineers have the obligation to restore the connectivity of all streams of LIC Montseny. Therefore, the motivation behind the removal of barriers will continue to be roads and footpaths.

The many hours spent at meetings with owners have been essential to reach agreements and to execute action C5. Before agreeing on the final project, several preliminary drafts have been prepared.

Process of disinfection of equipment, removal of drainage pipes, recovery of the stream bed and construction of the bridge.

Action Type	ID ACCIÓ	Execution Year
To restore the shape of the natural riverbed		
	C743RC	2020
	C723RU	2022
	C745RU	2022
	C746RU	2020
	C706RU	2018
	C703RU	2018
	C720RU	2018
	C726RU	2018
	C736RU	2018
	C727RU	2020
	C730FO	2020
	C749RU	2022
Improve river connectivity with wooden bridge.		
	C732FO	2020

Action Type	ID ACCIÓ	Execution Year
Improve river connectivity with platform bridge.		
	C724RU	2020
	C701SA	2020
	C709FO	2020
	C725RU	2020
	C734CI	2020
	C733CI	2020
Improve river connectivity with stone bridge.		
	C735RU	2018
	C721RU	2018
	C738FO	2020
	C731FO	2020
Improve river connectivity with vault bridge.		
	C707RU	2018
	C722RU	2018
	C705RU	2018

Actions executed during the LIFETM.

C8. Improve riparian habitat: Native riparian habitats and forestry practices

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date: 3T 2020 - Actual end date: 3T 2022

The main goal of this action was to improve the natural riparian habitat and promote good forestry practices throughout the river basin where there are newt populations. Actions executed:

- The coordination with ACA and CPF (Forestry Landlords Center) to consolidate administrative procedures to retore the river habitat
- The interventions defined after meetings with the landlords and field prospections in priority lands with their owners to discuss the interventions planned.
- CPF received the newt distribution cartography with the objective of evaluating the forest management plans in this area and to encourage land owners to use all opportunities to start working with new forestry practices
- In the streams where there are newt populations, areas of supervised management (ZGT) were defined. This area is basically the riverside habitat where all human activity is restricted except for that which is aimed at improving the riverside habitat. These areas were and will be defined in the land stewardship agreements (action B2) through which the property undertakes to maintain its natural state for the Montseny newt's benefit.
- Forestry work was carried out to cut down exotic conifers with the objective of replacing their plantation with native species by means of natural regeneration (approx. 3,5 ha). The execution was carried out in two steps for there to be enough shaded area for the stream and to minimize sedimentation. Measures were established, by employing bioengineering techniques, to decrease sedimentation in the stream and avoid erosion by using batters and nets.
- Modifications in the Technical Plan for Forest Management and Improvement (PTGMF) for 2 properties were promoted, in order to incorporate good forestry practices.

The planned action, in 2016, was to improve 5 sections of riverside habitat on 4 streams. After rethinking priorities and obtaining permission from the owners, 24 actions were executed, in 4 streams. The expected results have been surpassed with more than a thousand meters of barriers installed by using bioengineering techniques, and 3.7 ha of exotic conifers have already been cut down, thereby promoting the natural regrowth of an autochthonous forest.

Over the previous 50 years, a decline in river discharges has been observed in Spain, and it has been shown that this decline was due to an expansion of forests and that fast-growing exotic tree plantations are one of the largest consumers of water. Based on scientific publications and the advice of a prestigious hydrologist, the elimination of conifer plantations has been promoted. After technical visits and expert advice, the planned sediment retention meshes have been replaced by constructing barriers with local materials and applying bioengineering techniques.

Problems have been the same as the ones explained in Action C4. Moreover, technical discrepancies between biologists and foresters have led to great confusion. In some cases, a consensus has been found and plantations have been cut down. But in other cases, the removal of some exotic conifer stands has not been authorised and will have to wait until the end of its optimal silvicultural production.

Action Type	ID ACCIÓ	Execution Year
Exotic Conifer felling		
	C805RU	2022
	C809RU	2018
	C819RU	2019
	C824FO	2021
	C827FO	2021
	C830RO	2019
	C817RU	2018
	C836RU	2021
	C822FO	2022
Planting native trees		
	C837RU	2021
	C838RU	2021
	C839CI	2021
	C823FO	2020

Action Type	ID ACCIÓ	Execution Year
Planting native trees & Bioengineering		
	C829FO	2020
	C832FO	2020
	C840FO	2021
	C833CI	2021
	C834CI	2021
	C826RU	2019
	C810RU	2022
	C803RU	2019
Bioengineering erosion reduction		
	C820FO	2020
	C818RU	2022
	C814PE	2022

Actions executed during the LIFETM.

C9. Torreferrusa breeding Centre expansion

Foreseen start date: 4T 2017 - Actual start date: 4T 2016
Foreseen end date: 4T 2017 - Actual end date: 4T 2017

During the last quarter of 2016, contact has been made with the city council of Santa Perpetua de Mogoda in order to obtain the authorizations to expand the Torreferrusa breeding centre**.** The procedures to obtain authorizations by the city council took longer than expected, although they were obtained in the end. In April 2017, the tender was presented for the acquisition of the pre-built house and on June 29 its installation began. The installation consists of three interlocking pre-fabricated modules. At the end of September, the pre-fabricated module's installation was completed. The installation of the aquariums began in mid-November and was extended until the end of January. To maintain the room's ambient temperature, an industrial refrigerator was installed.

The new facilities are fully operational and the action objectives are thought to have been successfully achieved. For more technical information on the design and operation of the new facilities please refer to the attached document delivered in the 2018 mid-term.

Examples of diferents times to construction of the new breeding centre

C10. Operation of the Torreferrusa breeding centre

Foreseen start date: 1T 2018 - Actual start date: 1T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

After new aquariums were built in Torreferrussa (Action C9), intensive breeding management was carried out to maximize production and to control kinship of individuals according to species management protocols (Action F2). Adult specimens were individually identified and new couples were created to maximize genetic diversity of the population (fulfilling action F2). Breeding individuals were kept in pairs or small breeding groups (maximum 5F+4M). Some males were alternately shared with different females in different aquariums. Group management was incorporated to maximize success.

There was an increase in the number of breeding pairs and larvae, thereby exceeding the number that had been targeted at the beginning of the project. However, there is a big gap between the two populations. The success rate for the western population is as good as expected with a notable increase along the years, reaching the maximum expected bearing in mind the capacity of the centre. On the other hand, eastern population success fared poorly, a fact that was observed in all the breeding centres. No apparent reason is known for this poor performance, although some changes in breeding pairs and protocols have been carried out so as to improve results.

The high density of animals in the aquariums has had a negative effect, mainly in the early stages of development. High mortality and slow growth rates have been detected. This situation has also been aggravated by restrictions caused by the Covid pandemic as well as by bacterial overgrowth in the aquarium water circuits. This bacterial overgrowth has not had a direct pathological impact on individuals, but in some cases, it has led to the collapse of water circulation. This problem was resolved with the installation of filters and independent circuits, and during 2020 a new nursery room has been fitted out for larvae growth.

Due to the fact that the effort in the upkeep of the specimens is greater than initially expected, more staff and more funds than initially planned had to be invested. There has been an improvement in the eastern population in the last two years. In the western population, priority has been given to the breeding of the most genetically valuable specimens. The release of a large number of specimens is reflected in the census at the end of the year, especially in the western population.

Finally, the commitment of Forestal Catalana S.A. and the Generalitat de Catalunya to continue with the activity of the breeding centre after the end of the project is very noteworthy. This commitment is illustrated by carrying on with the investments necessary for the maintenance of the centre as well as the professionals' contracts, who were specifically hired for the project. Since the date of completion of the action, the activities of the breeding programme have continued taking place.

Year	Western Population Census (31 December)			
	T	M	F	U
2022	**402**	**62**	**62**	**278**
2021	**604**	**87**	**87**	**430**
2020	614	65	62	487
2019	440	76	87	277
2018	623	136	163	324
2017	529	144	177	208
2016	419	144	177	98
Year	**Eastern Population Census (31 December)**			
	T	M	F	U
2022	**276**	**90**	**93**	**93**
2021	**257**	**110**	**101**	**46**
2020	**309**	**88**	**89**	**132**
2019	**391**	**140**	**127**	**124**
2018	**399**	**149**	**136**	**114**
2017	**348**	**150**	**136**	**62**
2016	**371**	**162**	**148**	**61**

		Pairs	Eggs laying pairs	Breeding pairs	Eggs total	Born larvae	Raised larvae
2017	Eastern	17	12	3	253	23	18
	Western	10	9	4	346	128	117
	Total	27	21	7	599	151	135
2018	Eastern	17	13	6	419	48	24
	Western	26	16	10	623	192	142
	Total	43	29	16	1042	240	166
2019	Eastern	43	17	6	291	38	26
	Western	49	36	23	1247	272	175
	Total	92	53	29	1538	310	201
2020	Eastern	43	22	9	438	61	32
	Western	46	42	32	1589	415	312
	Total	89	64	41	2027	476	344
2021	Eastern	41	22	9	627	62	14
	Western	49	42	32	1758	747	649
	Total	90	64	41	2385	809	663
2022	Eastern	41	32	15	830	76	58
	Western	63	49	29	1596	583	483
	Total	104	81	44	2426	659	541

Evolution of the total number of individuals kept and breeding result in Torreferrussa breeding center (T: Total; M:Male; F: Female; U: Undeterminated).

Breeding centre in the activity of feeding and mantenimence works

C11. Expand and improve the Barcelona ZOOBCN breeding centre

Foreseen start date: 1T 2017 - Actual start date: 3T 2017
Foreseen end date: 4T 2017 - Actual end date: 2T 2018

The purpose of this action was to expand the existing breeding facilities of the Montseny brook newt (operational since 2013) at Barcelona ZOOBCN, with the main aim of doubling the production of *C. arnoldi*.

During the first phase of the project, the design of the new facilities was modified to considerably increase the capacity of the aquariums housed, as well as the area dedicated to education and awareness. The economic cost overruns in relation to the budget corresponding to this action were fully assumed by Barcelona ZOOBCN

The total number of aquaria in this pre-LIFE existing facility was 16, In the new facilities there are 5 aquarium batteries, with a total of 96 aquariums running at full capacity. This action is therefore considered a complete success, as it has tripled what was described in the initial proposal.

This success in construction must be followed by the facility being operated correctly and it is making it possible to increase all reproductive parameters for both populations of the Montseny newt. In addition, maintaining two separate facilities in operation has made it possible to house individuals from the two existing populations (eastern and western), thus increasing biosecurity in the global *ex situ* management of the species.

Examples of diferents times to construction of the new breeding centre and Official inauguration (June 28th 2018).

C12. Operation of the Barcelona ZOOBCN Breeding Centre

Foreseen start date: 4T 2016 - Actual start date: 4T 2016
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

The main purpose of this action was to increase the reproductive success rates of the *ex situ* breeding program, in order to contribute towards repopulation and to maintain a genetic reserve of the species' eastern population, by applying the protocols described in the Best Practice Guidelines (described in Action F2). The development of the scheduled handling tasks with the newts entailed a dedication of 6 hours a day, throughout the year. These tasks were considered to be highly specialised and have been assumed by the terrarium keepers. Two researcher-keepers have been hired and are supervised daily by a specialist keeper from Barcelona ZOOBCN terrarium staff.

Since the beginning of the Montseny newts' breeding activity at ZOOBCN (2012), only eastern population individuals have been kept. Due to the increased capacity in keeping newts from LIFETM, and the need to diversify the groups to maximize security against possible mortalities, it has meant that a total of 33 western adult newts were transferred to ZOOBCN. Currently, both populations are kept separate, with the new facilities being for the eastern population, and the pre-existing ones for the western population.

The number of breeding groups in the eastern population remained more or less stable over the first three years but clearly increased in 2019 and 2020. This is probably because many of the newts that were immature or inexperienced in the early years have become increasingly sexually mature and reproductively skilled. In 2021 and 2022, there is a decrease in the number of breeding groups, but despite this the results are still satisfactory. In general terms, the total number of eggs laid (fecundity rate) had been increasing until 2021. The number of fertile eggs in relation to the total number of eggs (fertility rate), has been increasing since the beginning of the project. The birth rate (number of hatchings over the number of fertile eggs) has been slowly increasing since the beginning of the project, and more quickly in 2019, 2020 and 2021, and the survival rate (number of surviving larvae over the number of hatchings) has increased only up to 2020.

With regard to the western population, breeding parameters have increased considerably in just the first two years that they have been kept at ZOOBCN. While the number of eggs laid has doubled from one year to the next, the number of fertile eggs, hatchlings and survivors has tripled, and therefore the total count of individuals corresponding to this population has doubled since their arrival in 2019 and up to the end of 2020. In 2021 and 2022, the positive progression has continued in terms of fertile eggs, hatchlings and survivors, despite a reduction in the number of eggs laid.

It is significant that there has been a progressive increase in reproductive success rates for both populations and this should be seen as a positive indicator in terms of progress. This increase seems to demonstrate the viability of *ex situ* breeding of this species. In coming years, it is expected that there will be a tendency to increase these rates, because more adult specimens will reach sexual maturity and will improve their reproductive skills. Therefore, with the course of time, the results will naturally improve. It should also be noted that the real coordination among all the breeding centres achieved thanks to the LIFE project (see action F2) has been another key factor, especially when sharing improvements in management protocols, overcoming recurring problems and optimising the *ex situ* reproduction of the species.

Finally, the commitment by Barcelona ZOOBCN to continue the activity in the two population breeding centres after the end of the project is remarkable. This commitment is

established by the extension of the professionals' contracts who were specifically hired for the project and who will be in charge of keeping this action going in the future.

YEAR	Breeding groups	Eggs laid	Fertile eggs	Hatchlings	Survivors	TOTAL Eastern
2016	10	91	5	5	1	91
2017	15	273	15	11	6	97
2018	15	264	62	61	49	146
2019	20	603	126	112	75	174
2020	27	661	126	118	97	241
2021	21	667	140	135	88	323
2022	21	512	150	127	54	304

YEAR	Breeding groups	Eggs laid	Fertile eggs	Hatchlings	Survivors	TOTAL western
2019	12	163	24	19	14	39
2020	13	303	72	70	36	81
2021	11	562	224	212	142	142
2022	10	508	265	246	188	214

Breeding results of eastern (left) and weatern (right) population in ZOOBCN Barcelona breeding center.

Breeding centre, with a newt trying to escape. Amplexus activity and egg laying in ZOOBCN.

C13. Extension of the Pont de Suert breeding centre

Foreseen start date: 4T 2017 - Actual start date: 3T 2017
Foreseen end date: 4T 2017 - Actual end date: 1T 2018

Initially, the decision was made to build a pre-fabricated module for the installation of the aquariums and a work office. When contacts were initiated with the municipality, the latter refused to grant the necessary permits because the area was classified as floodable and as such it could not be developed. Therefore, it was decided to remodel an existing area of the centre. The old building, previously used as a kitchen, has been transformed to be used as a new breeding centre, adapting the electrical, cooling and water systems to the new aquariums.

The works began in June 2017 with the installation of the cooling engine and in the capacitor, a double roof with thermal insulation was installed. The entire electrical system was subsequently refurbished to meet the requirements for the aquariums. The breeding room was conditioned with the installation of a thermally insulated door. An external wooden corridor was built that allowed the inside of the room to be viewed through a window without the need to enter it.

During the month of January 2018, the aquariums were assembled. Throughout the month of February, small aspects related to the aquariums were finalized and put on display in the work system. Finally, at the beginning of March, with the whole filtering system having been developed, the specimens were transferred. This transfer of copies has been carried out progressively to detect possible problems and finally, in April, all the copies were already in the new room.

Examples of diferents times to construction of the new breeding centre

C14. Operation of the Pont de Suert breeding centre

Foreseen start date: 1T 2018 - Actual start date: 1T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

The new facilities built in Pont de Suert have been fully operational since 2018 and they were equipped with 6 racks, totalling 120 aquariums. This has allowed for a progressive increase in the number of couples available for the western population's breeding program, and a greater ability to hold the specimens for growth purposes until their subsequent release.

Adult specimens were individually identified and new couples have been created to maximize the genetic diversity of the population. Breeding individuals are kept in pairs or small breeding groups (maximum 2F+1M). Some males are alternately shared with different females in different aquariums and group management has been incorporated to maximize success rates. Eggs were removed every two weeks from the aquarium to prevent predation, as well as to facilitate the control over their evolution. Eggs and juveniles were kept in family groups, to facilitate subsequent kinship verification of the specimens.

The number of breeding pairs from the western population has been increasing during LIFETM. Modifications concerning pairs with poor success rates have been implemented, and new specimens from the Torreferrussa breeding centre have been incorporated to the stock. Breeding success has been increasing with the addition of new couples. The results achieved at the breeding centre at Pont de Suert are as good as expected, with a notable increase along the years, reaching the maximum bearing in mind the centre's capacity. Over 2019 and 2020, 20 adult newts have been released into the wild. As a result, the availability of aquariums for growing larvae and sub-adults has been increased.

Since the date of completion for this the action (4T 2020), the activities which are part of the breeding program have carried on. In the western population there have been changes in pairs and some of the most genetically represented breeders have been released during the spring of 2022. Priority has been given to the breeding of the most genetically valuable specimens. These specimens are the most difficult to reproduce and for this reason there has been a decrease in the total production of larvae.

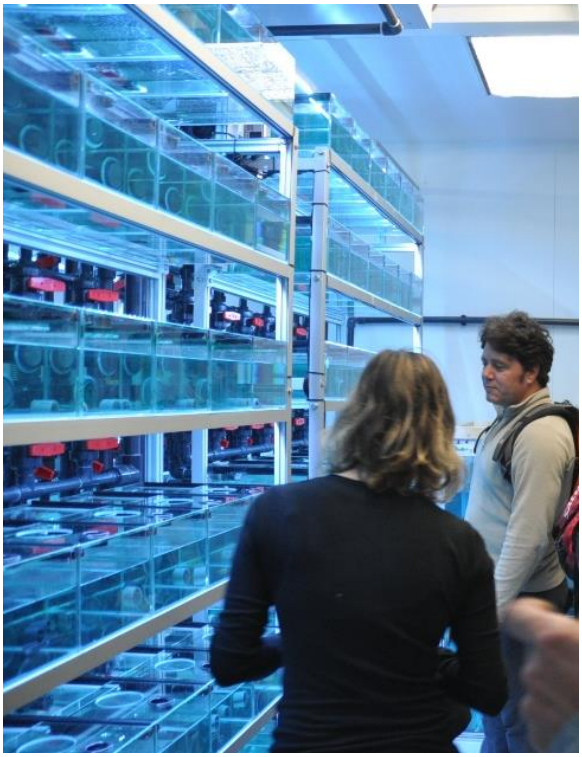
A part-time position was created to support the breeding program's activities, but due to administrative problems it has been delayed by half a year with regard to the planned start date. Due to the fact that the effort in the upkeep of the specimens is greater than initially expected, it has been necessary to invest more in staff than initially planned on behalf of the partners.

Finally, the commitment shown by Forestal Catalana S.A. and the Generalitat de Catalunya to continue with the activity at the breeding centre after the end of the project is very noteworthy. This commitment is illustrated by their continued investment, necessary for the maintenance of the centre as well as the professionals' contracts who were specifically hired for the project.

	Total	Male	Female	Undetermined
2022	343	12	14	317
2021	326	20	26	280
2020	536	20	26	490
2019	325	27	33	265
2018	222	27	33	162
2017	58	20	20	18
2016	40	20	20	0

Year	Pairs	Eggs laying pairs	Breeding pairs	Eggs total	Born larvae	Raised larvae
2017	6	6	4	369	111	16
2018	6	5	5	381	169	84
2019	19	15	10	544	182	108
2020	21	18	15	858	304	282
2021	21	18	13	962	337	253
2022	21	18	11	755	345	277
TOTAL				**3869**	**1448**	**1020**

Evolution of the total number of individuals kept and breeding result in Pont de Suert breeding center Western population Population Census (31 December 2022)



Breeding centre in the activity of feeding and general overview with 1 Juveniles from the eastern stock

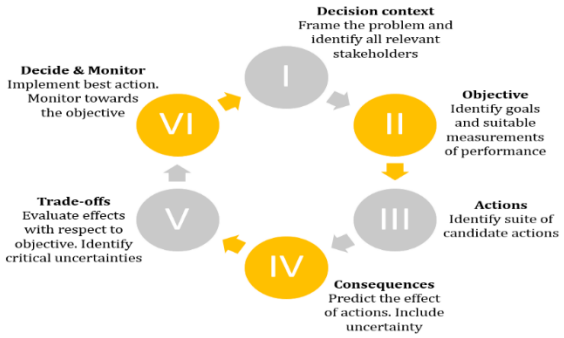
C15. Introduction of the Montseny Brook Newt, expansion its distribution area

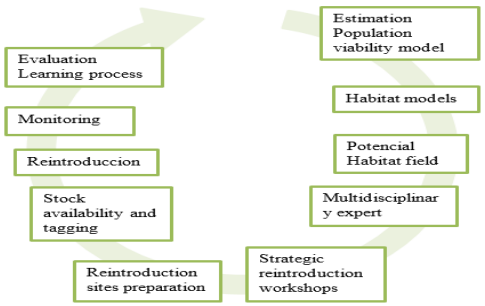
Foreseen start date: 4T 2017 - Actual start date: 2T 2017
Foreseen end date: 3T 2020 - Actual end date: 4T 2022

The main goal of this action was to increase the species' geographic range by releasing captive born newts. This was conditioned by production capacity and the availability of new potential habitats. In order to provide effective decision-making tools, a specific process was undertaken from the start to define a long-term Plan and therefore produce new populations, while a reintroduction experts workshop was created to asses this process.

Planing new popuation process:

- **Use a structured decision process framework**
- Involve key stakeholders to better frame specific objectives for the creation of new populations.
- Identify new potential sites through SDM and expert knowledge and subsequent field validation.
- Build population models based on expert assessments.
- Integrate all in an optimization analysis in order to identify the better strategy to create new populations.
- Give a strong basis for a future learning process.





Flow diagram. 1. Decision process. *2. Accions developed timelin*

Habitat models/ Demogràfic model. Two models constructed: First, a model based on the geographical variables using data on the presence of the species. Second, a demographic model to establish a reintroduction program. This model defined for each potential habitat several scenarios that combined the periodicity of reintroductions with the number of adult individuals to be released, in order to provide a guide when establishing a release protocol.

Potencial Habitat field survey. The methodological procedures involved in the modelling process have a main limitation, the lack of digital information on the hygroperiod of the Montseny streams. The models obtained, thus, could select a stream based on climate, forest structure and other relevant variables, but these potential habitats, actually, may have not enough water flow to allow the persistence of introduced populations. Therefore, it was essential, once the models were available, to carry out field surveys to validate the results obtained. Visit the different locations and to inspect and verify if they are, in fact, optimal to create new populations. Other information limitation, as biodiversity and abiotic (geology and soil) data on a very detailed scale, in the specific habitat of the Montseny newt, was contracted to specialists, in the field of action D5 or D6.

Expert evaluation and workshops. The results obtained above, were evaluated by a multidisciplinary team of experts (biologists, ecologistst , geologists, herpetologist, etc.) and

through multiple workshops, and both, the target localities and the most favourable range of individuals to release were defined by them. All releases and reinforcements carried out during the LTM have been previously agreed by the reintroduction workshop group.

Reintroduccion sites preparation/ Stock availability and tagging. Once the available locations and the individuals available for release have been established, two parallel processes start: 1. To prepare the locality: georeferencing, mapping and marking the available ponds in each stream for reintroduction, assessing the carrying capacity of each release point. 2. To prepare the individuals in the rearing centers: separate, mark (chips or elastomers) and analyze the individuals to rule out emerging diseases before their release.

Reintoduccion. Considering meteorological and hydrological conditions, the date of reintroduction is chosen and all the teams involved are coordinated to facilitate the transfer of the individuals to the field, reduce transport time and document the whole process.

Monitoring. Each reintroduction experience necessarily involves a posteriori monitoring aimed at tracing the evolution of the population over time, in order to assess its success. This is carried out through visits to the reintroduction areas during periods of favorable activity for the species and sampling of the population by capture-recapture. In the case of adult individuals, the identification procedure consists of the implantation of micro-chips, while in the case of immature, larvae, it is the marking with elastomer in at least one point of the body. In addition, an inspection of the physical, sanitary and reproductive conditions of the individuals is carried out.

Evaluation/Learning process. Establishing a specific reintroduction methodology and documenting it, has allowed us at the end of each reintroduction to evaluate the process, with its successes and failures. Detect and learn from the mistakes made and unforeseen events to improve the process.

Results.

All this process mentioned above, finally, was documented in the Programme to create new populations of the Montseny newt 2021-2030, and now included in the Montseny newt Recovery Plan to be approved by the Generalitat de Catalunya (C1,annex 5).

The plan to create new populations, developed during this project, it has been followed in all reintroduccions carried out. Surveys of potential habitat carried out in practically 90% of the territory considered as potential.

Since 2010, eight new populations created (5 under the LTM). Prior to the LTM, 724 releases were made and during the LTM, **2127 releases have been made,** which more than doubles the number of individuals released during the pre-LTM in a similar period of time. Five new localities opened and reinforced during LTM, monitoring pre-LTM locations maintained and the one that showed the greatest viability reinforced.

The next table shows all the individuals released before, and during the project. Due to the extreme sensitivity of the species and its habitat, the real names of the localities (streams) where reintroductions are carried out are not used in any public report. A code has been created to identify each location, as it was already done with the natural populations. It was stablished an alphanumeric code, A for estern locations, and B for wester ones, atached to a correlative number, started at 1, for de oldest location found.

Actually, there are **8 natural locations**, 3 in the estern sector (A1, A2, A3) and 5 in the western (B1, B2, B3, B4, B5), and 8 released locations, 3 in the ester sector (A4, A5, A6) and 5 in the western (B6, B7, B8, B9, B10). According to surveys, not all reintroduced localities have been successful, and localities A4 and B7 (pre LIFETM releases) have not been successful to our knowledge.

PRE LIFE PROJECT (location code: A4, A6, B6 i B7)				
YEAR	**WEAST S**	**EAST S**	**POPULATION**	**TOTAL**
2010	112	0	1	112
2011	180	123	2	303
2012	81	0	1	81
2014	94	69	4	163
2015	65	0	2	65
TOTAL	532	192	4	724
LIFE PROJECT (locations code: A5, A6, B6, B8, B9, B10)				
YEAR	**WEAST S**	**EAST S**	**POPULATION**	**TOTAL**
2019	136	0	1	136
2020	107	128	4	235
2021	814	0	2	814
2022	852	90	3	942
TOTAL	1909	218	5	2127

Table. Nº individuals released before and during LTM in each sector. EAST (eastern sector, WEAST (weastern sector)

The distribution of recaptures follows a pattern similar to the pattern of releases. Released newts show a greater dispersion than individuals do from wild populations, which may be a consequence of their previous life in captivity or in search of optimal environments in a new habitat. The last years, the lack of rainfall is causing longer low water levels in the streams, which drives the animals to move more to ensure their survival, leading us to reconsider new reintroduction strategies.

This work is preliminary and until more years pass, it is not possible to provide more data on the future of the new populations. For now, the information is very encouraging for the reintroduced populations, but as the plan says, intensive monitoring must be maintained to evaluate the success of the releases and to invest efforts in the most successful processes.
**Extended report on the results of this action attatched*

The next table shows new populations established in the *C. arnoldi* potential area of distribution. Only population codes are written because of conservation policies for this CR species. Range: slope location in La Tordera river basin. First release: year when first release was made. Last released: last booster. Last recapture: year when *C. arnoldi* was captured in the stream. Property: Land property where the new population and stream stretch are located.

CODE	RANGE	NUMBER OF RELEASED NEWTS	FIRST RELEASED	LAST RELEASED	LAST RECAPTURE	PROPERTY
A4	Eastern	166	2011	2014	2016	Private
A5	Eastern	153	2020	2022	2020	Public
A6	Eastern	127	2014	2020	2021	Public
B6	Western	436	2010	2020	2021	Private
B7	Western	106	2014	2015	2019	Private
B8	Western	327	2019	2022	2021	Public
B9	Western	1318	2021	2022	----	Public
B10	Western	219	2022	2022	----	Public

New populations established in the C. arnoldi *potential area of distribution*

As a conclusion, it is worth highlighting certain conditions for the success of the populations:

- Maintenance of a subway water flow during the summer drought period
- Existence of a slope that guarantees a minimum flow and oxygenation
- Presence of fissured shale type rocks and a native riparian forest or beech forest.

Regarding the success of each of the populations, eight years after the first reintroductions in population B6, reproduction has been observed in the wild. Within the reduced extension of habitat conditions, B6 has the possibility of being viable, although it is advisable to carry out periodical reinforcement releases. In the case of populations B8, A5 and A6, a minimum survival rate leads us to be optimistic about their future, while in B7, this could be much lower. According to what has been observed in population A4, the reunion of individuals even some years later does not represent any guarantee of long-term success, as it depends on the degree of habitat conservation. In addition to monitoring, it would be advisable to carry out periodic and spaced-out reinforcement releases to try to consolidate them.

The success of the program for the introduction of new populations of the Montseny newt is based on two crucial aspects: the release of a large number of newts in nature and the selection of streams with optimal habitat conditions. Until 2018, the number of released newts was slow because only one of the captive breeding centres (CRF Torreferrusa) was highly productive. In addition, most of the newts born in this centre were stocked to maintain a genetic reserve or to give to the other centres involved.

Nowadays, four more centres are involved in the breeding and growing process, Barcelona ZOO, Pont de Suert, Chester ZOO and most recently CREAC (Centre for Research and Environmental Education of Calafell), while more larvae are also available to be released.

A detailed map of optimal streams for reintroduction was not available at the start of LIFETM. To overcome the issue of subjectivity when choosing locations, an external team conducted an environmental modelling of the species' distribution, providing a high precision map of potential habitats for the species, and one of the firsts steps in the reintroduction process. Due to these preliminary tasks, no newts were released before 2019, yet, even if we take into account this delay, the action's goals have been fully achieved.

Activity of marking newts to be released and release of adults in Montseny

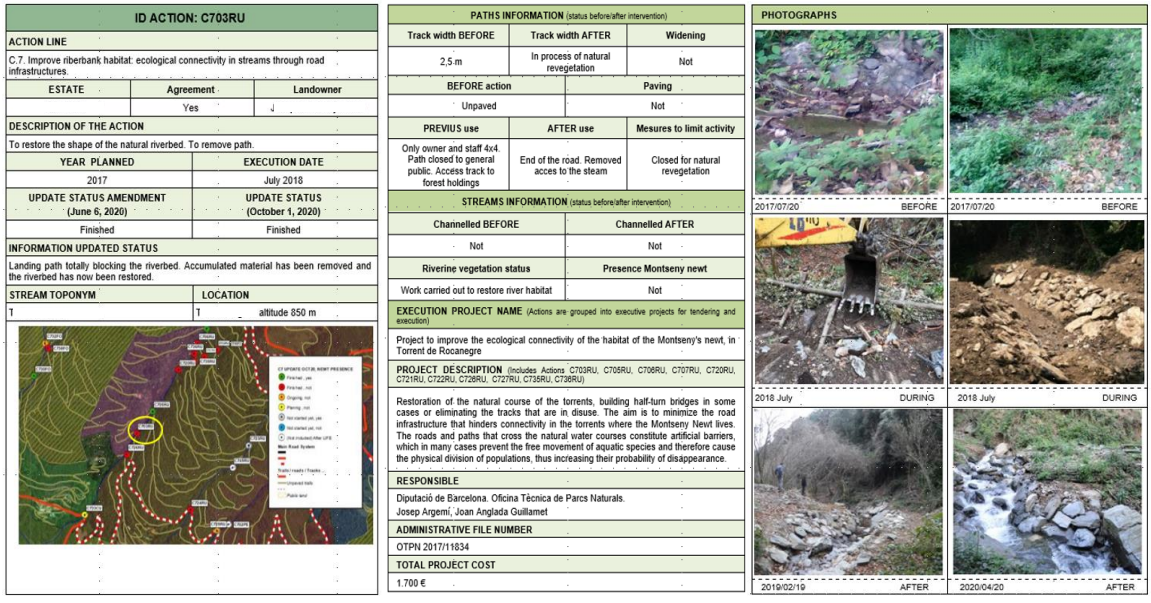
D1. Technical Monitoring of the actions for a sustainable and responsible water and improvement of habitat use.

Foreseen start date: 4T 2017 - Actual start date:1T 2018
Foreseen end date:4T 2020 - Actual end date: 4T 2022

The restoration of the riparian habitat is a job that does not yield immediate results. To determine how and where the interventions are working, threat reduction assessments should be performed to measure the conservation project's success. During the execution of the actions programmed to improve water use and the riparian habitat, each action has been monitored periodically in order to direct the works and confirm that they follow the project execution plan. Once the work was completed, the site was monitored to verify its correct operation and to propose corrective measures in the event that any operational problems were detected or its effectiveness could be improved. The follow-up consisted of visits to the action's area, supervision of what was done, cost control, planning of the next steps of the action and the implementation of changes during the execution, in order to meet the objectives set out. The monitoring of the works and infrastructures in the action to ensure their correct functioning has been carried out by the RB Montseny NP technicians who have directed the work, with the collaboration of the park nursery. The purpose of this follow-up is to verify the correct operation and to collect the data required to obtain the indicators that will allow the performance to be subsequently evaluated.

All this information has been kept up to date throughout the project in a geographic information system which is also linked to a database. Based on this data, a follow-up report has been generated for each of the actions carried out, including the basic data of each action and an update on their progress. The summarised information about this technical project and the 75 actions executed, is attached in the report D1.1.

As a conclusion, this action has made it possible to establish the natural regeneration of the habitat after LIFETM interventions. Over the years, bioengineering works become fully integrated into the natural environment. After two to three years of restoring connectivity in the streams, torrential rains are restoring the original stream bed, and it has been shown that newts are starting to move through these new open stretches.



ID ACTION: C703RU

ACTION LINE

C.7. Improve riberbank habitat: ecological connectivity in streams through road infrastructures.

ESTATE	Agreement	Landowner
	Yes	

DESCRIPTION OF THE ACTION

To restore the shape of the natural riverbed. To remove path.

YEAR PLANNED	EXECUTION DATE
2017	July 2018
UPDATE STATUS AMENDMENT (June 6, 2020)	**UPDATE STATUS (October 1, 2020)**
Finished	Finished

INFORMATION UPDATED STATUS

Landing path totally blocking the riverbed. Accumulated material has been removed and the riverbed has now been restored.

STREAM TOPONYM	LOCATION
T	T altitude 850 m

PATHS INFORMATION (status before/after intervention)

Track width BEFORE	Track width AFTER	Widening
2,5 m	In process of natural revegetation	Not
BEFORE action		**Paving**
Unpaved		Not
PREVIUS use	**AFTER use**	**Mesures to limit activity**
Only owner and staff 4x4. Path closed to general public. Access track to forest holdings	End of the road. Removed acces to the steam	Closed for natural revegetation

STREAMS INFORMATION (status before/after intervention)

Channelled BEFORE	Channelled AFTER
Not	Not
Riverine vegetation status	**Presence Montseny newt**
Work carried out to restore river habitat	Not

EXECUTION PROJECT NAME (Actions are grouped into executive projects for tendering and execution)

Project to improve the ecological connectivity of the habitat of the Montseny's newt, in Torrent de Rocanegre

PROJECT DESCRIPTION (Includes Actions C703RU, C705RU, C706RU, C707RU, C720RU, C721RU, C722RU, C726RU, C727RU, C736RU, C739RU)

Restoration of the natural course of the torrents, building half-turn bridges in some cases or eliminating the tracks that are in disuse. The aim is to minimize the road infrastructure that hinders connectivity in the torrents where the Montseny Newt lives. The roads and paths that cross the natural water courses constitute artificial barriers, which in many cases prevent the free movement of aquatic species and therefore cause the physical division of populations, thus increasing their probability of disappearance.

RESPONSIBLE

Diputació de Barcelona. Oficina Tècnica de Parcs Naturals.
Josep Argemí, Joan Anglada Guillamet

ADMINISTRATIVE FILE NUMBER

OTPN 2017/11834

TOTAL PROJECT COST

1.700 €

PHOTOGRAPHS

Example of a monitoring sheet for one of the 75 actions implemented.

D2. Montseny brook Newt population monitoring (natural and reintroduced)

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date:3T 2020 - Actual end date: 3T 2022

Field sampling on the natural populations of the Montseny Brook newt has been performed annually following the methodology that was previously established in 2016, so that the data before and during LIFETM's implementation were homologous. It allows us to calculate indicators to objectively quantify the level of conservation for the eight populations of the species during the period 2017-2020, compare it with the previous values for the same indicators, and therefore evaluate whether the situation of the species deteriorates or improves.

Throughout LIFETM, 72 nighttime itineraries were performed; sampling most of the species' range and 1211 geolocalised observations of Montseny Brook newts have been obtained. We analysed the accumulated data on a yearly basis which led to five annual reports being written, providing information on the results achieved in the development of action D2.

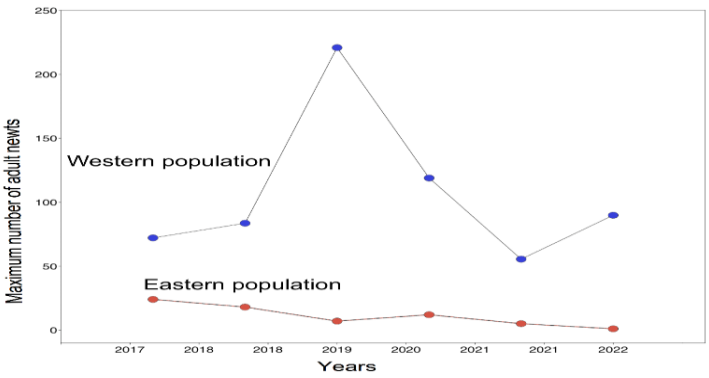
We have sampled eight populations that comprised all of the species' geographic range: three of them located in the eastern sector and four in the western one. Whenever possible, each population was sampled for two nights on a yearly basis by a team of three people, with most of the field work being carried out in spring. During this period, samplings were extended to the autumn if there was not enough water availability. Newts were visually detected and sexed, and in some cases samples for genetic, demographic and pathologic analysis were taken. We performed additional samplings in order to gather data on the species' diet and to define more precisely the lower limit of the species range.

When the latter were carried out, newts were found at lower altitudes than expected in one of the eastern populations as well as in a western one, while some newts were also found in a stream section that was difficult to sample.

Populations and Groups of populations											
Year	A1	A2	**A3**	Eastern	B1	B2	**B3**	B4	B5	Western	Total
2017	10	12	**2**	24	9	23	**10**	2	24	72	96
2018	11	5	**2**	18	25	13	**3**	31	11	83	101
2019	7	0	**0**	7	2	22	**12**	155	24	215	222
2020	4	8	**0**	12	10	12	**4**	80	11	117	129
2021	4	4	**0**	8	2	3	**4**	41	6	56	61
2022	0	1	**0**	1	5	13	**3**	68		89	90
Total	36	30	**4**	70	53	86	**36**	377	76	632	699

Maximum number of adult newts observed during one of the two nights invested in nigth samplings by population, groups of populations and in the total during the six years of LIFE project implementation.

Integrating the results of the analyses performed, we consider the A3 and B3 as the most endangered populations of the species and now experiencing the highest risk of extinction. The A1, A2 and B1 are in a worrying situation that could evolve in the future to the level of the A3 and B3. The B2, B4 and B5 populations are the best preserved and until now only periodic surveillance is needed.



Dynamics of the maximum number of adult newts counted by year through the period of the LIFE project implementation

The action D2 was annually implemented according to the deadlines of both field samplings and data analysis and drafting of the reports. The problems we experienced were not related with the timing of the action completion, but with the development (see below). We have changed some methodological issues related to the field surveys to try to overcome the problems we find without any impact on the foreseden budget.
All otther aspects included in the development of the D2 remained unmodified.

	Population size	Population density	Stream occupancy	Population fragmentation	Population isolation	Negative impacts
B1	Low	Low	Medium	High	Complete	Forest and water exploitation and forests tracks
B2	Medium	Medium	High	Very low	Medium	Water exploitation
B3	**Very low**	**Low**	**Very low**	**Low by restricted extension**	**Medium**	**No**
B4	High	High	High	High	Medium	Forests tracks
B5	High	High	High	Very low	Low	No
Western	Medium	Medium	Medium	Medium	Medium	
A1	Low	Medium	Medium	High	Complete	Forest and water exploitation, alteration of riparian forest and forests tracks
A2	Medium	High	Low	High	Complete	Forest and water exploitation, alteration of riparian forest and forests tracks
A3	**Very low**	**Low**	**Very low**	**Low by restricted extension**	**Complete**	**Forest and water exploitation, alteration of riparian forest and forests tracks**
Eastern	Low	Low	Low	High	Complete	

Categorisation of the populations and groups of populations of Calotriton arnoldi *based on parameters analysed and listing the negative impacts.*

During the implementation of the D2 action we have encountered two problems. First, we experienced severe droughts and in some cases short episodes of intense and heavy rain. In practical terms, these environmental issues limited the time available to sample the species' natural populations. The solution was to modify the sampling schedule, extending the period of field work until December. However, the impact of the droughts in the last two years was so dramatic that even in winter most streams remained superficially dry and we were unable to complete the samplings. We took advantage of the field sampling on the species' natural populations to obtain tissue samples and improve the sample size for a study on the species' population genetics.

The major finding after comparing the results prior and before the LIFETM implementation is that the Montseny Brook newt must still be a critically endangered species based on the criteria of the International Union for Nature Conservation (IUCN). The inferences of the analyses we performed is that Montseny Brook newts, after almost 20 years of its discovery, continue to be a critically endangered species and we found evidence that the situation of the natural populations have slightly deteriorated and worsened since this time. In concrete, we find evidence of the dramatic decline of one of the three populations of the eastern basin, which is the most endangered, that might have already become extinct. Another population, in this case in the western basin showed signs of decreases in their initially reduced range and population decline. Evaluation of the characteristics of the populations in relation to the negative impacts experienced by the habitats indicates that only three populations - all of them in the western basin - have possibilities to successfully face the severe droughts that each time more frequently affects the Montseny.

On the basis of this conclusion, the main hope for the species persistence in the future is the success of the program of reintroduction and implantation of new populations to compensate for the loss of geographic range and individuals. Nevertheless, the monitoring of the natural populations is a very important tool providing critical information for the species management and should be continued during the next years.

**Extended report with all results, analisis and evaluation attached to this document.*

Desinfecting and nocturnal sampling of a stream. Diet sudies and W*C to obtain excrements*. *Collection of biometric data and Individual marking with elastòmers*

D3. Surveillance of infectious diseases in PN-RB Montseny amphibians

Foreseen start date: 2T 2017 - Actual start date: 1T 2017
Foreseen end date: 2T 2020 - Actual start date: 2T 2020

The aim of this action was to assess the health status of amphibians in LIC Montseny bearing in mind the potentially high risk of disease introduction by the general public or by illegally introduced amphibians.

Biological samples have been collected mainly from Montseny brook newts (*Calotriton arnoldi*) but this was also done for 7 different other species of amphibians: *Bufo spinosus, Salamandra salamandra, Rana temporaria, Pelophylax perezi, Alytes obstetricans, Hyla meridionalis* and *Lissotriton boscai.* For the surveillance of the infectious pathogens *Batrachochytrium dendrobatidis* (Bd), *Batrachochytrium salamandrivorans* (Bsal) *and Ranavirus* (RV), samples were collected.

In total, 426 samples have been analysed by PCR for Bd/Bsal/RV until 2020, 398 from wild Montseny brook newts and 33 samples from other amphibian species. All samples have tested negative for Montseny brook newts but 3 cases of *Bd* have been confirmed by PCR in other species of amphibians (*H.meridionalis, R.temporaria* an d *A.obstetricans).* No mass mortalities of amphibians were detected associated to these positive cases and it is hypothesised that these animals could be asymptomatic carriers.

Year	Sample	B.d -	B.d +	B.sal -	B.sal +	RV -	RV +	N. Samples
2017	Calotriton	26	0	26	0	26	0	26
2017	Calotriton	9	0	9	0	9	0	9
2017	Other amphibian	7	0	7	0	7	0	7
2018	Calotriton	126	0	126	0	126	0	126
2018	Calotriton	37	0	37	0	37	0	37
2018	Other amphibian	11	**1**	12	0	12	0	12
2019	Calotriton	194	0	194	0	194	0	194
2019	Calotriton	2	0	2	0	0	0	2
2019	Other amphibian	10	**1**	11	0	11	0	11
2020	Calotriton	0	0	0	0	0	0	0
2020	Calotriton	0	0	0	0	0	0	0
2020	Other amphibian	1	**1**	1	0	2	0	2
								426

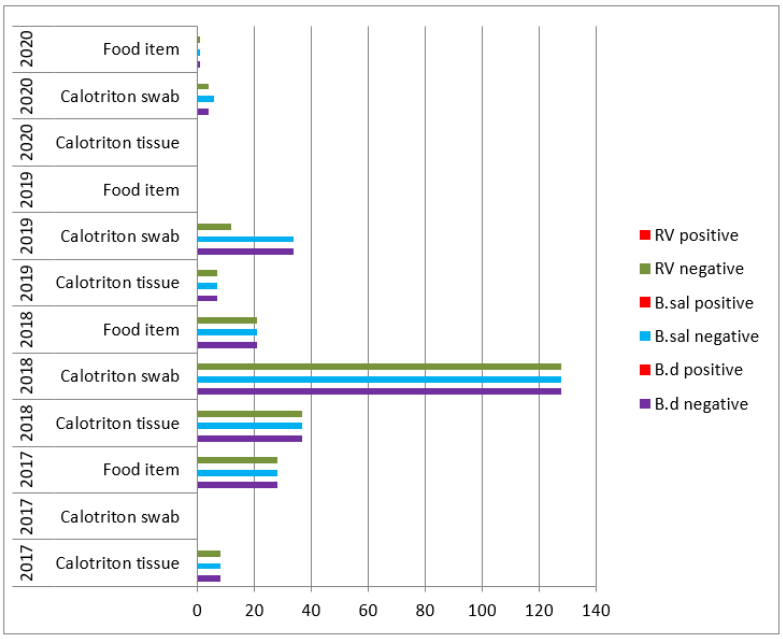
Collection of samples for the subsequent analysis of the presence of diseases.

D4. Sampling of infectious diseases prior to captive-born Montseny Brook Newt release.

Foreseen start date: 2T 2017 - Actual start date: 1T 2017
Foreseen end date: 2T 2020 - Actual start date: 2T 2020

In order to assess the suitability of captive-born newts before their release into the wild, analyses using PCR or qPCR were carried out to detect the most known infectious pathogens for amphibians *Batrachochytrium dendrobatidis* (Bd), *Batrachochytrium salamandrivorans* (Bsal) *and Ranavirus* (RV). Post-mortem studies were performed on dead adults. The histopathology of major organs was evaluated by specialised pathologists. Due to some issues in the water system and tanks, we investigated bacterial overgrowth and collected several samples for microbiological cultures.

In total, 270 samples have been analysed by PCR for Bd/Bsal/RV, 220 from captive newts (pooled swabs or tissue from dead animals) and 50 samples from food items (see Fig. 1). All samples have tested negative. 25 newts have been evaluated by using histopathology (Fig. 2). None of the animals had lesions compatible with Bd/Bsal/RV. No infectious diseases were diagnosed. 20 samples have been evaluated for microbiology (Fig.3), including samples from sick animals or water samples. The main strain found in the water system was *Aeromonas* sp. It does not affect the newts but it caused issues with regard to water quality. *Chlamydia*, an intracellular pathogenic bacterium, was confirmed by PCR in two groups of confiscated Montseny brook newts that were illegally kept in a mixed collection with other amphibian species. These two groups of confiscated newts were held in the centre (in isolated tanks) during a short period of time before being relocated and this finding was detected during routine pathological sampling. It is the first description of this pathogen for the species and it will be published soon.



Number of samples analysed by PCR for Batrachochytrium dendrobatidis (Bd), Batrachochytrium salamandrivorans (Bsal) and Ranavirus (RV) in captivity 2017-2020.

D5 Qualitative and quantitative hydrological monitoring

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date:3T 2020 - Actual end date: 3T 2022

During the LIFE project, a great amount of work has been carried out to understand and monitor the habitat of the Montseny newt. From the initial in-depth characterisation to the detailed study of the impact of the actions carried out by the project, including the implementation of a network to monitor the flow and temperature of the streams in the upper Tordera basin. The network consisted of sensors for continuous data collection at one point and periodic visits to assess the hydrological status of a section.

During the project, a network of sensors has been set up in 7 streams. The flow of the brooks has a behaviour linked to the rainfall as expected. They often have torrential floods due to their steep slope which confers enough energy to the water, even if it is not very abundant. These streams cover the typological diversity of streams in the upper Tordera basin. Although they are all typical headwater streams with the morphology that characterises them: steep slopes, narrow and encaged channels with few branches and a narrow or almost non-existent strip of riparian vegetation, there are differences between them that can lead to variations in the hydrological regime. The brooks have a basal flow that is in most cases very low, less than 4 l/s, and in the smaller basin brooks a basal flow of less than 1 L/s is recorded. The limit of 4L/s is important because it is the limit set by the Catalan Water Agency - the administrative body in charge of water management in Catalonia - to allow the exploitation of a watercourse. These data show a very low amount of water circulating under basal conditions. This implies that they have little margin if rainfall drops, so the possibility of running out of water is high.

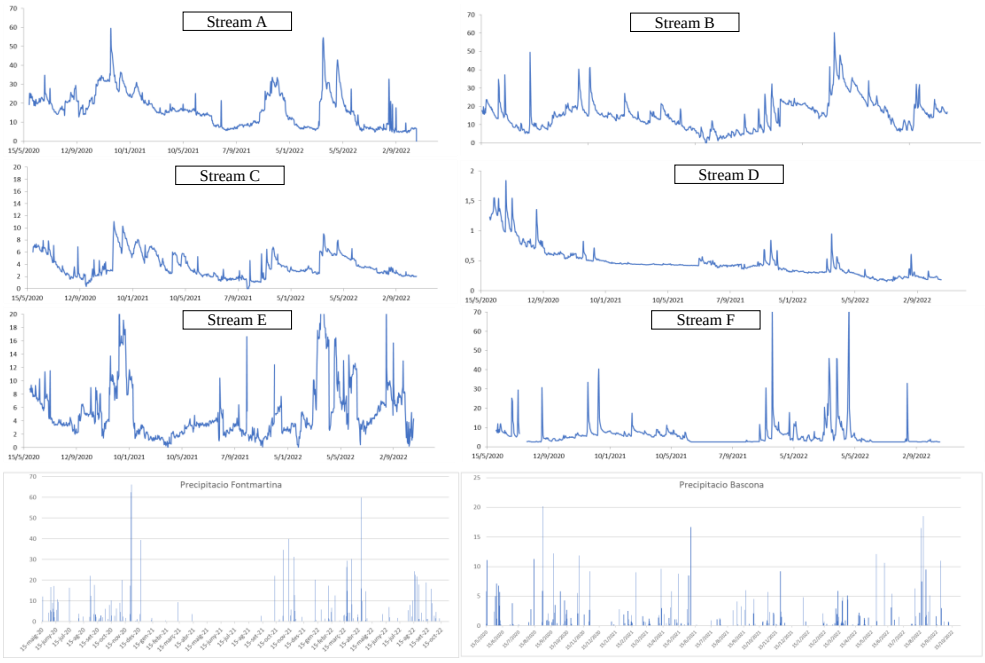


Fig.1 : Flows (L/s) calculated from the data of the stream pressure sensors. Left column: streams on the east slope, right column: streams on the west slope. Last row: Daily precipitation (L/m2) of the eastern (left) and western (right) slopes.

Values are shown since May 2020, when the sensors were last installed and the data series is constant and reliable.

The stream flow data is complemented by a description of the Hydrological state, which tells us whether the water flow is interrupted or not, whether there are pools and their dimensions, and whether the stream is 'completely dry'. data show that the hydrological regime of the different localities where the newt lives has a different dependence on rainfall: there are streams whose hydrological regime is highly dependent on rainfall probably because they are

small drainage basins. And there are others that are more independent because the town has a large catchment area, or because it is close to a spring.

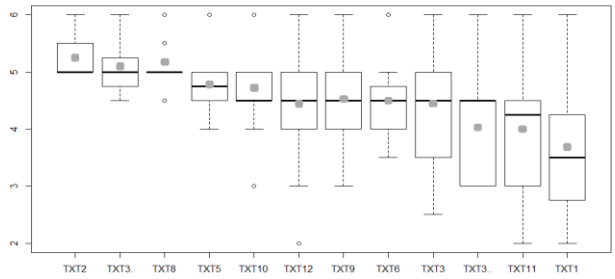


Fig. 2: Mean and variance of the hydrological status of the streams during the monitoring period.

Monitoring the impact of restoration river bed continuity It was assessed in a number of ways. The deposition of sediment in the actions to restore the continuity of the stream has been shown to be very punctual downstream of the action and not very long-lasting in time. The results showed that the accumulation of sediments is more important the closer to the actuation and that these were mobilised quite slowly over time, they were quite persistent since 5 months after the first measurement the ponds still had a significant presence of sediments, although the amount in depth had decreased, the extent was quite similar. And they were flow dependent, plus there is more mobilisation, although it seems that a large flood is needed to make them clean.

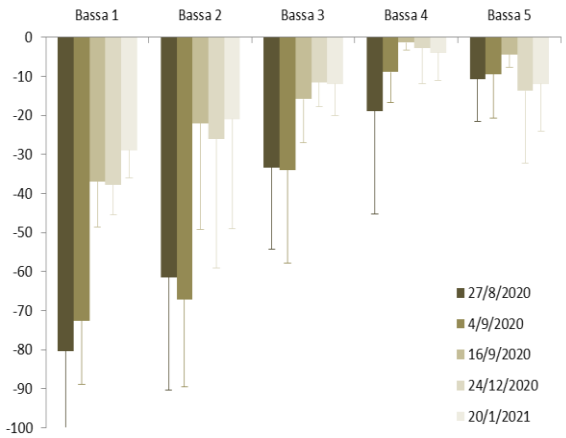


Fig 3: Percentage of pool depth occupied by sediment. Pool 1 is closest to the bridge where the restoration took place

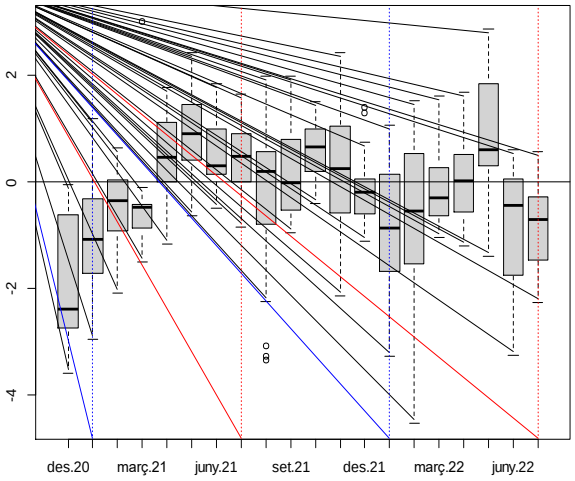


Fig 4: Boxplot of the monthly temperature differences between the Sun and Shade sensors (Sun minus shade). Positive values indicate higher temperature in unshaded section, negative values higher temperature shaded sections. The blue dotted lines indicate the months of January, the red ones July.

The change in water temperature due to the action on the riparian vegetation was shown to be small and variable between seasons, with a slight increase in warm periods and a slight decrease in cold periods. This is probably because the vegetation prevents cold air from falling over the stream.

The problems encountered at the beginning of the project with the installation of the pressure sensors for flow measurement have been solved with an installation that is more resistant to high flows and sediment movement.

Objectives associated with this action have been fully achieved.

D6. Monitoring of biological impact of the interventions in the riparian habitat

Foreseen start date: 4T 2017 - Actual start date:3T 2018
Foreseen end date:3T 2020 - Actual end date: 3T 2022

Ecological impact of interventions (macroinvertebrates,diatoms)

Actions to improve the riparian habitat of the streams in the Montseny newt area involve changes that may affect the organisms living in them. In order to monitor these possible effects, the biological communities have been studied in different periods and streams. Specifically, we have focused on monitoring macroinvertebrates, as they have the capacity to reflect both physico-chemical and hydromorphological changes. Diatoms have been added as they are also good bioindicators and allow to have a second group of organisms as a controller.

The results in all cases showed that the ecological status of the streams was very good, both before and after the interventions, on modified and unmodified sites (Tables 1). Also the community composition do not change significantly between 2020 and 2023 (fig1) We can conclude that the interventions did not damage this ecological status. The other aspect was to assess an increase in this quality thanks to the actions of the project. In the case of the Montseny streams, it is difficult to detect an improvement, as they are already of excellent quality. In addition, the nature of the improvements made had little impact on these groups of organisms.

Stream	Site	Date	IBMWP	R
Stream A	Sobre pista	11/6/2020	155	25
	sobre pista	26/8/2020	182	32
	Sota Pista	26/8/2020	206	38
	Sota pista	*4/9/2020*	188	33
	Sota pista	*16/9/2020*	210	36
Stream I	I	3/1/2020	106	16
	II	3/1/2020	93	13
Stream J	Zona 3	2/5/2019	167	28
	Zona 2	2/5/2019	170	29
	Zona 1	1/7/2019	164	27
Stream F	Sota pista	26/8/2020	214	36
	Sota pista	6/8/2020	223	41
	Sobre pista	6/8/2020	222	37

Stream	Date	IBMWP	R
Stream B	2/2023	203	33
Stream D	2/2023	147	27
Stream C	2/2023	165	30
Stream A-S	2/2023	225	38
Stream A-C	2/2023	226	38
Stream G	2/2023	173	32
Stream F	2/2023	206	37
Stream H	2/2023	138	26

Tables 1, Biological quality scores of streams according to the IBMWP macroinvertebrate index. Left table sites sampled in 2019 or 2020, right table sites sampled 2023. Blue indicates very good environmental quality, green good quality. R: Richness of families.

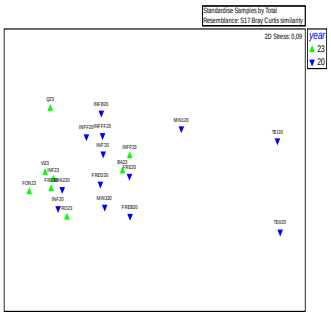


Fig 1 NMDS analysis of macroinvertebrate communities at different sites. The distance between points in the analysis is proportional to the similarity of the community composition. 2023 sample in green, 2020 sample in blue.

The ecological status of rivers has also been assessed using diatoms. These unicellular algae, present in all water bodies, are used as bioindicators. In their case, they are indicators of other environmental variables, more related to the physico-chemistry of the water than to hydromorphology. The environmental changes caused by the project's actions are not expected to affect diatoms in particular, but knowledge of the ecological status of any other organism reinforces the information on the ecological status of the rivers.The taxa found thrive in pristine waters and this is reflected in the Biological Index assessment. The results show an excellent water quality status of the streams, also according to diatoms, all sites rating in the Very good or Good quality categories.
The dominant taxa are also considered as pioneer and colonizers species, adapted to fast growings in unstable streams, either by substrate mobility or important flow changes which are characteristics present in the studied streams.

Diatom reassert the good to excellent level of the ecological state of the streams subjected to some improvement action during the project.

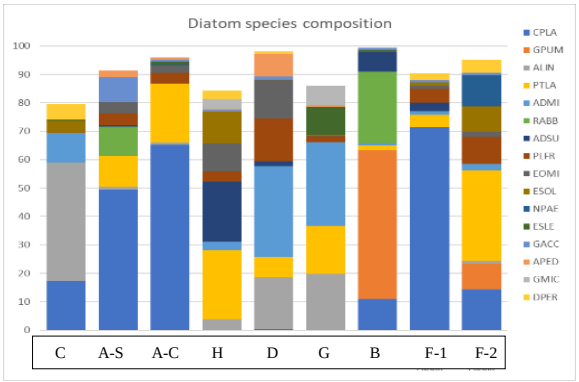


Fig 2: Diatom species composition of the sampled streams. Relaitive abundances of the species that have 5% at least in one site

Stream	Date	IPS	R
Stream C	2/2023	18,2	26
Stream F	2/2023	15,6	15
Stream A-S	2/2023	16,1	16
Stream A-C	2/2023	15,7	20
Stream H	2/2023	17,7	20
Stream D	2/2023	17	16
Stream G	2/2023	18,3	18
Stream B	2/2023	18,2	10

Table 2: Diatom biological index IPS values (Blue: Very Good quality, green: Good quality) and species Richness (R)..

Studies on the biology of the Montseny newt: The biology of the Montseny newt is still relatively unknown. In order to conserve the existing populations, it is necessary to know basic aspects of their biology. Several studies have been carried out on important aspects for the management of the populations: to know the diet with a non-invasive method, to evaluate its thermal tolerance and its adaptive plasticity to temperature, and to prepare a molecular method to detect populations in nature in order to be able to follow their distribution.

Diet by means of metabarcoding, the newts of Montseny are non-selective predators, since the most abundant prey in the diet are the macroinvertebrates most abundant in the streams, as well as salamander larvae. There are no differences between streams and the composition of the diet is very diverse.

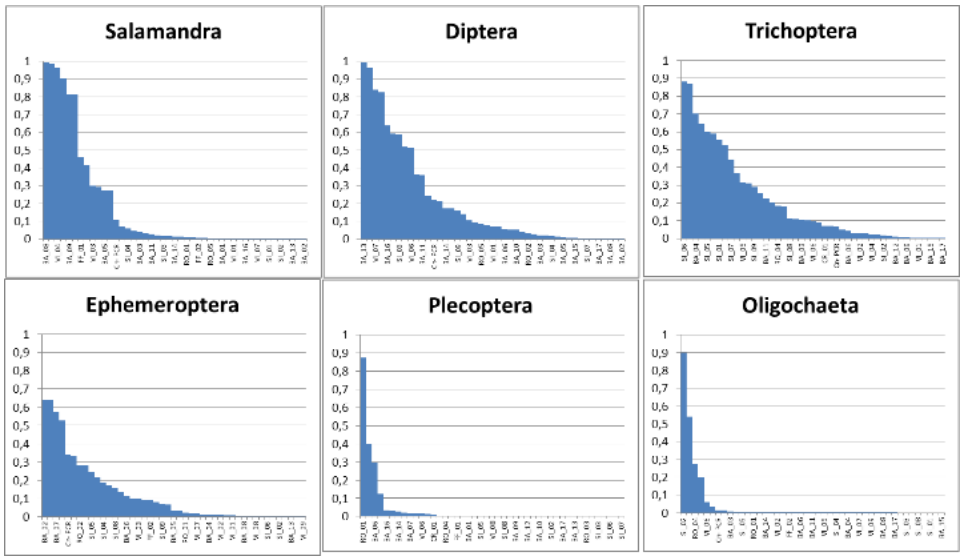


Figure 3. Signal distribution of the main prey of the Montseny newt

Temperature niches of the Newt of Montsent. The low genetic variability of C. asper can be explained, climatically, by the greater suitability during the last glacial maximum, which allowed population connectivity and genetic homogenisation, in addition to subsequent recolonisation. This difference may help to understand why one taxon is better adapted to higher temperatures than the other. The genetic homogenisation due to the dispersal capacity in the juvenile phase of the Pyrenean newt could have favoured the adaptation to temperature thanks to the genetic flow between different populations of this species.

Full extended report attached to this documents with more information.

Monitoring forestry actions

It has been monitored tree and shrub vegetation in the main actions carried out in the torrent de Rocanegra and the torrent de l'Infern or in the vicinity (exotic conifer plantations). The sampling method carried out for monitoring was adapted according to the characteristics of the vegetation and the type of action to extract the most appropriate monitoring indicators in each case. In some interventions, two samples were taken two years apart (autumn 2020, right after the intervention and in autumn 2022, two years after).

In this monitoring, it was possible to evaluate the changes in tree cover as a result of interventions. In the rest of actions, the monitoring was done only during the autumn of 2022 and allowed to evaluate the tree structure and the shrub recover without being able to evaluate the changes that occurred after the intervention. The result of the monitoring confirms that in most of actions the planned objectives have been achieved. Although some of the actions have not yet achieved the goal of recovering sufficient plant recovering to insure the slopes on both sides of the riverbed, no erosion problems have been detected thanks to the terracing systems designed to avoid it. The other actions, plantings made with riparian species or the spontaneous growth of shrub vegetation, have allowed a practically total recovery of the plant cover, avoiding any erosive process and protecting the riverbed.

With this monitoring, it has been possible to evaluate the changes in tree cover as a consequence of the different actions that have been carried out. The result of the monitoring confirms that, with some exceptions, the actions have succeeded in recovering the vegetation cover or at least avoiding significant soil losses as a result of the temporary loss of vegetation. In the areas where it has not yet been possible to recover the vegetation cover, the construction of the ditches on the slopes of the various streams has made it possible to prevent erosion (C829 and C833). In other areas, the planting of riparian species or the spontaneous growth of shrub vegetation has led to the almost total recovery of the vegetation cover, slowing down any erosion process and protecting the stream bed (C803 and C826).

In 5-10 years, in the areas where exotic conifers have been partially eliminated (C827), a new action is recommended, eliminating the rest of the exotics if the autochthonous vegetation has recovered. - In those areas where riparian vegetation has not yet recovered in five years (C829, C833, C809, C819 and C830), it is recommended to carry out reinforcement plantings with riparian tree species, excluding Salix caprea, which has shown high mortality rates,

- In areas with spontaneous regeneration of exotic conifers (C809, C819 and C830) it is recommended to clear them in 2 or 3 years to eliminate them definitively.

Full extended report attached to this documents with more information

General 2020 image of the action area where a continuous carpet of bramble was already visible (foreground) and the intact beech forest on the other side of the creek

Location of the plots of stand R3 before (left) and after (right) the actions

Image of the stand before (left) and after (right) logging.

D7. Social and economic impact of the project

Foreseen start date: 4T 2017- Actual start date:3T 2018
Foreseen end date:3T 2020 - Actual end date: 4T 2022

The goal of this action was to evaluate the economic and social impact of the project in the area of the LIC Montseny, therefore to assess the direct and indirect repercussions on the residents and users of the naturals area.Firstly, a theoretical work was elaborated to analyse the socio-economic impact of LIFETM and its benefit on ecosystem services. 6 categories of indicators were established ant the result have been:

1- Socio-economic impact: Project expenditure on outsourcing totalled 1.8 million €, and conservation actions accounted for 64% of the total. The project's budget had an impact both at the level of the park's municipalities (57%) and at the provincial level (43%). In the purchase of farms 10.8% has been invested, in the follow-up of the project's actions 14.6%

and in public awareness and dissemination 5%. The rest has been invested in the management of the LIFETM and the elaboration of executive projects of works.

2- Occupation Paid staff, jobs: 30% of the people who have been gainfully employed in the project were new jobs. The number of staff working on the project has been equal between women (54%) and men (46%). The number of actual hours worked was 55,000 hours, which is equivalent to the work of a person working 8 hours a day for almost 19 years.
3- Involvement of external stakeholders: Out of a total of 116 entities involved in the project's actions, 61% are from the public sector, 34% from the private sector and the rest from the third sector. Of the total number of entities involved, 22.4% of the entities are from the Montseny SCI, 60% from Catalonia and the rest from Spain or internationally. 22 entities have been involved in LIFE TM on a voluntary basis
4- Education and training: A total of 82 training events have been held, which amounted to about 12 sessions per year. 66% have been technical conferences and the rest promotion or participation in scientific congresses. A total of 10,630 people have participated in the events that have taken place within the framework of the project.
5- Production of technical-scientific literature: A total of 19 articles have been published, 63% of which have been in journals of scientific or technical impact.
6- Information and divulgation: A large volume of information has been generated, which is stored in more than 68,000 files in the LIFETM Information System. 57% of these files are linked to technical actions of the project. Most of the events have taken place locally and in Catalonia (71%), although the project also had an important visibility in the rest of Spain (12%) and internationally (17%). There have been 8,651 visits to the LIFETM website, 89% have been from Spain, but among the other 14 countries, visits from USA, France, UK, and Germany stand out. Most of the visits were in Catalan, 22% in English and 24% in Spanish. The 139 videos posted on YouTube have had a total of 14,856 views. The LIFETM travelling exhibition has been held in 24 locations, with more than 374,000 visitors. A total of 481 news items were generated in the media, 65% on the internet, 229% in the press, and 6% on TV and radio.

The LIFETM project has had an important multidimensional impact, measured in areas as diverse as the generation of expenditure in the territory, employment, education and training and dissemination.

Due to the conservation actions carried out in the territory, LIFETM has promoted ecosystem services, including provisioning, regulating and maintaining natural and cultural heritage. The socio-economic study shows that conservation projects such as LIFETM can bring many benefits to society.

Despite the good data obtained, it has not been possible to assess the impact of LIFE on the activities of the primary sector, which should be the main local beneficiaries due to the impact of the actions on the natural resources they exploit.

The main problem that has occurred in this action has been the absence, from 2019 onwards and which has not been replaced, of the person responsible for integrating the socio-economic information and assessing these indicators during the implementation of the project. For this reason, it has been necessary to contract an external technician to unify the available information and carry out an overall analysis of the project's impact.

E1. Strategy and relationship with the media

Foreseen start date: 1T 2019 - Actual start date: 3T 2016
Foreseen end date: 1T 2019 - Actual end date: 4T 2022

LIFETM has maintained a communication strategy agreed upon by all the entities involved in the project. The communication commission was created and was comprised of communication representatives from each of the partners. The 18 meetings held have defined the type of messages to be disseminated, the different types of information recipients and the most effective mechanisms to disseminate the information. The following have been shared communication strategies:

- Coordination among all project partners to disseminate the project based on the same communication strategy. This generates homogeneity in the dissemination to reach a greater number of public.
- Follow-up of articles or messages published in the different existing channels: television, the written press and DIGItal, as well as on social networks.
- Local dissemination of the project's actions through the local media.
- Creation and maintenance of the project website (www.lifetritomontseny.eu) and promotion of social networks.
- Approval of the content for the promotional material: brochure, project information panels, informative videos and items such as magnets and stickers.
- Discussion and consensus on the exhibition's contents, which was managed by the Diputació de Girona.
- Discussion and consensus on the content of the didactic material and children's workshops coordinated by Barcelona ZOOBCN.
- Hiring of a professional photographer to undertake a photographic report on the Montseny newt.

A communication strategy has been defined that establishes the mechanisms to facilitate the project's visual identification. All dissemination material contains the partners' logos, the project logo, the Natura 2000 network logo as well as the LIFETM program one. With regard to social media, the content of the tweets posted has been agreed upon and all partners are tagged so that the dissemination of information can be shared.

The dissemination of the LIFETM project has achieved its objectives through a communication strategy shared and agreed upon by all partners. A common criterion has been established for: the press, web content, social networks and information material (brochures and information panels). A constant exchange of information has been achieved among the partners' communication representatives that were involved in the project. Information content has been agreed upon, thereby developing a shared communication strategy. All dissemination actions have included the LIFETM program and the Natura 2000 network logos, along with the partners' logos.

E2. Development of corporate image

Foreseen start date: 4T 2017 - Actual start date: 4T 2016
Foreseen end date: 2T 2020 - Actual end date: 2T 2017

The project's corporate image was successfully created in the 2T 2017 with DIGI internal resources (graphic designer), so LIFETM's image and specifications were available from the project's very beginning. Logo design specifications (colours, font style, layout, black and white versions) are defined in the visual identification file (Graphic design of the project).

The idea of using the three-colour code to conceptually symbolise the essential elements of the project has been considered as very appropriate to communicate the project's values: "Life" in blue (aquatic environment), "Tritó" in brown (Montseny newt), "Montseny" in green (riparian forest and other forest habitats).

The planned schedule to complete action E2 did not suit administrative procedures. Even though the plan was for the project's image to be ready during the first term, the budget had not yet been allocated to hire an external assistant for this purpose. Because of this, internal resources from Diputació de Girona (graphic designer) were used to complete action E2 on time.

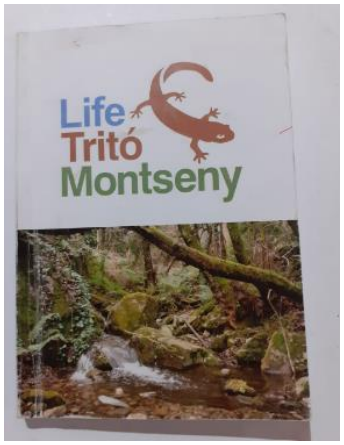
Pantone 285 / 80% C67/M40/Y00/K00
Pantone 470 / 80% C16/M53/Y72/K19
Pantone 370 / 80% C54/M08/Y82/K16

Life Tritó Montseny

Life Tritó Montseny
LIFE15 NAT/ES/000757

LIFE Tritó Montseny's corporate image has been visible during the years the project has been active. It has been the project's distinctive brand and one which can be found in the internal administrative and technical documentation, as well as all the dissemination elements.

This action is considered to have been completed successfully.



E3. Website “LIFE Tritó Montseny”

Foreseen start date: 1T 2017 - Actual start date: 1T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

The "LIFE Tritó Montseny" website (**http://lifetritomontseny.eu**) was launched at the end of June 2017 in Catalan, Spanish and English. It has been designed with the main objective of disseminating as much information as possible about the project and to involve local stakeholders in the conservation of the species, riparian habitats and their biodiversity. Since its launch, it has become the project's main information space.

The website has both public and private areas. The private area is run through a shared mailbox between technicians and project partners. The public area of the website is used to disseminate information about the project. It has links to the partners’ websites as well as to other European projects or websites with similar themes.

The "Evolution" section contains the latest news related to the project, classified by years from the beginning to the end of the project. Constant updates have made it an agile and dynamic website.

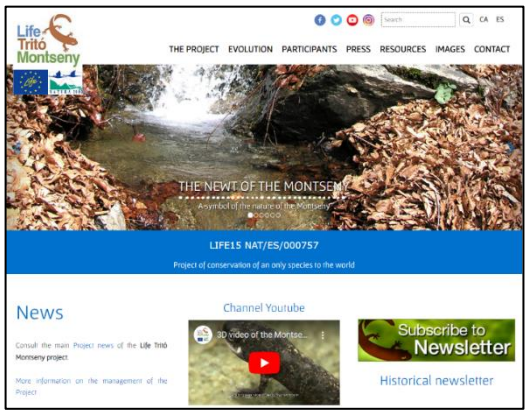
On the website, users can also consult the press releases in the media via links to digital articles.

The "Resources" section includes all the technical information related to the project: articles, studies, presentations and other materials of interest. It also contains a gallery with images of the project.

The website’s homepage hosts the project's own social networks: the Twitter channel and the YouTube channel. It also has links to the DIBA Natural Parks Network’s own social networks (Facebook, Twitter), which show its daily activity.

The team that manages the website is based at the DIBA's Natural Parks Network office and the website contents are hosted on the DIBA server, which has the Information Support Unit of the Natural Areas Services Management Unit.

Web side	
Pages viewed	78.846 pages
Number of users	9.881 users
Number of web side sessions	16.555
News	143 news published
Number of newsletters	15 newsletters
Registered in the newsletter	232 persons



E4. Social networks

Foreseen start date: 1T 2017 - Actual start date: 4T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

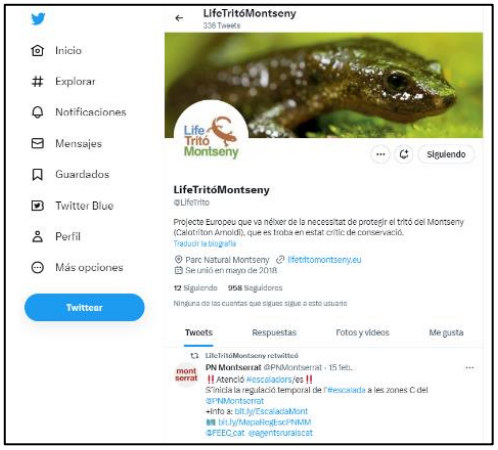
In February 2017, the LIFETM project began its dissemination campaign on social networks. Two own channels have been created for the project: the **Twitter channel** (@LifeTritó) and the **YouTube channel** (@LifeTritoMontseny). Both social networks are hosted on the homepage of the project website **(**www.lifetrito.eu**)** The languages used in the messages posted on these social networks have been Catalan and Spanish.

The hashtag #LifeTritóMontseny has been included in all publications, in order to increase the dissemination of the project. the project partners have been tagged in all the tweets that were posted.

As established in the Communication Strategy, the project has not created its own Facebook channel because it already has DIBA's own Natural Parks Network channel.

The Information Support Unit within the DIBA's Natural Areas Services Board has been responsible for this action. Videos have also been periodically added to the project's YouTube channel.

	Supporters	**Diffusion**
Twitter channel	958 followers	214 tuits y 86 retuits
YouTube channel	135 subscribers	61 videos, 14.338 views, 101.972 impressions



Outside of LIFE:
Inclusion of the Montseny Brook Newt in Wikipedia:
Three new pages have been created in Wikipedia, which explains what the Montseny Brook Newt is in Wikipedia (in Catalan, Spanish and English).
Catalan**:** https://ca.wikipedia.org/wiki/Trit%C3%B3_del_Montseny
Spanish: https://es.wikipedia.org/wiki/Trit%C3%B3n_del_Montseny
English: https://en.wikipedia.org/wiki/Montseny_brook_newt
The pages contain information about: 1 Characteristics, 2 Discovery, 3 Original publication, 4 References and 5 External links

E5. Promotional merchandising

Foreseen start date: 4T 2017 - Actual start date: 2T 2018
Foreseen end date: 4T 2020 - Actual end date: 4T 2020

The information brochure and the information panel are the most important promotional material of LIFE Tritó Montseny. Other elements of dissemination that had not been foreseen in the Proposal were also developed: a photographic report, a photographic exhibition, a 3D video, a children's story, roll-ups and banners, as well as various promotional items (notepads, stickers, magnets and key rings). Edited material was delivered to project collaborators, attendees at conferences, meetings or visitors at the Montseny newt exhibition

Information brochure. It contains an explanation with regards to the species *Calotriton arnoldi:* where it lives, what it looks like, its biological cycle, why it is endangered, how we ensure its conservation, the geographical scope of the project and captive breeding. It has been produced in digital support and printed in a quadriptych format and in colour (2,110 copies in English, 4,300 in Spanish and 10,100 in Catalan).

Information panel. It summarizes the basic content of the project (schedule, budget, objectives and actions) in three languages (English, Spanish and Catalan). Eight information panels have been published and placed in strategic locations within the LIC Montseny and in the breeding centres.

Photographic report. Made by a photographer specialized in wildlife. The images show the species (*in situ* and *ex situ*), its natural habitat, actions carried out within the area, environmental awareness activities. The photographic report includes a total of 280 photographs in digital format. The digital report has been disseminated through the social media channels Twitter and YouTube.

Photographic exhibition. Comprised of a selection of 25 photographs that represent the project. Three copies have been edited and printed in exhibition format (50 cm x 70 cm), with an explanation in three languages (Catalan, Spanish and English). It has also been edited in digital format (accompanied by music) to be disseminated on the website, as well as the YouTube and Twitter channels. It was exhibited at the Pont de Suert breeding centre and also in the libraries, as a complement to the project's travelling exhibition.

3D video. A 3D digital animation of the Montseny newt. It was produced by using sculpting techniques and based on aquatic recordings. It shows the species' biological cycle and the habitat where it lives.

Children's story. "*Sóc en Marçal, un petit tritó del Montseny"* is a 15-page story, published in Catalan. It has been given as a gift to the visitors of the Montseny Biosphere Reserve travelling exhibition. 3,000 copies of the story have been printed in Catalan.

Roll-ups and banners. Six roll-ups (85 cm x 204 cm) and six banners (60 cm x 160 cm) have been produced to contribute to the dissemination of the project.

Promotional items. Notepads, stickers, magnets and key rings, not included in the Proposal, have been produced.

Information brochure and Information panel

E6. Networking

Foreseen start date: 4T 2016 - Actual start date: 4T 2016
Foreseen end date: 1T 2020 - Actual end date: 1T 2020

In order to exchange experiences with nature conservation projects, visits have been made and external technicians have been attended to. Thus, there has been some networking with other projects such as:

LIFE Montserrat (LIFE13 BIO/ES/000094) (15/11/2016, Montserrat, Barcelona).

LIFE Clinomics (LIFE15 CCA/ES/000102) (21-22/6/2017, Barcelona).

BeWater (Interreg POCTEFA - ECTOPYR) (23/1/2017, Montseny, Barcelona; 12/6/2018 Barcelona) These projects have helped us in linking LIFETM actions to LIC Montseny's adaptation to climate change.

LIFE RedBosques (LIFE15 GIE/ES/000809) (23/11/2017 Pots, Tarragona, 12/6/2018, Montseny, Barcelona; 5/11/2018 Guadalajara).

LIFE Alnus. (9/11/2019 Montseny, Barcelona) Both projects (RedBosque and Alnus) are related to habitat management, whether it is with regard to open spaces or forests or more directly, riparian environments. It has been possible to apply their experiences to actions or recommendations made by LIFE Tritó Montseny.

LIFE Hidrology (LIFE16NAT/FI/000583) and **LIFE Freshabit** (LIFE14 IPE/FI/000023). Exchange of experiences related to small water bodies focuses on fresh- and groundwater dependent habitats to develop new methodology and indicators for assessing the conservation status of freshwater habitats. (19-26/1/ 2019, Findland).

They are related to the management of the habitats in large rivers in northern Europe and to **LIFETRivers** (LIFE13 ENV/ES/000341), which focuses on temporary Mediterranean rivers. It has allowed us to incorporate their recommendations for the hydrological monitoring of the Montseny torrents and has allowed us to establish collaboration protocols with their partners. (3-4/5/2018, Barcelona; 17/10/2018 Berga, Pyrenees).

LIFE GoProFor. Linked to good environmental practices. It has made it possible to provide experiences applied in the LIFETM so that they can be used as examples in future forest management projects. (29-31/8/2019, PN Casentine Forest, Italy; 24-26/11/2019, Montseny, Barcelona).

LIFE Wetfly Amphibia (LIFE 14NAT/IT/000759), **LIFE Floodplain Amphibians** (LIFE14 NAT/DE/000171). Exchange of experiences related the actions carried out to promote amphibian populations and especially their breeding sites. Interesting exchange of experiences about common problems about reduction of threats linked to human activity. (29-31/8/2019, PN Casentine Forest, Italy; 24-26/11/2019, Montseny, Barcelona).

LIFE Limnopirineus (LEFE13NAT/ES/001210). Related to habitat management for the conservation of amphibians. There have been several exchanges of information with these projects along with ways to manage wetlands while seeking the involvement of landowners. (24-26/10/ 2018, Pont Suert, Pyrenees).

Interesting exchanges of a technical nature have also taken place with research projects related to hydrology and with administrations such as the Catalan Water Agency (which manages Catalonia's water resources) and the Centre of Forest Property (which controls forest management in Catalonia).

LIFETM has signed a collaboration agreement with Barcelona Zoo and Chester Zoo (UK) to improve the breeding of the Montseny newt and at the same time, become involved in the European Association of Zoos and Aquaria (EAZA) and actively participate in its working groups related to the breeding of protected amphibians. (From 2018 to 2022, Barcelona). This action will involve a future technical collaboration with a group of renowned European specialists in the field of amphibians, which will certainly contribute to the LIFE Tritó Montseny project. The new Montseny newt breeding centre at the Chester ZOOBCN (UK) is not funded by the LIFE project but will contribute to its results by exchanging experiences and expertise at the European level.

E7. Layman's report

Foreseen start date: 4T 2019 - Actual start date: 4T 2021
Foreseen end date: 4T 2019 - Actual end date: 4T 2022

The Layman Report has been conceived, from the outset, as an informative document.

It has been published in four languages, (Catalan, Spanish, English and French).

The edition format is digital and 1,000 paper copies have been printed.

It summarizes the results obtained throughout the LIFE Tritó Montseny project. The document is structured in five sections.

The first section introduces the Montseny newt. It shows the precarious conservation status of the species, which is the reason behind the implementation of the LIFETM.

The second section directly states LIFETM's two objectives: to preserve the Montseny newt and to improve its riparian habitat. The 5 operational objectives are: the protection of this endemism and its habitat, the genetic and ex situ conservation of the two populations, the management of the riparian habitat in order to improve it, the research and monitoring of the populations to apply the knowledge to their management and, finally, the dissemination and educational projects that are basically aimed at the local population.

The third section summarizes the results obtained for each of the operational objectives.

It is accompanied by images or diagrams to facilitate the understanding of the text.

The fourth section discloses the lessons learned in LIFETM in order to show the good and bad experiences that could be useful for future natural heritage conservation projects.

The informative document ends with the commitments undertaken by the institutions involved in LIFETM in order to continue working to improve the conservation status of the Montseny newt and reduce the threats that are still present in its riverside habitat.

E8. Exhibition "The Montseny Brook newt and the riparian habitat"

Foreseen start date: 4T 2017 - Actual start date: 2T 2018
Foreseen end date: 3T 2020 - Actual end date: 3T 2022

In May 2018, the exhibition “El meu nom és *Calotriton* i només visc al Montseny” [My name is *Calotriton* and I only live in Montseny] was inaugurated in Girona, and from the time it was presented until November 2020, it has travelled around the park’s different municipalities, as well as other locations in Catalonia. During this time, the exhibition has had almost 21.000 visitors, which would have been much higher had it not been for the interruption caused by the lockdowns and travel restrictions due to the COVID-19 pandemic. The exhibition is made up of 9 roll-up posters with information in Catalan and a model of a Montseny newt at an enlarged scale, accompanied by a few smaller posters with text in English and Catalan.

Although it is a linear exhibition, it can be separated into two parts. Posters 2 to 4 show all the aspects of the species that make it so unique: its morphology, its biological cycle, diet, and a description of its habitat. Posters 5 to 8 show the main threats that endanger its survival, the actions included in the project “LIFE Tritó Montseny” and a list of suggestions that everyone can do to help and contribute to the conservation of our natural heritage. Two replicas of the exhibition were created so that it can be displayed simultaneously in two different places at the same time.

In 2021, when it became possible to travel and re-engage in cultural activities even with the pandemic, there were plans to travel with the exhibition once again. For this reason, a document was created to present the exhibition and for it to be offered mainly to library networks in the regions of Barcelona and Girona, secondary schools, or other locations that had not hosted it yet. From mid-June 2021 until December 2022 the exhibition reached 11 municipal libraries and an education and research centre.

During this period, it was impossible to calculate the number of visitors, since this type of equipment has a very high influx of people and one cannot tell who actually visits the exhibition. Currently, the newt model is permanently on display at the Montseny Ethnological Museum - La Gabella, one of the information centres in PN-RB Montseny, located in the town of Arbúcies.

Aside from the traveling exhibition, the annex shows some other complementary activities that were carried out (such as lectures and guided tours of the exhibition) that were not originally planned. These talks were given by technical staff and experts who were familiar with the project. These talks were offered in 14 locations where the exhibition was hosted.

E9. Education and awareness campaign: Documentary Montseny Brook Newt

Foreseen start date: 4T 2017 - Actual start date: 3T 2018
Foreseen end date: 4T 2020 - Actual end date: 3T 2022

A documentary was made in the format of eight thematic capsules that focused mainly on raising awareness with regard to the Montseny newt's (*Calotriton arnoldi*) biology and ecology and on conveying the importance of improving its habitat to recover it as a species as well as explaining the most important actions in the "LIFE Tritó Montseny" project. These micro-documentaries are available on the YouTube channel LIFE Tritó Montseny, lasting approximately 5 minutes each and have been subtitled in three languages (Catalan, Spanish and English), with the following titles (annex E9.1):

- ✓ *Calotriton arnoldi*: An amphibian endemic to Montseny
- ✓ The captive breeding of the Montseny brook newt
- ✓ Releasing new individuals
- ✓ The Montseny brook newt: from knowledge to conservation
- ✓ Habitat improvement for the Montseny brook newt
- ✓ Diseases affecting amphibians: prevention and environmental dissemination
- ✓ Environmental education, a fundamental part of "LIFE Tritó Montseny"
- ✓ "LIFE Tritó Montseny": A collective challenge for the preservation of a unique species

For the production of the documentary, the services of an audiovisual publishing and production company were contracted. Additionally, to enrich the content of these documentaries and show some of the people directly or indirectly involved in the project, some 25 people were interviewed. Some of these contributions make up part of the script used for the capsules. Furthermore, the revision of the scripts was possible thanks to collaborations between scientists, experts, and technical staff participating in the project.

Since dissemination began in July 2020, these capsules have had a considerable number of visualizations (see annex E9.2). Furthermore, these micro-documentaries, aside from being an important tool for teaching and raising awareness, also serve as an educational resource for the program "El Montseny i l'aigua" as part of the lesson on Montseny in the classroom. The dissemination of the capsule videos began in July 2020 in through various means (project website, newsletter, partners' social networks, and local and regional newspapers), making it possible to generate a large number of views, which on average was 3,450 per capsule.

Plans were underway to screen the capsules at information centres in the park (Masia Mariona, Can Casades, Fogars, Espai Montseny, etc.) and at documentation centres (La Gabella and Museum of Granollers), although this was put on hold as a result of the pandemic, given the fact that large gatherings and sharing spaces were prohibited to reduce the risk of COVID-19. From mid-2021, some of these capsules were screened in the Fogars Montclús information centre. Eventually, the documentary was picked up by local and public television channels in Catalonia, with various news segments broadcasting it in prime-time sections, such as Telenotícies (Catalan news program).

E10. Outreach programme in the area of the PN-RB Montseny

Foreseen start date: 4T 2017 - Actual start date: 4T 2017
Foreseen end date: 3T 2020 - Actual end date: 3T 2022

With the execution of this action, three new educational materials have been produced, which have been incorporated into the subject dedicated to water in the program "El Montseny a l'escola", a program directed towards school-aged children in municipalities throughout Montseny Natural Park and Biosphere Reserve.

1. Newt workshop: In the end-of-year activity for the 2018-2019 academic year "El Montseny a l'escola" held at the Barcelona ZOOBCN, we presented this new resource, while taking the opportunity to visit the Montseny newt's environmental education facilities.

This material, which has been given to the park's primary schools, consists of 25 silicone moulds to make life-sized plaster newts with an informative sheet from the workshop, which describes the content that the student will work on.

During 2019 and 2020, coinciding with European Parks Day, this material was put into circulation and in workshops, boys and girls made their own newt, which they were able to take home. Subsequent workshops had to be cancelled due to the coronavirus pandemic. The feedback we have had on the workshop have been very positive, as it is an activity that has been very well-received by children. The version of the school unit "El Montseny i l'aigua" includes the worksheet from the plaster newt workshop. In 2021, we bought 25 additional moulds more, and now we have 50 moulds available, based on which some libraries have developed workshop. At the end of 2022, more than 600 plaster newts have been made in schools, libraries and different activities organised, and 613 people have participated in the plaster Montseny brook newt workshops (406 children, and 207 participants in summer camps and extracurricular activities).

2.Handbook of good environmental practices in educational activities has been created, written, and designed (in Catalan, Spanish and English). The aim of this manual is to disseminate the problem of infectious diseases in amphibians and to establish a series of preventive measures to take into account when conducting outdoor activities as part of the program "El Montseny a l'escola".

Two specialists in herpetology drafted the contents for this document, which was shared and discussed in a participatory way in two workshops which were attended by approximately 20 people from Montseny educational institutions, schools and naturalist and conservation organizations in Catalonia.
5.000 copies were printed and they were distributed to project members, schools within the park's area, and the organizations and entities that participated in the work sessions, as well as the local government. The DIGItal version is available at
http://www.elmontsenyalescola.cat/

3. Revision of the contents and the model for the school curriculum

The contents of the school unit "El Montseny i l'aigua" have been reviewed, so that all the new knowledge and aspects relevant to the management of newts and amphibians have been incorporated (i.e., the prevention of infectious diseases in field work or the capsules in the documentary), and it's available on the website (*http://www.elmontsenyalescola.cat, https://lifetritomontseny.eu/*).

A demonstration workshop was held for teachers and staff from environmental education organizations, e-mails have been sent to each school, news items have been published on social media, while there is also a note in the Europarc-Spain bulletin (#50) and links to news clips from Televisió de Catalunya.

Outside of LIFE: The PN-RB M Amphibian Identification Guide.

E11. Education program of ZOOBCN

Foreseen start date: 4T 2017- Actual start date: 3T 2018
Foreseen end date: 4T 2020 - Actual end date: 4T 2020

The main purpose of this action was to involve and engage the general public in the conservation of an autochthonous and critically endangered species, such as the Montseny brook newt. This objective was to be achieved through the definition and implementation of a specific educational program on this species, to be developed at different levels: visitors to the ZOOBCN on their own, visitors guided by ZOOBCN educators, guided school groups at the ZOOBCN and talks to school groups outside the ZOOBCN.

The conceptual change of the spaces dedicated to the breeding room led to a rethinking of the educational room, greatly increasing the resources deployed in it. The educational program associated with the Montseny newt at Barcelona's ZOOBCN has been created and developed and was initially pilot-tested with some small groups to fine-tune all the elements involved, and since the 4T 2018 it is being developed in a 100% operational mode.

The complete list of outputs and deliverables are (1) Project badges and key rings, (2) Large newt sculptures to be placed at the educational centre, (3) Story of the Montseny newt in pdf and printed in Din-A5 format, (4) Printed large format version of the story, (5) Educational booklet for students, (6) Educational booklet for teachers, (7) Interactive newt game for large touch-screens and (8) Educational brochure for kids on the differences between Montseny and Pyrenean newts, (9) Audio-visual project on the Montseny newt's life cycle.

Since the inauguration of the new education and breeding centre in June 2018, almost 500,000 people have visited it in a free visit format. Additionally, a total of 13,800 people (most of them belonging to school groups) have also carried out activities on the Montseny newt, guided by ZOOBCN educational staff.

In this COVID context, the educational team at Barcelona ZOOBCN deployed a series of online proposals aimed at children, called "ACTIVIZOOBCN" (https://view.genial.ly/5e70bf6badf8780fc366e0af). These activities were created to offer entertainment alternatives during the home confinement, 16,255 people had accessed and used the activity from 17th March to 31st August 2020. During the 2021 and 2022 academic years, schools have returned and visited ZOOBCN and the Montseny newt program, together with activities such as Animals in danger of extinction or Catalan's wildlife have helped the Montseny facilities to reach 2.186 visitors. Activities such as summer camps and special visits have led to 2.876 visitors going through the Montseny newt facilities.

Outside of LIFE: *ZOOBCN Club Magazine***:** ZOOBCN sends out, on a quarterly basis, a magazine reporting ZOOBCN news to its Club members as part of the ZOOBCN Club loyalty program which also includes access to educational activities and unique exhibitions, quick-entry passes, etc.


E12. Good forestry practices in riparian habitat awareness and training program

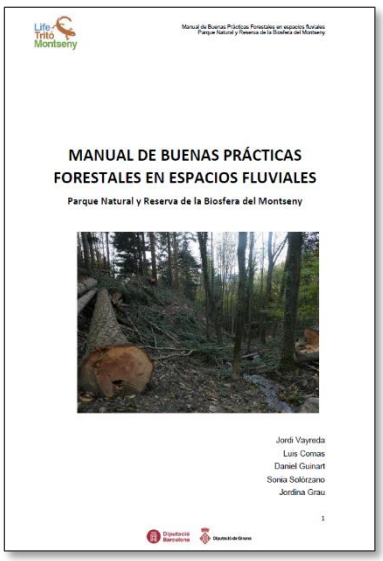
Foreseen start date: 4T 2017 Actual start date: 2T 2018
Foreseen end date: 3T 2020 Actual end date: 4T 2020

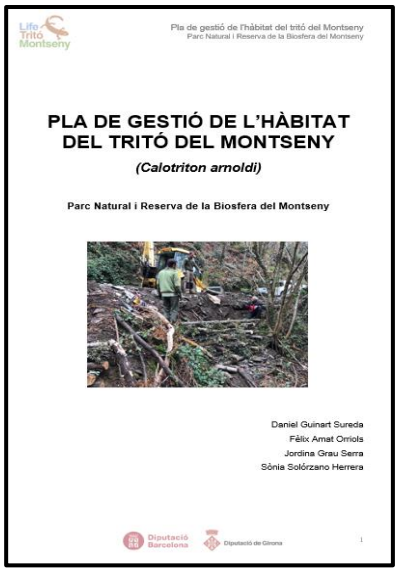
For the development of this action, it has been necessary: a) Coordination with the CPF (Centre de la Propietat Privada) to incorporate riparian forest protection measures and apply good forestry practices. b) Concretion of forest management criteria with conservation objectives, thanks to the active participation in the debate sessions promoted by LIFE RedBosques. c) Coordination with the entire scientific and environmental education community to minimize the impact of emerging diseases. d) Debate and awareness-raising sessions for the application of good practices with professionals in environmental education, civil works, research and environmental monitoring. e) Technical description of surface water abstractions compatible with the maintenance of an ecological flow in the exploitation of mountain torrent waters. f) Technical description of the restoration of fluvial connectivity in mountain streams of Montseny. As a result, three essential documents have been elaborated, the Manual of Good Forestry Practices in riparian habitat, Manual of Riverine habitat mangement and the Biosecurity Protocol, all three products available from the LIFE Tritó Monseny website.

The **Manual of good forestry practices in riparian habitats** is part of the need to improve the state of conservation of the entire fluvial area of the LIC Montseny. The good practices described in this manual are addressed to any native wooded habitat and, especially, to the Natural Park, i.e., it includes other types of native forest that border the riverside habitat and which, due to their proximity, may have a direct or indirect influence in fluvial dynamics. The good management practices described in this manual exclusively include actions of a silvicultural nature that make it possible to modify the structure and composition of the forest with the main objective of making it more mature and, therefore, more resilient to climate change, improving diversity (biological, functional and structural), stability against disturbances (erosion, floods, wind...), regeneration, etc. Good practices essentially consist of preserving and improving the key elements of pre-existing old-growthness in order to recover the processes and functions of forests, proposing low-intensity intervention. The manual is addressed to forest and environmental managers and technicians, forest rangers, but also to public and private property.

The **Manual of Riverine habitat mangement** is based on the threats identified to the riverside habitat. Four lines of work have been established that are directly linked to the improvement of the riverside habitat, namely a) management linked to land ownership, b) management of water resources, c) management of ecological connectivity, and d) forest management. This Plan is intended to be an operational document that proposes strategies for action applying good environmental practices linked to compliance with current regulations and based on the results of various conservation projects.

The **Protocol of Biosecurity** is a health prevention method for activities involving direct or indirect interaction with amphibian populations in the natural environment. It is a guide for the application of biosafety standards in works and maintenance activities in riverside and wetland environments. Addressed to the competent administrations, owners, managers, construction contractors and scientific entities that carry out activities in aquatic environments.





DESCRIPTION	DATE	Nº ASSISTANTS	SUBJECT	LOCATION
1st Meeting of Good Forestry Practices in Riverside Habitats	21/07/2020	8	Forest management	Montseny Natural Park Office. Masia Mariona
2nd Meeting of Good Forestry Practices in Riverside Habitats	30/09/2020	10	Forest management	Montseny Natural Park Office. Masia Mariona
3rd Meeting of Good Forestry Practices in Riverside Habitats	30/11/2020	5	Forest management	online
4th Meeting of Good Forestry Practices in Riverside Habitats	25/11/2020	5	Forest management	online
Presentation and workshop of the manual of good forestry practices to the staff of the PN-RB Montseny	03/02/2021	7	Forest management	workshop online
Meeting with landowners to present the results obtained linked to the manual of good forestry practices.	18/11/2021	18	Forest management	Montseny Natural Park Office. Mosqueroles

Table. Meetings in good forest management

E13. Technical and scientific conferences of the Montseny Brook Newt

Foreseen start date: 4T 2017 - Actual start date: 4T 2016
Foreseen end date: 3T 2020 - Actual end date: 3T 2022

The aim of the action is to actively participate in technical-scientific training workshops, conferences and congresses at a local, national and international level, with the aim of disseminating the interests and actions of LIFETM.

From the beginning of the project until the end of 2022, 54 conferences have been held: 39 have taken place locally and around Catalonia, 6 in the rest of Spain, 6 in other European countries, 2 in America and 1 in Oceania. In total, approximately 5.446 people have attended these sessions. 25% of the conferences were organized by LIFETM; in 7% of the conferences, the participants presented a poster or participated as attendees; but in the remaining 68% of the conferences, the participants took part as speakers in one or more conferences related to LIFETM.

Half the conferences were of a technical or scientific nature, 19% were project presentation days and 20% were conferences related to a scientific congress. 30% of the conferences were held at herpetology sessions, 22% were conferences directly related to the Montseny newt or the LIFETM project and 17% were scientific conferences.

The rest of the presentations have been given at conferences on the management of the Natural Areas Network or at others that focused on dissemination, hydrology, zoo management and other LIFE projects.

Examples of diferents times Technical and scientific conferences

F1. Management and technical coordination of the project

Foreseen start date: 4T 2016 - Actual start date: 4T 2016
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

The aim has been to ensure that the project meets its administrative and economic objectives within the scheduled timeframe. This objective has not been fully achieved because the project could not be finished as was planned and it was necessary to request for an extension, for the reason set out in the amendment.

Several meetings with partner representatives have been held, for technical, communication, and administrative & financial purposes. Since February 2018, a weekly technical meeting has been held by the coordinating partner (DIBA) with the aim of promoting the most delayed activities (especially C4, C5, C6, C7, C8) and solving the problems (lack of human resources for the drafting of projects, lack of agreements with the owners, complexity of administrative processes, etc.).

The coordination among the partners and all the people involved has been good and the small discrepancies that may have appeared have been satisfactorily resolved. Although the coordination of the project has involved a major investment in terms of time, the results have been as planned. The large number of professionals and researchers that took part, more than a hundred, have been involved in a coordinated manner and without serious personal problems.

Deliverables have been attached to this report.

There have been major problems with the stability of the DIBA staff. Organisational changes within the LIC Montseny staff in 2017 meant that the head of works had to significantly reduce their involvement in LIFETM. A senior technician who could dedicate themselves exclusively to LIFETM project could not be hired until the end of 2018.The administrative coordinator at LIFETM changed jobs in 2019 and their vacancy was never filled. All of these issues have led to a long delay in the planning and management of the works and a lot of stress within the small coordination team.

LIFETM's technical coordinator (who is also the conservation director at LIC Montseny) had to delegate many of his other projects and technical responsibilities in the LIC Montseny, in order to take over the work of technicians who were absent.

Examples of diferents fild coordinating, and working meeting

F2. Monitoring of the breeding programme

Foreseen start date: 4T 2016 - Actual start date: 4T 2016
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

The main objective of this action is the coordination of the breeding programme for the species, in order to maintain the genetic diversity of the *Ex-situ* population and to obtain specimens for introduction and expand its distribution area.

The main duty carried out in this action is the management of the studbook. All specimens are registered in the database and the best pairings are then determined in order to maintain the genetic viability of the population. In addition, the specimens to be kept in the Genetic Reserve are selected, and finally it is determined which specimens will be released according to a plan designed to maintain the genetic diversity of the new populations, with ZIMS and PMx. Software.

With the new facilities built under the LIFE programme, the capacity of the breeding centres has been considerably increased. In addition, Chester ZOOBCN has been incorporated to the breeding program. This has allowed for an increase in the number of breeding pairs and nursery capacity.

At the beginning of 2020, the European Association of ZOOBCNs and Aquaria (EAZA) approved the creation of the new EEP (European Endangered Species Program) for the species. Within the EEP, work has begun on the incorporation of new ZOOBCNs to the breeding programme, and several applications have been received both nationally and internationally.

The results obtained for the western population have been very successful in all centres and have exceeded initial expectations. In contrast, for the eastern population, the success of the breeding program is lower than expected, in all centres. The modification of non-breeding pairs and the formation of breeding groups have been worked on to try to improve outcomes in the coming years.

Currently, we have managed to maintain a genetic variability of over 90% in the two populations (91% for Western and 97% for Eastern), which is the target for a genetic safeguard programme. Genetic diversity has increased year by year.

The management of breeding pairs, with the prioritization of the most genetically important specimens as well as the release of the most represented specimens, has resulted in an increase in the genetic diversity of the captive population.

There has been a continuous flow of information between the different centres, with regular contact among the people in charge of them, as well as at least one annual meeting with all staff from the centres.
Active participation in an international workshop on group population management organised by IUCN is ongoing. The Montseny brook newt has been chosen as a focal species for amphibians in this workshop.

The problems with exporting newts to Chester ZOOBCN has been resolved and the breeding specimens have finally been transferred.

The document "Long-Term Management Plan" has been drawn up, with the help of EAZA population management specialists. It is currently in the process of being adapted to the EAZA Best Practice Guideline, as a guide for the breeding of the Montseny brook newt, as well as a reference for breeding projects with other similar species that may require it in the

future. It is expected to be finished during the first half of 2023. After the completion of this action, work has continued on the coordination of the breeding program.

Outside LIFE:
Chester ZOOBCN (UK): This action will involve a future technical collaboration with a group of renowned European specialists in the field of amphibians, which will certainly contribute to the LIFE Tritó Montseny project. and will contribute to its results by exchanging experiences and expertise at the European level. At the beginning of 2020, the **European Association of Zoos and Aquaria** (EAZA) approved the creation of the new EEP (European Endangered Species Program) for the *C. arnoldi*. Within the EEP, work has begun on the incorporation of new zoos to the breeding programme, and several applications have been received both nationally and internationally.

Western	Total	Males	Females	Unknown
Totals	1235	99	107	1029
Pre Reproductive	944	0	0	944
Breeding Age	289	98	106	85
Post Reproductive	2	1	1	0
Proven Breeder	121	57	64	0
Of breeding age	119	56	63	0

Eastern	Total	Males	Females	Unknown
Totals	579	129	130	320
Pre Reproductive	269	0	0	269
Breeding Age	307	127	129	51
Post Reproductive	3	2	1	0
Proven Breeder	72	32	39	1
Of breeding age	69	30	38	1

Number of animals in the Breeding Programe, distributed in the 4 breeding centres

Joint visits of breeding technicians and researchers to evaluate improvements in the new aquàriums, and technical working meetings between the three breeding centres and LIFE coordinators.

F3. Experts Committee

Foreseen start date: 1T 2017 - Actual start date: 1T 2017
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

An experts Committee was created with the aim of promoting a forum for discussion and exchange on technical and scientific aspects, advising and assisting in the design and implementation of the actions, guaranteeing their objectivity and rigour, proposing actions in the different fields of knowledge, as well as answering questions raised by the project.

The committee held two plenary sessions, between September 2017 and February 2019, and divided them into 3 thematic blocks: a) Population of the Montseny newt, b) Ecological monitoring and territory management and c) Communication-dissemination. Both sessions were extremely productive and provided new solutions to issues raised in the execution of the project, as explained in the sessions' reports attached.

Also, from the first meeting of the committee of experts, the need to create new specific workshops, or subcommittees, was already established and agreed by all the members. In order to discuss and evaluate the different actions of the project, according to specific topics and including in each one, experts from a wide range of topics:

1. Workshop on strategies for the reintroduction of the Montseny Brook Newt
2. Advisory Committee of Hydrologists of the LIC Montseny
3. Workshop on Good Forestry Practices in Riverside Habitats (linked to E12 action)

As a result, during the execution of the project, more than 20 meetings or working groups were held, with more than sixty assistants in all. The main contributions made by these expert committees in the different lines of work of the project have been:

- Initiating a line of research and hydrological monitoring in newt basins.
- Starting original studies applying environmental DNA techniques on the newt's diet and its spatial distribution.
- Developing a rigorous methodology for the process of reintroduction of the species in its natural habitat
- Proposing management methods for the riparian habitat, prioritizing its conservation
- Improving the dissemination of the project and the actions carried out related to environmental education.
- The debate between multidisciplinary specialists has created many new unanswered questions about the biology of the Montseny newt and the management of its habitat.

Problems:

Finding available dates to bring together such large groups of experts is not easy.

Covid-19 has not facilitated face-to-face meetings during the pandemic period. These are preferable in order to generate discussion and create synergies among attendees.

New unanswered questions about the biology of the Montseny newt forces us to open new lines of research, which have not been foreseen in the project budget.



Some examples of Annual Meeting of the Advisory Board and Advisory Committee of Hydrologists

F4. Audit

Foreseen start date: 4T 2022 - Actual start date: 4T 2022
Foreseen end date: 4T 2022 - Actual end date: 4T 2022
The main objective of this action is to certify, by an independent auditor appointed by the DIBA co-ordinating beneficiary, that all expenditure incurred complies with the LIFE+ Common Provisions and respect of national legislation and accounting rules. According to the letter amendment to grant agreement number 1, a Certificate on the financial statements are needed for beneficieries for which the total contribution in the form of reimbursement of actual costs is at least 750.000 €.

According to the expenses finally declared, only DIBA requests a contribution from the European Union above this amount:

DIBA ..... 1.046.801,04 €
DIGI ..... 30.381,00 €
FC ..... 469.537,00 €
ZOO ..... 234.645,51 €
GENCAT ..... 1.399,45 €

Although it was not mandatory, the coordinating partner DIBA contracted, for internal purposes, an external review of the expenditure declared by the partners, which was carried out during 2021. It should be noted that 100% of the partners declared amount has been considered eligible by the Auditor and no exceptions have been noted.

At the beginning of 2023 DIBA obtained the certificate on the financial statements and the approval of 100% of the amount tested by the Independent Report of Factual Findings. Both reports are attached “AF14 Partners Financial Audit” and “AF7 Certificate on the financial statement”.

The contracts were carried out by means of a request for three quotations and the resulting costs have not been charged to the project. For the internal partners review, quotations were requested to Gabinet Tècnic d’Auditoria i Consultoría, S.A., Uniaudit Oliver Camps SL and Faura Casas Auditors Consultors SL. The offer submitted by Faura Casas Auditors Consultors SL was the most economic one.

For the DIBA audit, quotations were requested to CET Auditores, Faura Casas Auditors Consultors SL and Uniaudit Oliver Camps SL. The offer submitted by CET Auditores was the most economic one.

The factual findings found by the auditor have been that, in order to justify the catering meals declared under other expenses, DIBA has provided attendance lists, which in some cases are not signed. However, DIBA has provided photos of the different caterings and attendees and all documentation and accounting information. In some cases, the Auditor was not able to successfully complete the procedures specified, these exceptions are detailed in the Certificate ond the DIBA financial statement atteched.

It should be noted that 100% of the DIBA declared amount has been considered eligible by the Auditor.

F5. After LIFE Plan

Foreseen start date: 2T 2020 - Actual start date: 2T 2022
Foreseen end date: 4T 2020 - Actual end date: 4T 2022

After the end of LIFE, work will continue on many of the actions initiated with the project

Recovery Plan will be implemented, in particular its annexes (habitat management, monitoring, release, breeding, biosecurity, etc.)

The habitat restoration actions, with satisfactory results, will continue to be implemented with LIC Montseny's internal means and with external programmes' funding. There are more than a hundred actions to restore riparian habitat in streams (C4, C5, C6, C7, C8). Most actions (50%) are related to the improvement or elimination of surface water abstractions. The rest are to promote the native riparian habitat, improving the ecological connectivity of torrents, rainwater harvesting or improving the treatment of discharged water.

Two private land swaps are being agreed upon, farms that are important for the conservation of the Montseny newt, for public land of low conservation interest. There is also the desire to close six land agreements with landowners who have potential streams for Montseny newt.

To maintain good management of the newt population, LIC Montseny (DIBA & Digi), ZOOBCN and GENCAT will continue to work on the actions: Information System (C3), Operation of breeding centre (C10, C12, C14), Expansion of newt distribution (C15), Monitoring (D1, D2, D3, D4, D5, D6), Disseminate (E3, E8, E10, E11, E12).

The Montseny Newt Introduction Plan identifies potential torrents for the release of newts, but the problem is that very few places have good environmental conditions. Therefore, riverside habitat restoration actions are planned in potential torrents for the future newt releases. These actions will be performed in the PostLIFE stage.

In order to promote an adaptative management of newts and the river habitat, studies and monitoring will be maintained in all areas under intervention, with the aim of obtaining biotic/abiotic data. It's essential to manage the project by basing ourselves on scientific, technical and objective knowledge.

AFTER LIFE ACTIONS

Goal	Action Type	Num.of programes
PROTECTION		
	Recovery Plan	3
	Collaboration with landwners	5
	Biosegurety	2
	Coordination	3
CONSERVATION		
	Genetic reserve	3
	Breeding programe	5
	New population	3
HABITAT MANAGEMENT		
	Ecological flow	7
	Riverside habitat	5
	River connectivity	2
LEARN		
	GIS	1
	Monitoring	6
	Projects	2
DISSEMINATE		
	Divulgation	4
	Education	3

AFTER LIFE PLAN - HABITAT MANAGEMENT

Num. of actions to be executed in the streams with Natural, Entered or Potential newt population

Action Group	Natural	Entered	Potential	TOTAL
C4 - Remodeling of the water system of collection and distribution				
Improvement of water tank		1		**1**
Modification of water catchment	4	1	3	**8**
Remodeling or removal of catchment	15	6	17	**38**
Removal of water catchment	3			**3**
Tank shot-off valve	6	2	3	**11**
Water pipeline	2	3		**5**
C5 - Installation of the collection of rainwater				
Rainwater tank	8	1		**9**
Restoration of natural water drainage	1			**1**
C6 - Implemention of green filters of sewage in isolated houses				
Wastewater treatment	3			**3**
C7 - Ecological connectivity in streams across road				
Platform bridge	3		2	**5**
Road elimination, Riverbed recovery	6	2	2	**10**
Stone bridge.	1		2	**3**
Vault bridge.			3	**3**
C8 - Improve the riparian habitat				
Exotic Conifer felling	2		3	**5**
Planting native trees	3	2		**5**
Planting native trees & Bioengineering	3	1	2	**6**
Actions linked to habitat restoration	**60**	**18**	**37**	**115**

6.2.Main deviations, problems and corrective actions implemented.

Action	Main deviations/problems	Corrective actions/solution
	Technical nature	
A1	Due to problems in the multiplex design, one microsatellite marker had to be discarded.	All samples were then genotyped for the 23 microsatellite marker set.
A1	Individuals from 2017-2018 cohort could not be analysed, because these individuals were still too small to be microchipped, and thus, they could be sampled for genetic testing.	They could not be sampled for genetic testing.
A1	Analyses of minimum viable populations have not been performed yet, as only 13 reintroduced individuals could be sampled in wild reintroduced populations. However, genetic information of these 13 individuals is of great importance in the management of this species' reintroduction program.	These pending analyses are expected to be performed soon since most individuals released in 2019-2020 are already microchipped and genotyped. Thus, as soon as some of these individuals are found in nature, no further genotyping will be needed, and the analyses can then be carried out.
A2	Although the action was initially planned to start in 2017, because of logistical problems we started in the spring of 2018.	This fact was not a major problem for the development of the action and the results obtained have led to interesting conclusions for improvements with regard to management.
A2	The first step in the study of sperm quality is to separate the spermatophores, which is very difficult due to their agglutination.	We worked in collaboration with the Department of Animal Production of the Universitat Autònoma de Barcelona on the best protocol for the incubation of the spermatophores.
A4	20% of land owners have been very difficult to locate because they are forest lands with old segregations and which are poorly-registered, some have deceased owners, others are owned by public limited companies with a person in charge who is difficult to find.	It has been necessary to spend a lot of time and staff resources to search in the official property register to find the heirs or property managers so that they could be contacted directly.

A4	In general, there is distrust towards the administration's management and only two technicians have the traditional owners' trust to propose possible changes in the exploitations of natural resources.	It has been necessary to force and coordinate the agenda of these two technicians to find time to jointly visit and convince the owners.
B1	In general, Montseny inhabitants do not want to sell their family lands and due to this, the property with the best newt population cannot be purchased, even if it is of strategic interest. In addition, there is a discrepancy with regard to land borders between this property and DIBA's public property, which is next to it.	Explaining to the owner that this strategic land has many restrictions for the exploitation of natural resources and that it will probably be declared a special protection zone. DIBA has offered the owner to change it for a property in the same area but one that is outside the area of high conservation interest. Negotiations are expected to be finalised during After LIFE time.
C2	The main problem found was that this action could not be fulfilled exactly as proposed because of issues that were not in our hands.	However, the species is protected by the Habitats Directive because 100% of its populations were already protected and this protection cannot be lifted because of a taxonomic issue.
C4	There is no official and proven system for water catchment to allow for ecological flow in mountain streams.	A prototype of a water distribution box was designed to prioritise the ecological flow as opposed to water being abstracted from the stream. This prototype is to be validated during the After LIFE period.
C10	In TF, the success rate for the eastern population was poor, a fact observed in all the breeding centres. High mortality and slow growth rates have been detected on descendants of the western population. Perhaps overpopulation of individuals was the reason, caused by a delay in the release of previous years' specimens, staff restrictions caused by the Covid pandemic and bacterial overgrowth in the aquarium water circuits.	From 2019 to 2022, more adult newts have been released into the wild. As a result, the aquariums' availability for larvae has increased. During 2020, a new nursery room was fitted out for the growth of larvae.

C11	A minor problem in the breeding area was the initial regulation of the cooling system for the environment and some insulation on the roof surface. Although all aquariums were ready for use, air temperature was considered a critical factor for the normal development of newt life, and therefore, the newt breeding groups were not transferred until the desired environment temperature could be maintained.	This delay (1.5 months) in transferring individuals to the new facility was overcome by means of a continuous monitoring and adjusting parameters with regard to the functioning of the cooling system and by fixing roof insulation deficiencies. Optimal levels of air temperature were achieved and appropriately maintained in less than 2 months, making the new facility 100% operational in T2 2018. and allowing it to officially open in June 2018.
C12	The reproductive success rates are lower than expected at the beginning of the project. This was the case at Barcelona Zoo, despite the positive evolution of reproductive indicators at a global scale during the project.	To improve coordination with other breeding centres in order to make progress in improving the knowledge of the species' biology and breeding behaviour, as well as in the management guidelines that optimise breeding results. With the incorporation of new founders and the formation of new breeding pairs and groups, it looks like these parameters will improve, as has been the case for the western population in recent years.
C14	During the first year of the project, in TF there was high larval mortality, presumably due to bacterial infection.	After antibiotic treatment, the mortality has stopped and has not recurred in the following years.
C15	The Montseny Newt Reintroduction Programme identifies potential streams for the release of newts, but the problem is that very few places really have good enough environmental conditions to do so.	Riverside habitat restoration actions are planned in potential streams for future newt releases. These actions will be performed in After LIFE.
D2	Immature newts were too small to be marked using elastomer.	This problem cannot be overcome, because no alternative methods for marking were available. If they are captured, these individuals will be marked when they are larger.

D2	Severe droughts and in some cases, short episodes of intense and heavy rain. These environmental problems reduced the available time to sample the species' natural populations. The strong drought experienced during 2021 in the Montseny, has been a factor that has significantly limited the extent of the results obtained in the monitoring campaigns of natural and introduced populations.	The solution adopted to overcome these problems was to modify the sampling calendar, extending the period of field work until December.
D5-D6	The effects of the severe drought and a few storms periodically affected the network of hydrological and meteorological sensors. The Montseny range was especially affected by the storm 'Gloria' (22-24/01/2020), with accumulated rainfall reaching up to 400mm/m2 and with wind gusts reaching more than 140km/h. These factors have had devastating effects on the infrastructure, installed monitoring devices and pathways.	It was necessary to restore hydrological monitoring facilities and abandon some experimental systems. It is necessary to review, maintain, repair or replace elements that form part of this network periodically to avoid malfunctions and data loss. The team of rangers and project technicians are in charge of these tasks. It was also necessary to re-think already drafted projects in order to adapt them to any future storms of this kind.
E5	The design and production of the information brochures was delayed. The reason for this delay was in unifying the criteria with the content of the exhibition.	To solve this, the design of this promotional material was carried out by the same external supplier, thus merging criteria and minimizing the economic cost.
E9	In the progress report from 2018, the initial proposal for action E9 was adjusted with the goal of having the documentary adapted to the current formats being consumed in audiovisual media.	Thus, instead of producing a 50-minute documentary with 30 DVDs, it was seen as more appropriate to record a minimum of 6 capsules, with a total duration of 30 minutes and 30 distributable USBs. The final product featured 8 micro-documentaries with a total duration of 43 minutes.

E9	Work on the Montseny Brook Newt documentary was supposed to begin in the spring of 2017, by taking pictures of those aspects that referred to the biology and ecology of the Montseny newt, and the filming for conservation activities was planned for the period 2018-2019, to have the final product ready in early 2020. Initially, a delay was caused because the majority of the habitat-improvement actions were behind schedule.	Despite this initial delay, the action has been completed successfully, with the creation of 8 micro-documentaries that diffuse a large part of the actions that are part of the "LIFE Tritó Montseny" project.
F2	The main problem observed in the implementation of this action has been the eastern population's low reproductive success.	With the incorporation of new founders and the formation of new breeding pairs and groups, it is expected that these parameters will improve, as has been the case for the western population in recent years.
	Organisational	
A3	It was impossible to find a multidisciplinary team to design and manufacture an automated and centralized control system.	The budget item was transferred to Forestal Catalana (FC) to be taken over this action.
B2	The delay in signing Land Stewardship Agreements has affected the execution of planned actions linked to the riverside habitat (C4, C5, C6, C7, C8) because it´s mandatory to obtain a landowner's permit to start working on their land.	Firstly, DIBA drew up and approved a general agreement template for all affected landowners. This one was adapted to each specific case and the different types of actions planned. But the delay in the collection of signatures has been considerable and forced us to extend the project so that we could implement the actions on private land.
B2	More than half of the land proprieties are managed by several generations of families that live in Montseny and, in general, their practices are traditional. Overall, there is distrust in the administration's management and in particular, when it comes to the management of natural resources such as wood and water. Only two technicians, with more than twenty years of service in the park, have the traditional owners' trust to propose possible changes in the exploitation of natural resources. (Same as Action A4).	It has been necessary to force and coordinate the agenda of these two technicians to find time to jointly visit and convince the owners. (Same as Action A4).

B1-B2	The lockdown caused by COVID19 resulted in a considerable delay in many administrative processes, as it proved to be impossible to hold meetings with the property owners involved in actions B1 and B2.	The work meetings were held again when the government authorised it.
C1	There has been a great delay in finishing these documents. Among other reasons, there was little information available about the species and the lack of confirmation on its main threats, the processing of the edict on Catalan threatened species (published in September 2022) in which it not only catalogued the species in danger of extinction in Catalonia (where the Montseny newt is included, just as it was also in the Spanish threatened species catalogue), but it established the guidelines for what the recovery plans should include, as well as the technical documents that must accompany them, and all their processing. Additionally, our governmental department has undergone significant structural changes, which has caused a significant administrative stoppage of many actions, and especially of legislative procedures as is the case in this instance.	The Montseny newt conservation plan will be published in the Generalitat de Catalunya ‘s Official Journal as a resolution. It has a lower normative rank, but will allow the document to be more dynamic and open to updates as the evolution of the species is checked and as new technical information is issued on this.
C4	Traditionally, the Montseny owners have obtained the water from mountain streams. Most of the catchments are old and not legalised. There is distrust in the administration’s management, particularly when LIFETM staff have proposed changes in water management.	Technicians had to convince them of the need to adapt to climate change and the reduced availability of water in the streams. As a last resort, the owners’ obligation to maintain an ecological flow was explained (Act MAH/2465/2006, Act 1/2017) and they were subtly warned of possible future complaints.

C4	ACA is the administration with the competence to legalise water catchments, but there were no updated inventories in LIC Montseny to work with. ACA and their involvement is essential in order to find solutions in disputes concerning water and any action within the riverbank woodland.	This action has suffered a long delay because the catchments' legality had to be checked and it has been necessary to negotiate and sign agreements with the owners while, at the same time, the dossiers were processed with the ACA. A long process of mutual understanding between ACA and DIBA was required in order to streamline a joint strategy for the coordinated management of the relevant administrative processes so as to achieve the implementation of actions in private estates. This process has forced us to extend the project.
C5	Homeowners are unaware of the consequences of climate change and the anticipated water shortages. Owing to this, in general, they did not see it as a priority to devote a part of their land to build a water collection system or to store rainwater or runoff.	Time must be invested in convincing owners of the need to store water and to find places on their land to build ponds. In order to have more technical arguments to convince them, it was proposed to focus efforts on the 2 properties that believe this to be an essential measure to improve adaptation to climate change and to use these two projects, once completed, as practical examples to encourage the involvement by other owners with newt populations.
C8	In the second year of LIFETM, when landowners had already been informed of the need to conserve the riverside forest, LIC Montseny rangers reported on machines having already been fitted out and the workers being ready to cut down a riverside forest with newts.	The rangers stopped the riparian forest cut-down and held several meetings with the property, to avoid the exploitation of the riparian forest and to clarify this farm's borders, since they are next to DIBA's public farm and are not precise. It was agreed to continue cutting down the holm oak forest but not to act in the riverside forest, which was delimited in situ by the park rangers.
C8	Traditionally, Montseny owners have repaired roads and carried out their logging activity in autumn and spring. These periods of the year are when the newt and fauna in general are at their most vulnerable and human activities are often detrimental to the breeding and travel seasons.	It has been agreed with the property that all forest actions will take place preferably in late autumn and winter, taking into consideration the fauna and vegetation's phenology. As a result, some actions have had to be postponed until the summer or the following winter.
C4→C8	Between 2017 and 2022, organisational changes within the LIC Montseny staff and a lack of engineers working for LIFETM caused a long delay in the development, drafting and technical processing of the works projects for actions.	After several administrative steps taken by the central services, in May 2018 an engineer from another the DIBA office joined LIFETM but it was not enough and an external technical consultant had to be hired to draft and manage projects.

C4→C8	The introduction of electronic administration processes at DIBA in 04/2017, applied according to Act 39/2015, entailed an introduction of new protocols which have caused a long delay in case processing (in some cases by more than 18 months).	A lot of patience has been required to allow administrative staff to adapt the protocols dictated by the law.
C5-C7-C8	There has been a big delay in getting the municipality license in most of the actions carried out in the eastern sector.	A lot of patience has been required and we insisted on a weekly basis that the council technician sign their report. In the end, a few political steps were taken and made it possible to have several licenses in place in March 2022.
C5-C7-C8	The passing of Act 9/2017, with regard to Public Sector Contracts has caused a delay in adjusting the legal precepts in contract specifications and therefore in the awarding of works projects.	A lot of patience has been required to allow administrative staff to adapt the protocols dictated by the law.
C12	During the development of the project, a bitter debate was generated in the Barcelona City Council on the continuity of the ZOOBCN, creating a context of uncertainty within the organisation.	This situation was overcome by the technical team's enormous professionalism. Neither in those worst moments, nor in a context as complex as the one generated by COVID19 in 2020, has Barcelona ZOOBCN failed to make the necessary effort to maintain each and every one of the activities it committed to in this action, albeit in adequate conditions. Fortunately, this discussion process seems to have been overcome, and ZOOBCN has now established a strategic plan in which the work carried out during the LIFE project with the Montseny newt is a clear example to follow.
D2	The collaboration by rural agents, who form part of the Generalitat de Catalunya mountain group, with the team involved in the field samplings. In a few occasions, due to work overload, rural agents could not participate in a specific night of samplings as had been scheduled.	In this case the sampling was postponed until a new date was available, and the incorporation of trained park rangers is also planned to replace the rural agents' team when necessary.

D5-D6	The same storm (Gloria) caused major damage to the roof of LIC Montseny's garage-warehouse where all the logistical material of the personnel involved in the LIFETM was stored. During the repair works, asbestos contamination occurred throughout the facilities, which led to the closure of the building and until October 2020, personnel access and the use of all the material in the facilities was prohibited, including LIFETM's instruments and tools.	DIBA hired specialized personnel to decontaminate the entire warehouse and gradually access all the material and eventually moved it to a new warehouse.
D5-D6	The effects of the severe drought and a few storms periodically affect the network of hydrological and meteorological sensors. The Montseny range was especially affected by Storm 'Gloria' (22-24/01/2020), with accumulated rainfall reaching up to 400mm/m2 and with wind gusts reaching more than 140km/h. These factors have had devastating effects on the infrastructure, installed monitoring devices and pathways.	It was necessary to restore hydrological monitoring facilities and abandon some experimental systems. It is necessary to review, maintain, repair or replace elements of this network periodically to avoid malfunctions and data loss. The team of rangers and project technicians are in charge of these tasks. To re-thinking of already drafted projects in order to adapt them to any future storms of this kind was also necessary.
E8	Touring started later due to a general delay with regard to the exhibition's design and layout to ensure the text and graphic contents were correct.	Good coordination with PN-RB Montseny and municipal equipment was ensured. A special effort was made to disseminate the exhibition tour calendar among local people.

E10	The outreach programme started off with a slight delay. In the initial proposal, it specified that all materials would be available for 2018-2019. This deadline was partially met with the gypsum newt workshop which was introduced at the end of 2018-2019, and the rest of the materials were finished in 2020. The delay was mainly due to the fact that the contents in the handbook were debated and consensus was reached in a participatory way, which is something that we value very positively, although it did cause a slight delay in settling on the text, which lasted longer than we had planned. Thus, the revision of the design and layout is what took more time than was originally planned.	At any rate, this slight delay led to the creation of a final document that is an enjoyable read, with very an informative design and graphics. On the other hand, the revision of the teaching unit, with the incorporation of the new materials, was performed when all the completed resources were already available. During spring 2020, due to the COVID-19 pandemic, 5 planned workshops had to be cancelled. (Action E10).
E11	Delay in making use of part of the newt breeding aquariums (which can be observed from the educational area). And a slight delay in the interactive touch-screen game.	The impossibility of observing the aquariums in the breeding area with newts was replaced by the possibility of visiting the newt breeding facilities that the Zoo has been operating since 2012.
E11	Major issues with the proper development of the education program arose due to the restrictions associated with the COVID pandemic during 2020 and 2021. This situation dramatically reduced the number of visitors and school groups who could enjoy the newt's educational program in any of its on-site modalities.	The recovery of normal levels of activity at Barcelona Zoo in terms of visitor numbers, and the recovery of normal mobility by citizens (and tourism), were key factors in returning to the figures achieved so far. It should be noted that the numbers expected in the initial proposal only contemplated the guided visit modalities, so when the new educational facility was opened to free-format visits, these numbers increased exponentially when compared to those that were expected. Furthermore, in this COVID context, the educational team at Barcelona Zoo deployed a series of online proposals aimed at children, called "ACTIVIZOO", with Activizoo number 16 being entirely dedicated to the Montseny newt. Subsequently, and due to the great interest and acceptance of the proposals (i.e., more than 16.000 visitors to Activizoo n.16 from March to August), they have remained active.

E12	The main deviation was that the decalogue could not be done. After the first meetings it was decided to write two documents: 1. Biosecurity protocol to aply biosafety standars to all activities in riverside, and 2. Manual of good forestry practices in riparian habitats. For this last one, could not hold plenary and participative discussion with landowners and therefore it was not possilbe to have a decalogue of good practices approved by the director body of the Montseny LIC.	Instead of a Decalogue, two documents were done: a Biosecurity Protocol, and a Manual of good environmental practices elaborated with the participation of technicians, specialists, professionals and scientists. This version will be presented to owners and professionals of the territory during the After LIFE, and discussed to be finally aproved. The Biosecurity protocol is already beeing applied in al Natural Park activities.
F1	The Project needed two specific technicians (herpetologist and conservation management biologist). In 2016, the internal process was initiated to call for applications. The public call for the herpetologist was discarded due to the urgency of having to start in 2017. The administrative process of contracting the management biologist was annulled by the challenge of the "Colegio Oficial de Ingenieros de Montes".	The herpetologist was employed by using external services until the end of 2017 was carried out with Montseny PN-RB's budget because the LIFE budget had not yet been generated. For the remaining 3 years of the project, a multi-year service contract was offered and finally approved and resolved by the end of December 2018. For the technical biologist, DIBA initiated a new administrative process to include these professionals in the call. The selection process did not end until November 2018, when the conservation biologist was finally hired. The position of technical biologist in management was taken over by the project's technical coordinator (D.Guinart) with the collaboration of external technical assistance in 2017 and 2018.
F1	The technical coordinator of LIFETM (who is also the conservation director of all the LIC Montseny) had to delegate many of their other projects and technical responsibilities in the LIC Montseny, in order to take over the work of technicians who were absent.	The BC of LIFE Project technical team should be permanent and full-time, from the beginning to the end of the project.

F1	Due to the COVID19 pandemic, during 2021, some of the planned workshops and dissemination events could not take place. Most scheduled meetings and participatory processes (with owners, experts and technicians) were suspended or postponed.	Some technical meetings were held online, and allowed for progress to be made on some actions.
F2	There are ongoing problems with the transfer of specimens from Torreferrussa to Chester ZOOBCN because of European restrictions on the transport of amphibians to reduce the impact of Bsal. This move has now been further complicated by Brexit.	We are awaiting a decision on whether the European Union will relax these restrictions in the case of transactions between centres participating in conservation programmes in enclosed facilities.
Financial		
B1	The management of a land purchase has never been fast and requires the ability to convince the current property that they will not be able to profit economically from its exploitation. It takes time to negotiate a price that is right for the buyer and the seller although there is a commitment towards finding a fair price.	An official assessment was carried out and it offered a reasonable price that encouraged the sale of the property. The economic valuation of the land purchased has been carried out by employing the method of analytical valuation of capitalisation of rents on forest land (Act 7/2015 and Act 1492/2011).
C5	Based on the land custody agreement signed with the landowner, the owner had to finance part of the investments to improve the nursery. Since the economic investment was high, the property could not execute the actions on an ongoing basis.	Action was planned in phases, the first one by changing the irrigation system, which has reduced water consumption by approximately 40%, and the second one was carried out a year later, when the owner was able to pay for their share of the installation of the new water tank and its infrastructure.
C5-C7	The lockdown caused by COVID 19 caused a lack of materials and a significant increase in prices. This led to a delay in actions and the withdrawal of some commitments by construction companies.	New budgets had to be requested in order to reprocess the awarding for pending works. In the end, the project had to be extended in order to be able to execute most of the works.

C10-C11-C12-C14	During the first phase of the new ZOOBCN breeding centre, the design of the new facilities was modified to considerably increase the capacity of the aquariums housed, as well as in the other two breeding centres. There have been significant budget increases compared to the initial forecast.	It has been necessary to involve more staff than initially planned. It has been assumed by ZOOBCN and FORCAT's annual budget.
C11-E11	One of the most important tools for the correct development of the educational program in ZOOBCN was undoubtedly the construction of a space adjacent to the breeding centre, where visitors could have all the necessary elements at their disposal to focus their attention on this species. In the initial proposal, the use of this educational room was intended exclusively for small groups guided by an educator. The conceptual change with regard to the spaces dedicated to the breeding room led to a rethinking of the educational room, greatly increasing the resources deployed in it.	The considerable surplus cost generated by the improvements in the architectural project and the definition of the contents for the educational space were assumed through the general annual budgets of ZOOBCN.

6.3. Evaluation of Project Implementation

a. **Methodology applied**

The methodology applied and the results of the actions carried out have been evaluated in accordance with six operational project objectives:

Obj.1: To ensure the conservation of *C. arnoldi*'s wild population, its genetic conservation and expand its geographic distribution.

The infrastructure to expand the breeding centres has been adequate. However, the operation of the aquariums had to be changed, to separate the water circuit and its filtration for each aquarium, to achieve optimal hydrological quality conditions

The methodology applied in the breeding centres has allowed for the intensive production of newts to be able to carry out population introductions and to increase its geographical range. The progressive increase in total number of newts housed in the breeding facilities, "used" for intensive reproduction and the slow but positive increase in reproductive rates are two clear indicators of the success in this action. The decision to house individuals from the western population in ZOOBCN led to increased biosecurity in the management of the global ex situ population.

One of the improvements proposed for captive breeding management is the implementation of breeding groups instead of pairs (action A1). However, this type of management makes it difficult to trace the animals' pedigree and complicates studbook management.

The system to mark released newts should improve with individual microchips and readers that are not a specific brand or model.

Surveys to determine release sites and the system of tagging each newt introduction location has been good, but the dedication sown by rangers has exceeded expectations.

A total of 1.149 individuals were successfully genotyped. Thus, the genotyping methodology was useful for the genetic assessment. The analyses of genetic diversity indices and parentage analyses were successfully performed, resulting in relevant information to be taken into account in the management of this species.

Obj.2: To increase the hydrological quality and ecological flow of streams with *C. arnoldi*.

Obj.3: To minimize threats in the riparian habitat, improving river connectivity and increasing area of native riparian forest in these streams.

The procedures for drafting and awarding the works and administrative permits have been extremely slow. Administrative management should be simplified, in particular environmental project files led by the administration of the protected areas themselves.

In all the negotiation processes with private owners, LIC Montseny technicians have been involved, and many days of work have been put in. Although technicians have extensive experience in dealing with private property, it would be necessary for a mediation specialist and/or psychologist to be involved in these projects, where there is a need for a consensus among different interests.

The modification or elimination of catchments has involved a lengthy administrative procedure and a multitude of meetings with ACA. Many of these are still in the process of being resolved and further work will need to be done in the After LIFE. Many hours of meetings with the owners have also been devoted to explaining the problem and seeking satisfactory solutions. Despite the hours spent to obtain some agreements, in the end, it has been essential to turn to the law, which forces private owners to respect a flow rate and therefore obliges them to modify their catchments. To improve water catchments, it would be necessary to cut bureaucratic formalities and to use more human resources into identifying catchments that are outside the law and force their modification.

To increase the flow of mountain streams, it is firstly necessary to have a system to calculate and monitor the flow rate, but there was no previous experience of this. LIFETM has had to plan and implement a method, with the collaboration of hydrologists and technicians, to establish a hydrological stream monitoring network in LIC Montseny. After 4 years of trial and error, consistent data has been obtained over the last two years. Therefore, the effect of the C4 actions carried out can be assessed in the After LIFE.

LIFETM has had to plan and build a water catchment system that respects an ecological flow. There have been problems in finding certain filter tubes and their implementation has been delayed. It is a new system to be validated during the After LIFE.

The methodology applied for sewage waste in isolated houses has been successful and efficient. But for the implementation of new green filters, it would be important to have a long physico-chemical data series of the discharges in order to be able to compare them objectively with post-intervention water analyses.

Methods to restore connectivity in streams and the native riparian habitat have been satisfactory and these will be replicated throughout LIC Montseny.

Obj.4: To establish proper legal coverage, with the conservation plan of *C. arnoldi.*

The processing of the recovery plan has been affected by political problems and changes in GENCAT's administrative structure. Technicians have been heavily influenced by political issues and should have been more expeditious in the preparation of technical documents.

Obj.5: To increase scientific and technical knowledge

The aim to ensure good management has been achieved with a broader knowledge of *C. arnoldi*'s biology and ecological requirements, getting annual status population indicators, and integrating all the information into a GIS-Dbase, for global analysis.

The involvement of more than one hundred researchers and ten research centres has been very satisfactory and has contributed to the success of many LIFETM actions. Scientifically-based decision making has been the basis of a successful project.

The Montseny newt monitoring campaigns have been successful and it have been efficient thanks to the involvement of the LIC Montseny rangers.

The management of field data and its linkage to the GIS, has involved validating the information and updating it periodically. The partial dedication of a technician has not been enough. In the After LIFE, more time should be devoted to analysing and linking the databases throughout LIC Montseny.

The methodology applied in the Montseny brook Newt population monitoring allows us to compile enough information on the state of the natural populations to diagnose the level of conservation of the populations and the whole species. This methodology considers three criteria.

a) feasibility, given the short period of time when there is enough water on the streambed, we realistically think that each population can be sampled twice a year.

b) impact on the population, sampling of newts should not be an additional problem for the species. Therefore, we reject the idea of carrying out capture-recapture samplings for all populations of the species (restricting it to short periods in a few stream sections) not only because of logistic and budgetary limitations, but also to avoid increasing the negative pressures on the newts.

c) economic costs and logistics, which have been much higher in terms of personal involvement (rural agents and personnel at the natural park have limited time to invest in this task) and available budget.

Obj.6: To involve stakeholders and land owners in the conservation of riparian habitats and its biodiversity

The task of involving owners has been taken up by the LIC Montseny technical staff, but none of them is a specialist in conflict resolution. Their involvement has been essential thanks to their many years of service in LIC Montseny and landowners trust them. But in future projects it would be important to have the collaboration of experts in conflict mediation.

The lessons learned in managing to buy private land have made it possible to establish an action protocol, which would facilitate future purchases of private land which are of conservation interest to the public administration

The Land Stewardship Agreements signed with private properties have been a positive experience for DIBA. It has involved many hours of meetings to reach favourable agreements, but its 20-year shelf-life ensures the long-term preservation of the riparian habitat. Due to the good results obtained, it is a method that will be replicated to involve many private owners with farms in natural areas.

The methodology to disseminate and involve the local population has been very successful. The traveling exhibition was very well-received in the municipalities within the park, and outside. In this case, the quick and easy set-up meant it could be put on display in various places. Along these lines, it is especially interesting to explore places like libraries, since they are often frequented by a lot of people and tend to offer many services. Travelling to a site like this allows you to reach a much wider audience, while at the same time, it can provide resources such as specific books on the subject or other interesting information. Without a doubt, the exhibition together with the other communication actions for the project LIFE, have made a decisive contribution to raising awareness on the Montseny newt and the “LIFE Tritó Montseny” project.

The plaster newt workshop was well-received at every school where the activity was carried out, which we attribute to the fact that the gypsum newt that is obtained looks like an authentic Montseny newt. In addition, it is an educational resource that is fun and valuable, because the particularities associated with the newt’s biology and ecology and the infectious

diseases that affect the amphibians are explained in a playful way. At present, the fact that each student gets to bring home their own gypsum newt helps extend the learning to the family setting.

After starting to use this resource, the Pont de Suert Breeding Centre expressed interest in recreating the workshop and doing it with the schools that visit the centre. Since 2020, the worship is also being offered at this centre in Alta Ribagorça (Lleida).

With regard to the handbook, even though there were different disinfecting protocols directed towards the scientific community, there were no educational documents for environmental education organizations and educational centres. This is the handbook of good practices that was published in Catalonia with this intention in mind and with the goal of it serving as a guide both for outdoor activities in the river habitat of Montseny, as well as other places in the Catalonia region.

b. Objectives and expected results, achived and evaluation

Action	Foreseen in the revised proposal	Achieved	Evaluation
A Preparatory action			
A1 Genetic evaluation of the breeding program	Objectives: To evaluate the genetic diversity of the successive cohorts.To verify the pedigree. Expected results:The frame image of the genetic conservation in order to ensure the genetic viability of the breeding stocks and to optimize the reintroductions in the field.	The evaluation of the genetic diversity of the successive cohorts. The pedigree of all genotyped samples are verified. The frame image of the genetic status in the breeding stocks, reintroduction populations and wild populations.	Near 75% of the captive individuals from the four breeding centres have been successfully genotyped and analysed All reintroduced individuals that could be sampled in wild after their release could be genotyped, elucidating crucial results for the reintroduction management. Over 200 wild individuals were still genotyped to keep updated the genetic status in wild. The image of the current genetic status is relevant for the management of this critically endangered species.
A2 Determination of the causes that produce defects in bone tissue and study of sperm quality	Objectives: To determine possible causes for the low fertility observed during the first years of the breeding programme. Establish the osteological health of specimens born and kept in captivity, in order to implement possible improvements in breeding and feeding protocols. Expected results: To establish a diet and an adequate substrate to avoid malformations skeletal structure. To recognize possibles causes of decrease of hatching, studying the sperm quality.	Aiming to determine the causes of the low fertility, observed in couples that included captive-born males, sperm has been thoroughly studied, also reproductive behaviour has been monitored to detect possible conduct abnormalities Larval growth has been analysed under different feeding and habitat conditions. Bone density and metabolomic aspects have been analysed, as well as the effect of stocking density in aquaria.	The sperm quality study has not detected any abnormal percentage of malformations or mobility limitations in the sperm of captive-born males. No problems have been detected either in the sexual maturation of the specimens or in their reproductive behaviour. With the aging and sexual maturation of more specimens, it has been successfully bred from F1. Nevertheless, a marked difference in the reproductive success of the two populations persists. The study of the effect of diet and substrate has shown a higher growth in the specimens fed with live prey and natural substrate. Even so, osteological studies do not detect any deficiencies or malformations in the bone structures of any of the groups. The normal diet of the breeding programme has been improved over time with the addition of more and more varied products and can now be considered correct. However, the incorporation of live food in the diet of the specimens will be valued, as well as more natural materials in the decoration.

A3 Technical development of naturalized aquariums	Objectives: To dispose of aquariums with different environmental conditions to analyze their effect on the breeding success of the species. Expected results: Determination of the best environmental conditions for the breeding of the species and determination of the possible effects of climate change on its conservation.	Research has been carried out on the effect of environmental enrichment, changes in temperature, illumination and physico-chemical conditions of the water.	Observation of behaviour of the specimens in landscaped aquarium has provided a better understanding of the species' biology and habitat requirements. Research on temperature change has shown a high adaptability of the species. Some changes may be implemented in the breeding protocols with regard to temperature, illumination and water quality. The effect of warming due to global climate change could not be properly tested. Based on experimental results, the major problem probably won't be so much the effect of increase in temperature on animals directly or breeding success, but other habitat changes such as the drying up of streams, more recurrent floods or changes in riparian forests.
A4 Information to potentially involved private owners	Objectives: Inform de land owners. Expected results: Improve the collaboration with the owners to find synergies about river habitats conservation	All 18 mayors of the municipalities informed. All landowners with newt in his propriety and 75% of land owners with potential habitat to be introduced, were informed. More that 80 private meeting have been kept with 12 different owners	Difficulties to convince the traditionally owners, and to find one of the owners. Results have not been fully achieved, but, despite the delays and difficulties, efforts have been made to strengthen collaboration with the other owners in the nexts years
B Purchase of land and compensation payments for use rights			
B1 Purchase of land or compensation of use rights	Objectives: Buying land or the benefits of resource exploitation. Expected results: To own the areas of greatest interest to the newt stock. Ensure the good conservation of strategic riparian habitats.	Incorporation of 2 privately owned properties, with newt population, into the public properties of the LIC Montseny. Represents 87 ha where the management objective will be conservation. The land swap has been agreed in two properties, while a third one is currently being negotiated.	Negotiations with strategic owners have been long and hard, but we finally reached an agreement with two buy 2 properties. An agreement to swap lands is expected to be reached in After LIFE. It will be advised to have the collaboration of experts in conflict mediation for the nexts negotiations.

B2 Implementation of Land Stewardship Agreement	Objectives: To have an agreement, signed by DIBA and the private owners, to conserve river habitat Expected results: To sign several Land Stewardship Agreement to specify the interventions on each farm.	A model of general agreement was draw up and approved by the provicial Council (DiBa). Land Stewarrsship Agreement have been signed with 3 landowners. Represents 65 ha of new supervised management land, with natural newt population streams, where the management objective is conservation	It has been really difficult to approve long-term agreements, 25 years in force, with the 3 owners. The delays in signing Land Stewardship Agreements has affected the execution of planned actions (C4, C5, C6, C7, C8) because it´s mandatory to obtain a landowner permit to start working in their land. It will be advised to have the collaboration of experts in conflict mediation to speed up this proces.
C Concrete conservation actions			
C1 Montseny Brook Newt Conservation Plan	Objectives: Draft issue and approval of the Conservation Plan Expected results: Approval of the Conservation plan	The technical document of the Conservation Plan for the Montseny newt has been done. It has been attached Cartography, Monitoring programme, Captive breeding programme, Habitat management programme and Creation of new populations programme.	The Montseny newt conservation plan, will be published in the Official Journal of the Generalitat of Catalonia as a resolution. It is a lower normative rank, but will allow the document to be more dynamic and open to updates as the evolution of the species
C2 Steps to include the Montseny Brook Newt in the Habitats Directive	Objectives: To include *C. arnoldi* in the Annexes IV of D. 92/43/EEC Expected results: Modification of the Annexes IV of Council Directive 92/43/EEC	*C. arnoldi* was included in the updated Article 17 checklists for species and habitats. Define the Reserve Areas, which will be the future Conservation Areas of the Natura 2000 network, Annex II.	Although the European Commission will not update the list with a new Annex IV, we consider that the fact that *Calotriton arnoldi* is listed as an individual species in the current Article 17 checklist and a specific report has been submitted. The European Commission will not modify the Habitats Directive's Annexes in the short or middle term, and therefore *Calotriton arnoldi* species will not be individually listed. However, since the populations were already protected as Euproctus asper, they cannot be unprotected because of a taxonomical change.

C3. Information system and biodiversity database	Objectives: To incorporate in the information system and database of PN-RB Montseny (SIMSY) the reports and the scientific and technical data acquired all along the project. To create a computer application to visualize and analyse the data efficiently. Expected results: LIFE Tritó Information System (IS) developed. Newt geolocations added to the Montseny Biodiversity Database. GIS app developed to visualize and analyse all the data developed throughout the project.	Montseny Information System (SILTM) developed. New Montseny newt geolocations included in the Montseny Biodiversity Database. Geographical information system (GIS) developed and operational. 1 laptop and 2 tablets obtained and operational GIS mobile application compatible with our system installed in all project devices and running.	Process to include all the developed data in the SILTM is slower than expected due to the large amount of information produced. The SILTM and the associated applications are dynamic tools and requires constant updating to meet the expectations of its users. Several improvements in those systems expected After LIFE project.
C4 Remodelling of the water system of collection and distribution	Objectives: To assure an ecological flow in strems To adapt water catchment, storage and distribution systems, Expected results: To have intakes that respect ecological flow. To eliminate illegal recruitments.	Good inventory of water catchment and its distributions network. 6 water catchments modified with ecological water distributor. Elimination 7 unlawful uptaken. Improvement of 10 Water tank, closure in storage cisterns, and infrastructure Agreements with ACA, about regulation of 8 catchment status.	This action has suffered a long delay because firstly the legality of the catchment had to be known, then it has been necessary to negotiate and sign agreements with the owners and at the same time process the dossiers with the ACA. Continuity of multidisciplinary team of technicians must be ensured during project implementation to success. Administrative precesses should be simplified. The managers of LIC Montseny will continue to inform owners about the legislation, and they will continue to advise them to implement the necessary procedures and reforms. Montseny Natural Park has a line of subsidies for homeowners to implement good practices such as the C4 action. The ecological water distributor are working satisfactorily

C5 Installation of the collection of rainwater and greywater system	Objectives: Rainwater harvesting and transformation of irrigation systems Expected results: To increase storage capacity of rainwater and reduce water use for irrigation.	Irrigation transformation in a nursery with installation of 60.000 drippers. Construction or adaptation of 5 tanks with total storage capacity of 895 m3	Many hours of meeting with owners have been essential, to reach agreements and to execute this action , and delays were the same as already explained in C4. The installation of drippers has reduced 40 % water consumption. Because of the consequences of climate change and reducer water availability, the managers of LIC Montseny will continue to offer owners technical and economic assistance for rainwater use. The park's engineers will promote the installation of renewable energies to pump rainwater from the new reservoirs.
C6 Implementation of green filters of sewage in isolated houses	Objectives: To avoid the discharge of wastewater in *C. arnoldi* streams's Expected results: To implement green filters on waste wáter, in streams with *C. arnoldi* population	A mass campaign was carried out to collect water samples from the Montseny brooks to analyse the water's chemical components, and the results indicated no presence of significant concentrations of toxic elements or contaminants. One green filter has been built in the only equipment that could affect a newt population	The implementation of the lagoon treatment (green filters) has been efficient and the result of its operation has been satisfactory. The tertiary purification raft will be an example to replicate in other tourist infrastructures (camping, rural houses, youth colony houses, etc.) in LIC Montseny, for its efficiency in purification and also as an educational tool and a means of raising environmental awareness.
C7 Ecological connectivity in steams across road infrastructures	Objectives: To improve the ecological connectivity along the streams across road infrastructures Expected results:: Modify road infrastructures that are a barrier for the newts in its streams. Adapt the trekking trails to discourage access to streams.	Good inventory of ecological barriers in the basic road network of the transit basin done. Elimination of 11 forest tracks and built 19 bridges of different types according to their level of use. More that 6 km of ecological connectivity restored. Excursionist path removed, that directly affected a newt population.	Continuity of multidisciplinary team of technicians must be ensured during project implementation. Administrative precesses should be simplified. Delays were the same as already explained in C4. All the different types of bridges made, are good solutions to restore connectivity and it has been found that newts are already using these stretches of restored connectivity.The managers of LIC Montseny will continue to offer owners and town councils, technical and economic assistance for to improve stream ecological connectivity. The park's engineers has the obligation to restore the connectivity of all streams of LIC Montseny. Therefore the removal of barriers will continue to be motivated by roads and footpaths

C8 Improve the riparian habitat Native riparian habitats and forest practices	Objectives: Improve the natural riparian habitat, and promote good forestry practices Expected results: Elimination of exotic forest plantations. Reduction of the erosion and increase of tree cover. Improve the conservation status of the riparian forest, the hydrographic basins of the newt	Agreement with the CPF to protect river basins with newt. Restore 700m2 of native riparian habitat, Removal of 3,7 ha of conifer plantations. Construction of > 1000m. natural barriers to avoid erosion processes, Staff training in bioengineering. Delimitation of river protection areas.	Despite all delays and discrepancies betwen biologists and forest engineers, after bioengineeriong works, the forest recovery is very satisfactory. The total removal of the conifer pantations is positive for the recovery of the riparian forest and a greater ecological flow. It have been promoted good forestry practices throughout the river basin. It is expectet to continues this actions during the next years and outside de newt distributions area.
C9 Enlargement of the Torreferrusa breeding Center	Objectives: Expansion of the Torreferrusa breeding centerExpected results:. Triple the capacity of the current breeding center. Establishment of a separate room for each of the two Montseny newt populations.	The new room has been built.120 new aquariums are now available for each of the populations.	The expected objectives of the action have been achieved with a minor delay. The new breeding center has become functional during the first quarter of 2018.
C10 Operation of the Torreferrusa breeding center	Objectives: Maintenance of the breeding centre in Torreferrussa. Expected result: Increase production to ensure the creation of new populations in a good habitats	The number of breeding pairs has been increasing during LIFE Project, actually Torreferrussa kept 46 couples for the western and 43 for eastern populations. Breeding success has been increasing with the addition of 77 news couples. Of these, a total of 41 have been successfully reproduced (32 western and 9 eastern).	Western population success is as good as expected with a notable increase along the years, reaching the maximum taking into account the capacity of the center. Eastern population success is so poor, fact observed in all the breeding centers. By incorporating new founders and increasing breeding group management, it is expected that improved success will be achieved, especially for eastern population
C11 Expand and improve the Barcelona Zoo breeding center	Objectives: To double the capacity of house in optimal conditions and thus increase the ex situ breeding rates Expected results: Construction of a new breeding facility	The construction of the new breeding center for Montseny newt has been fully achieved, considerably exceeding what was set out in the initial proposal. (Current number of aquariums: 112)	The new breeding centre is now 100% operational, and therefore this action is considered satisfactorily closed.

C12 Operation of the Barcelona Zoo breeding center	Objective: To improve the management capacity of the ex situ population, to increase the reproductive rates and maintain a genetic reserve ex situ Expected results: To increase the total number of individuals in the ex situ population, in order to be able to implement reintroduction,.	It is now very well established, a clear protocols and professional staff involved Progressive increase in total number of newts housed in the breeding facilities. Slow but positive increase in reproductive rates. Release to the wild of newts born ex situ.	It should be noted that the zoo's current strategic plan considers research, conservation and education actions associated with local fauna with a high degree of threat as a priority, making de facto the Montseny newt project a model for the zoo itself to follow.
C13 Extension of the Pont de Suert breeding center	Objectives:Expansion of the Pont de Suert breeding center Expected results Triple the capacity of the current breeding center.	The new room has been built. 120 new aquariums are now available for Western population.	The expected objectives of the action have been achieved with a minor delay. The new breeding center has become functional during the first quarter of 2018.
C14 Operation of the Pont de Suert breeding center	Objectives: Maintenance of the breeding centre. Get offspring from some of the couples. Expected results: Increase production to ensure the creation of new populations in a good habitats	The number of breeding pairs has been increasing, actually 21 couples for the western populations. Breeding success has been increasing with the addition of news couples	Breeding success is as good as expected with a notable increase along the years, reaching the maximum taking into account the capacity of the center.
C15 Introduction of the Montseny Brook Newt and expansion of its distribution area	Objectives: expanding the geographical distribution of the Montseny newt. Expected results: To create and consolidate new populations, to increase the home range of *C. arnoldi*.	Generation of models of species distribution. Map of potential habitat. Plan to create new poplulations developed and attached to the Recovery Plan. This plan has been followed in all reintroduccions carried out. During the LIFETM, five new populations and 1,935 releases have been made and monitored.	The expected results of the actions have been fully achieved. The success of the program of introduction of new populations of Montseny newt is founded in two crucial aspects: release of large number of newts in the nature and the selection of streams keeping an optimal habitat. Results evaluations are still in progress, but coincides with the expectations of the specialist. It is still early to confirm the success of all new populations, but reproductions confirmed at least in one of them.

D Monitoring the impact of the project actions			
D1 Technical Monitoring of C4, C5, C6, C7, C8	Objectives: To evaluate the effect (positive or negative) of the actions carried out Expected results: To have indicators of the effect of the actions carried out on the riverside habitat.	Periodic monitoring of each action has been carried out, in order to direct the works and confirm that they follow the executive project and that they are carried out correctly.The summarised information about 75 actions executed, with evolution photo, is grouped in a report to be updated during future field visits. All this information has been kept up to date throughout the project in a geographic information system and linked to a database.	This monitoring is essential to verify the correct functioning of the works and to collect the data required to evaluate the intervention. Monitoring has made it possible to modify certain executed works and to improve their efficiency. After several delays (related to C4-C8 actions), expected results have been achived.
D2 Monitoring populations of Montseny brook Newt (natural and reintroduced)	Objectives: To know the state of conservation of the Montseny newt populations Expected results.stable populations or increase in area of distribution	Anual monitoring camapains done. Diagnosis of Montseny conservation status made. 70 field campaigns have been conducted. There have been almost 700 newt sightings. The area of distribution has increased with 5 new populations in the Montseny.	Final results satisfactory, usefull for species management and decision making. The delay on the implementation of the actions devoted to mitigate the negative impacts on the habitats coupled with the biological and ecological characteristics of the species prevented us from assessing whether these actions have been effective. The Montseny newt is still in critical status of extinction
D3 Surveillance of infectious diseases in PN-RB Montseny amphibians	Objectives: Assess the health status of amphibians in Montseny Natural Park Expected results: Early detection of amphibian infectious diseases and application of control measures	Periodic surveillance of amphibian diseases (Bd, Bsal, Rnv) using PCR has been performed in the park. Detected dead amphibians have been necropsied and/or sampled to detect possible pathological problems. Creation of a biosecurity protocol for amphibian fieldworkers.	Extensive sampling has been performed and diseases have not been detected in wild Montseny brook newts in the park. It is noteworthy to mention that B.dendrobatidis have been detected in 3 amphibians of different species in the park during this period. It have been able to analyse more samples due to a collaboration agreement with one laboratory. It is considered very important to continue the surveys to detect possible outbreaks in the future.

D4 Sampling of infectious diseases prior to the release of *C. arnoldi*	Objectives: To ensure the good health of the animals from the breeding centres. Expected results: To detect as soon as possible the appearance of diseases and avoid spread to nature.	Periodic surveillance of amphibian diseases has been performed in all captive breeding Sick animals have been diagnosed and treated appropriately. Dead animals have been necropsied and/or sampled to detect possible pathological problems. Prior to the release of newts to nature, all animals were tested for selected infectious diseases. All animals were negative.	Diseases have not been a problem in captivity and all newts have been specifically evaluated for infectious diseases before release to the wild being negative. We have been able to analyse more samples due to a collaboration agreement with one laboratory
D5 Qualitative and quantitative hydrological monitoring	Objectives: To collect quantitative and qualitative hydrological data. Expected results: To describe the hydrommorphological habitat of the Montseny newt.To establish a long term hydrological monitoring network	Montseny newt hydromorphological habitat described. Long term hydrological monitoring (LTHM) settled and started. Meteorological installed and are operational. Data from al stations and sensors are being collected and stored. First results analysed during LIFETM.	Montseny newt hydromorphological habitat described and LTHM data collected so far show flows below 4l/s. Therefore, it is a really negative impact to extract water for private use in this area, especially considering the effects, already evidents, of climate change. It is considered essential to maintain this hydrological monitoring network.
D6 Monitoring of biological impact of the interventions in the riparian habitat	Objectives: Monitoring biological impact in the newt riparian habitat. Expected results:To establish a network to monitor biotic and abiotic parameters in river habitat	Invertebrate fauna in the newt riparian habitat has been thoroughly studied. Effects of plantation logging and its regeneration evaluated. The impact of the sediment input caused by the actions was monitored. The temperature and flow of the torrent were monitored during the actions. And aintenance and improvement actions should be carried out in the logging areas. Data from al monitoring stations are being collected and stored anually.	All the data collected showed than the action carried out have had no negative impact on the riparian habitat and newt populations. To evaluate significant improvment will be necessary to continiue monitoring this area.
D7 Social and economic Impact of the project	Objectives: To obtain a report of a social and economic impact of the project. Expected results: Obtaining a methodology to measure the socio-economic impact of the project.	Indicators were defined and 6 categories of socio-economic impact have been calculated with more than twenty indicators	The LIFETM project has had an important multidimensional impact, linked to the generation of expenditure in the territory, employment, education and training and dissemination.

E Public awareness and dissemination actions			
E1 Strategy and relationship with the media	Objectives: Defining a communication strategy agreed upon by all the communication references. Expected results: Dissemination of the project through a homogeneous and consensual communication strategy	A shared criterion has been established for the communication of the LIFE Tritó Montseny project: press, web content, social networks and information material. A constant exchange of information has been achieved between the communication references of each project partner.	Homogeneous informative contents have been agreed among the partners of the project. A shared communication strategy has been developed. All the dissemination actions have included the LIFE programme logo and the Natura 2000 network logo, together with the logos of the partners.
E2 Development of corporate image	Objectives: To have a project corporate image Expected results: To create own trademark for promotion and communication purposes.	The project's visual identity was created in early 2017 with a code of three colours that symbolize the values of the Montseny newt and the conservation project for this species. With the corporate image, a well-known brand has been established, with the local residents having a certain level of knowledge about the project. The project's logo made it possible for local residents to quickly identify the actions.	The idea of using the three colour code to conceptually symbolise the essential elements of the project has been considered as very appropriate to communicate project's values. Internal resources (graphic designer) were used to complete action E2 on time. The logos for the project, for Natura 2000 and the UE, and for partners were included in all the material published. The project's corporate image achieved recognition for itself as a successful brand throughout the region, which helped bolster communicative strength for the project.
E3 Website "LIFE Tritó Montseny"	Objectives: The creation of a project-specific website as one of the main dissemination elements. Expected results: To be available and updates in Spanish, Catalan and English by the end of project	Creation of the LIFE Tritó Montseny project website in three languages: English, Spanish and Catalan. Dissemination of the project's objectives and actions in digital format. Visibility of communication products and other project resources. Constant updating of content. Registration of a high number of users and visits. Give greater visibility to the project's social networks. Creation of a quarterly newsletter. 143 news items published and 15 digital newsletters edited and sent.	The webside has disseminated the project to a large number of people. The effectiveness and acceptance of this digital environment is positively valued. The dissemination of the project has been achieved as initially proposed. The objectives set have been achieved.

E4 Social networks	Objectives: Creation of own social networks Expected results: Dissemination of new developments and audiovisual material produced	Creation of the social networks Twitter (958 followers) and YouTube (135 followers, 61 vídeos disseminated, 14.338 visualisations and 101.972 comments) channel.	It was managed to adapt appropriate dissemination channels to the project. The objectives set so far are considered to have been achieved. Positive assessment of the effectiveness and acceptance of social networks
E5 Promotional material	Objectives: Publish information brochere and 8 information panels.Expected results: To have visula material to explain the project to residents and visitors to LIC Montseny	16.500 information leaflets. 8 information panels. 280 hight quality photos. 26 pannels for photo exposition, Video 3D of *C. arnoldi*. 3.000 children's book units. 2 travelling exhibition with 6 roll ups (85 cm x 204 cm) and 6 banners (60 cm x 160cm). Blocs de notas 1.510 notebook (13,8 x 10, 3 cm). 510 magnets (7,2 cm x 7,2 cm). 510 stickers (7,2 cm x 7,2 cm) Llaveros 530 unidades (3 cm x 3 cm)	The information brochure and information panels disseminate the project in a clear and attractive design. It is a dissemination material capable of summarizing the basic content of the project.Material suitable for the general public. It has made it possible to disseminate the project in the facilities of the Montseny area, partner offices, breeding centers, schools, libraries and the Barcelona Zoo. It is a diversity of facilities that receive a high number of visits from people of different ages and typologies.The dissemination elements not foreseen in the Proposal have reinforced the dissemination of the project.The results have been visible from the initial moment of its dissemination.The effectiveness and acceptance of the promotional materials published is positively valued. It is considered that the objectives set have been achieved.
E6 Networking	Objectives**:**Establish lines of work with projects technically related to the LIFE Tritó Montseny Expected results: Share methodologies, experiences and knowledge with other conservation projects.	Networking with the LIFE projects (Clinomics, Montserrat, RedBosques, Hidrology, Freshabitat, Trivers, GoProFor, Wetfly Amphibian, Limnopirineus) Interreg projects (Be Water) and others institutions ans administations(ACA, CPF, Zoo de Chester)	The relationship with other conservation projects has been very positive. Following exchanges with other projects, working methods have been adopted, especially in abiotic and biotic monitoring. New technical criteria for riparian habitat management have been incorporated. good environmental practices to be applied in riparian habitats have been agreed upon, with colleagues from other European projects

E8 Exhibition "The Montseny Brook newt and the riparian habitat"	Objectives: Involve the local residents in the conservation of the Montseny newt. Expected results: Take the exhibition to municipalities located within and outside the park.	2 copies of the exhibition. 42 visited places, more that 22.000 visitors. Complementary activities were carried out, including school visits, or guided tours for the public and conferences. The Montseny newt mock-up is high realistic. It reinforces the exhibition's emotional impact.	This exhibition taught about the Montseny newt and most importantly, about the LIFE project among local agents and residents that visit the park or live within its limits. Local organizations' involvement with the LIFE project.
E9 Documentary Montseny Brook Newt	Objectives: Introduce the Montseny newt and its peculiarities and transmit the importance of maintaining river habitats. Expected results: 50-minute documentary, 30 copies on CD (initial proposal).	8 micro-documentaries with a total duration of 43 mins. 30 USB drives. Over 3,000 visualizations per micro-documentary	The micro-documentary format by thematic area, lasting some 5 minutes each, made a high number of visualizations possible. The 8 micro-documentaries are an additional educational resource for schools that participate in the Montseny program in classrooms.
E10 Education program in the area of the PN-RB del Montseny	Objectives: Reinforce the educational program "El Montseny a l'escola" with new materials Expected results: To consolidate the participation of the educational community as key agents for the knowledge of the park's environmental problems and their solutions.	Creation of 3 educational resources: 1) Workshop making plaster newts , 2) Publication "Infectious disease in amphibians. Handbook of good practices in outdoors educational activities" , 3) Review and update of the content in the school unit about "El cicle de l'aigua i el tritó"	These educational resources allow to expand upon knowledge about the Montseny newt and its fragility, as well as get residents involved in its conservation

E11 Barcelona Zoo Education program	Objectives: to increase the knowledge about the Montseny newt and its threats among Zoo visitors. Expected results: definition and implementation of an educational program focused on the Montseny newt, especially for being developed in the educational area of the new breeding center, as well as its inclusion in the Education department annual offer of Zoo.	The educational area is fully operational and the education program has been defined, developed and implemented properly. All the planned deliverables have been appropriately produced. The numbers of people which have enjoyed the educational program of the Montseny newt highly exceed the numbers planned initially.	Action is considered successfully achieved. The maintenance of the educational program associated with the Montseny newt is guaranteed over time, thanks to the commitment of the Barcelona Zoo to continue developing the activities programmed in it. It should be noted that the zoo's current strategic plan considers research, conservation and education actions associated with local fauna with a high degree of threat as a priority, making de facto the Montseny newt project a model for the zoo itself to follow.
E12 Good forestry practices in riparian habitat awareness and training program	Objectives: Involve local stakeholders in the conservation of riparian habitats and their biodiversity, Expected results: Agreements with owners to apply good environmental practices. Publication of a good practice manual	Inventory of bad environmental practices, in Montseny Natural Park done. Active participation in the Europarc mature forest working group. . Good forestry practices manual and Protocol of Biosecurity documents edited. Six meetings in Forest managment acomplished. Training sessions for park staff.	The good practice manual should have been agreed with forest owners and forest technicians,.but it has not been possible to schedule the last participatory meetings. During After LIFE meetings are being prepared to discuss the handbook that has been developed. The biosecurity protocol is already beeing aplied in al Montseny Parka activities.
E13 Technical and scientific conferences of the Montseny Brook Newt	Objectives: To disseminate the interests and actions of the project and the management for the conservation Expected results: To have carried out enough conferences and workshops to disseminate the LIFE Tritó Montseny	54 conferences have been held (39 in Catalonia, 12 in Europe, 2 in America and 1 in Oceania. In total, approximately 5.446 people attended. More than 6 scientific articles have been published.	Action is considered successfully achieved. The dissemination of the project at local, regional and national level has been satisfactory.

F Project management			
F1 Management and technical coordination of the project	Objectives: Monitoring of the project managementExpected results: Overcome the difficulties and achieve the objectives.	All agreements with partners have been signed. Submission of the progress report. Regular coordination meeting have been held. All technical discrepancies could be resolved.	All the partners showed a good collaboration and a great willingness providing all the information required and the results achieved by the end of the project. However, it is important to highlight that the coordination of a project such as LIFETM requires a full-time coordination team (administrative and technical) to guarantee the execution of the actions within the established time and to be able to solve unforeseen events and delays with greater efficiency.
F2 Monitoring of the breeding programme	Objectives:Breeding center coordination. Expected results: Maintain the genetic diversity of the Ex-situ population. Obtain sufficient specimens to introduction in the field	Standard protocols have been established. Genetic diversity of the population remains on target, with potential for improvement. For the western stock, breeding forecasts have been exceeded. A slight improvement in the results of the eastern population has been observed, thanks to the changes of couples carried out.Chester Zoo has joined the breeding program.	The objectives of the action have been successfully achieved. However, it would be necessary to improve the results with the eastern population. Coordination action should continue despite the end of the LIFE project, for the duration of the ex-situ conservation programme for the species.

F3 Committee of experts	Objectives: To create a multidisciplinary committee of experts as a technical and scientific advisory body. Expected results: To have an Advisory Board for the technical aspects and scientific content of the actions to be implemented and on the problems that arise.	The Committee of Experts and sub committees have been constituted, with more than 60 experts from different disciplines in all. Work methodologies have been validated and new lines of research have been established. 3 New specific subcommittees have been set up and the lines of research have been extended to this specific fields: Reintoduccions, hydrology and Riverside habitats.	The objectives have been successfully achieved. The participation and involvement of experts has been very satisfactory and new working synergies have been established.
F4. Audit	Objective: To certify that all expenditure incurred is in compliance with the Common Provisions of LIFE Expected result: To obtain approval for all accredited expenditure	Certify 100% of the amount tested by the Independent Report of Factual Findings on costs claimed under the Grant Agreement by beneficiaries for wich the total requested EU contribution is at least 750.000 euros.	An audit report on the financial statements has been carried out for the other partners to provide an independent opinion.
F5. After LIFE Plan	Objective: To plan how the LIFE actions will be continued and developed. Expectes results: To draft working guidelines for the next 5 years	After LIFE Plan are writed, 2 exchanged of land and 6 Land stewardshio agreement are foreseen and 116 actions are planned linked to habotat restoration (eemodeling of the water sustem of collection and distribution, installing rain water collection, improving ecological connectivity in streams across road and improving the riparian forest)	The administrations involved in the project have committed themselves to continue working to execute the After LIFE Plan

The synthesis of the LIFETM evaluation is presented in the table below, where we note that the expected objective has been satisfactorily achieved in 69.6% of the actions. In 26.1% there have been very significant delays which have not allowed the expected results to be fully achieved and therefore the results could have been better. Among these acceptably valued actions, there is the purchase or compensation for use(B1) which could not be fully accomplished.

Actions to improve ecological flow (C4, C5) have been very satisfactory, but not all the expected results have been achieved, because of the long delay in the drafting and administrative management of the projects. Although a great deal of work has been done in the creation of new new newt populations (C15) and many inicially unplanned results have been achieved, only 5 new locations have been created instead of the expected 6. During the project extension it has been possible to consolidate most of the long-term monitoring plots (D5, D6), but the delay in its operation has meant that the data series are not sufficient to draw objective conclusions and will have to be analysed in the After LIFE. In the collection of socio-economic indicators (D7) it has not been possible to invest sufficient human effort to obtain data for all planned indicators. Several good practice manuals (E12) have been produced but some could not be agreed with the owners and foresters. The coordination of the project (F1) has achieved the expected objectives and has been able to manage problems properly between partners and working teams, but better working dynamics could have been achieved if the coordination had been the responsibility of a technician 100% dedicated to LIFETM.

Only 2 out of 46 actions have been negatively assessed. The technical report of the Protecction Plan of *C. arnoldi* (C1) has been drafted, but legal approval is expected by the end of 2023, therefore result has not achieved. Action B2 was a success for the LIC Montseny, because the administrative process to establish land custody agreements has been opened, but the expected results, which were too optimistic, have not been achieved since was intended to achieve signed agreements with 90% of the owners.

In general, some of the actions should have been approached with less optimistic and more realistic objectives, taking into account the administrative difficulties in project management, and the time investment required to reach agreements with private landowners.

	Synthesis of the LIFE Trito Montseny evaluation
A1	Genetic avaluation of the breeding program
A2	Causes of defects in bone tissue and study of sperm quality
A3	Technical development of naturalized aquariums
A4	Information to potentially involved private owners
B1	Purchase of land or compensation of use rights
B2	Land Custody Agreements with Private Owners
C1	Montseny Brook Newt Conservation Plan
C2	Steps to include the Montseny Brook Newt in the Habitats Directive
C3	Information system and biodiversity database
C4	Remodelling of the water system of collection and distribution
C5	Installation of the collection of rainwater and greywater system
C6	Implementation of green filters of sewage in isolated houses
C7	Ecological connectivity in steams across road infrastructures
C8	Native riparian habitats and good forest practices
C9	Enlargement of the Torreferrusa breeding Centre
C10	Operation of the Torreferrusa breeding centre
C11	Expand and improve the Barcelona Zoo breeding centre
C12	Operation of the Barcelona Zoo breeding centre
C13	Extension of the Pont de Suert breeding Centre
C14	Operation of the Pont de Suert breeding centre
C15	Introduction of C.arnoldi and expansion of its distribution area
D1	Technical Monitoring of the actions in riverside habitat
D2	Monitoring populations of Montseny brook Newt (natural and reintroduced)
D3	Surveillance of infectious diseases in PN-RB Montseny amphibians
D4	Sampling of infectious diseases prior to the release Montseny Brook Newt
D5	Qualitative and quantitative hydrological monitoring
D6	Monitoring of biological impact of the interventions in the riparian habitat
D7	Social and económical Impact of the project
E1	Strategy and relationship with the media
E2	Development of corporate image
E3	Website "Life Tritó Montseny"
E4	Social networks
E5	Promotional material
E6	Networking
E7	Layman's report
E8	Exhibition "The Montseny Brook newt and the riparian habitat"
E9	Education and awareness campaign: Documentary Montseny Brook Newt
E10	Education program in the area of the PN-RB del Montseny
E11	Barcelona Zoo Education program
E12	Good forestry practices in riparian habitat awareness
E13	Technical and scientific conferences
F1	Management and technical coordination of LIFE
F2	Monitoring of the breeding programme
F3	Committee of experts
F4	Audit
F5	After Life Plan

Objective achieved. Expected results have been obtained or exceeded. Dalays did not affecte the final outcome

Objective not fully achieved or achived with significant delays and results to be improved.

Objective has not been achieved, due to long delays or for reasons beyond LIFE's control.

To the existing threats, it would be necessary to assess the SWOT (strengths, weaknesses, opportunities and threats) at the end of the LIFE Tritó Montseny, to define the actions that should be continued in the coming years.

	Species	Habitat	Stakeholders	Management
Strengths	**Successful** creation of new populations.	**Good experiences in: Restoration** of riparian habitats.	**Multidisciplinary** of decisions made.	**Writing** a management and conservation plan.
	Successful ex-situ reproduction of the species.	**Removal** of barrier structures.	**Post**-Life commitment of the administrations to continue working	**Acquired** experience.
	Significant improvement in knowledge of the biology of the species.	Catchment improvement	Dozens of stakeholders involved in the project	Availability of management and conservation plan.
		Background knowledge of the environment restauration	**Good Experiences** in Land Stewardship Agreement	Creation of the areas of supervised management
			Knowledge and involvement of Montseny inhabitants	**Great experience** in the management of the territory and natural resources
			Good results in the purchase of private land.	
Weakness	**Not enough** information is available on the biology of the species.	**Short** duration of the project in relation to the time required to observe the evolution of actions.	**Few** similar experiences in LIC Montseny.	**Slowness** of administrative procedures to act in the territory.
	Very **difficult** species to track and mark	**Not enough** knowledge of ecological processes	Only 3 land owners signed agreement	Experienced but not stable or specific staff
	Critical status of conservation of the species.	Network monitoring hydrology difficult to implement and maintain	Not experience in land swap	Limited funding and human resources
		Previous experience on successful previous similar actions very scarce		
Opportunities	**Good** knowledge of the biology and ecology of *C.arnoldi*	**Improvement of** ecological information.	**Involvement** of many administrations or entities.	**Great successful** ex-situ reproduction and introduction of the species.
	Implemented of biosecurity measures	**Involvement of** forest ecology research groups.	**Large number of entities** and landowners in favour of conservation.	Established good practices
		Introduction of good forestry practices	Great involvement of herpetologist, hydrologist, ecologist.	**Public** administration involvement. **Agreements** with landlords
		Monitoring information		
Threats	**Fragmented** population.	**Orography** complicated	**Involvement** of many administrations or entities	**Cost** of habitat management.
	Low number of individuals.	**Some** private property	**Difficult** and time-consuming interlocution with private property	**Short** duration of the Life project to continue the habitat restoration.
	Restricted distribution.	**H**uman presence.	**Ignorance** of the species and its threats.	GIS needs **constant updating and** supervision
	Illegal capture or manipulation.	**Traditional** resource exploitation.	Significant increase in human presence	Private water and timber exploitation
	Infectious **diseases**	**Reduced** distribution area.		Administrative slowness.
		Poor forestry practices.		**Land** ownership.
		Overexploitation of hydric resources.		
		Allochthonous riparian habitat.		

c. **Immediate visible results**

- Land Stewardship Agreements signed with 3 landowners who have *C. arnoldi* populations.
- Purchase of two properties of interest for the conservation of the Montseny newt.
- 377 ha of supervised management land (ZGT), with natural newt population streams, delimited and where the management objective is conservation.
- Modification of 6 water catchments with ecological water distributors and the removal of 7 illegal ones.
- Improvement of 10 water tanks, closure in storage cisterns, and infrastructure.
- Irrigation transformation in a nursery with the installation of 60.000 drippers.
- Collection of rainwater with remodelling and construction of water storage tanks.
- Improvement in wastewater treatment using lagoon techniques.
- Improvement in river connectivity with wooden, platform, stone or vaulted bridges. LIFETM removed 11 forest tracks and built 14 bridges.
- Restoration of the riverbed to its natural shape, with the elimination of roads.
- Elimination of a trekking path, that directly affected a newt population.
- Removal of 3,7 ha of conifer plantations.
- Construction of > 1000m of natural barriers to avoid erosion processes, employing bioengineering techniques.
- *Calotriton arnoldi* was included in the updated Article 17 checklists for species and habitats of Habitat Directive.
- Extension of 3 breeding centres with 120 new aquariums are now available.
- In the breeding centres, the parentage of the *C. arnoldi* population was verified in most captive genotyped individuals. The production of newts for release was tripled and a new centre set up to facilitate their growth before their release.
- Extension of *C. arnoldi* distribution area fulfilled in recent years, with the creation of 5 new populations.
- Long term meteorological and hydrological monitoring stations implemented in the distribution area of *C. arnoldi.*
- Long term monitoring program for *C. arnoldi* population and a fifteen-year data set already available.
- Geographical information system (GIS) implemented and linked to LIFETM's database.
- Website with all LIFETM information and 8 documentary films available.
- Eight big LIFETM information panels, placed in LIC Montseny.
- Publication of a good practices manual.
- Travelling exhibition on the *C. arnoldi* about its value, problematic and solutions given by the LIFETM.
- Implementation of the educational area at the breeding centre and its inclusion in the ZOOBCN educational offer.

d. **Mid-term Results**

- Sincere involvement from local owners.
- Recovery of stream flows.
- Water self-sufficiency thanks to rainwater harvesting.
- Restoration of ecological connectivity within streams.
- Control of infectious diseases in LIC Montseny.
- Restoration of the native riparian habitat.
- Increase in the production of newts from the eastern population, in the breeding centres.
- Long term viability of the newt populations created.

e. **Project amendment results achieved**

LIFETM's two-year extension has made it possible to fulfil most of the commitments that were part of the Grant Agreement LIFE15 NAT/ES/000757. The amendment has made it possible to successfully implement 9 delayed actions:

- B1 Purchase of land or compensation for rights of use.
- B2 Implementation of "Land Custody" agreements with private owners.
- C1 Montseny Brook Newt Conservation Plan.
- C4 Remodelling of the water system for collection and distribution.
- C5 Installation of the rainwater collection and greywater systems.
- C7 Ecological connectivity in steams that cross road infrastructures.
- C8 Improvement of native riparian habitats and forest practices.
- C15 Introduction of the Montseny Brook Newt and expansion of its distribution area.
- D5 Qualitative and quantitative hydrological monitoring.

And the other 16 actions dependent on the delayed ones (A4, C3, D1, D2, D6, D7, E1, E3, E4, E6, E7, E13, F1, F3, F4, F5). (See *more information in the Extension request LIFE Tritó Montseny dated 15 July 2020 (Ref. ARES(2020)3756165) (LIFE15 NAT/ES/000757*).

f. **Results of the replication efforts**

In the LIC Montseny and outside the area of *C. arnoldi*, natural park technicians are advising the construction of bridges, when road repairs are requested. Two works have already been carried out replicating the C7 action.

Two new breeding and fattening centres have been created (Chester ZOO and Calafell), replicating the three existing ones.

The methodology we used to sample the natural populations of Montseny Brook newt is applicable to other species living in similar habitats throughout the EU depending on how its ecology resembles our species. However, the bioindicators we used may be applied to quantify and analyse objectively the conservation of other species that live in streams.

The structure and contents of the Montseny newt Recovery Plan can be used as an example in the drafting of other plans for protected species.

The biosafety protocol has been transferred to different entities and is being used as reference document for activities in the environment.

The Land custody agreement model will be applied to farms beyond the newt's range and even beyond the Montseny.

The participatory processes developed during LIFETM are being replicated in other management areas and with different groups (such as in hunting management).

The committee of hydrologists created during the project is still active and is currently working on the development of a project that will cover the entire area of the Biosphere Reserve, based on the information gathered during LIFETM.

A non-invasive method has been developed to obtain newt droppings and thus learn about their diet, which is applicable to other amphibians.

g. **Effectiveness of the dissemination activities**

LIFETM's dissemination activities have been the extremely successful, in particular

- E1-Strategy and relationship with the media.
- E3 Website "LIFE Tritó Montseny".
- E8 Exhibition "The Montseny Brook newt and the riparian habitat".
- E9 Education and awareness campaign: Montseny Brook Newt Documentary.
- E11 Barcelona ZOOBCN Education program.
- E13 Technical and scientific conferences on the Montseny Brook Newt.

The dissemination activities related to the monitoring of Montseny Brook newt populations have been, to date, limited to summarising the yearly results within the overall LIFE project at conferences, talks, and in a publication of the journal "Land". After the project's completion we want to publish a scientific paper in a SCI journal specifically analysing the results with regard to the monitoring of natural populations.

These actions have ensured that all Montseny inhabitants are aware of the existence of an amphibian unique in the world and it is now considered a LIC Montseny trademark.

Montseny visitors and inhabitants of the surrounding areas, including the city of Barcelona, and especially the student and university population, know *C. arnoldi*, and there is a constant demand for students requesting information for their final degree project. These actions are getting the local inhabitants and Montseny visitors to value the riparian forest and its great ecological function.

h. **Policy impact**

The law makes it compulsory to respect an ecological flow (MAH/2465/2006, Act 1/2017) but this is not respected in the majority of water concessions. The methods applied in LIFETM are a good example to be incorporated legally.

The enforcement of environmental laws has facilitated, or sometimes forced, the signing of agreements with private owners (B2). These laws are one of the best arguments to promote and facilitate the signing of Land Stewardship Agreements.

The main obstacle has been the lengthy administrative process needed to contract the works or external services, motivated in part by the new Act 9/2017, with regard to Public Sector Contracts, and due to the slowness in obtaining the municipal permits to carry out the works. This was one of the main reasons for extending the LIFETM.

Actions C4, C5, C7 and C8 directly contribute to the implementation of Habitat Directive (Obj.1), improving the conservation status of priority habitats, linked to the aquatic environment, ensuring efficient management of LIC Montseny (ES5110001) and promoting the implementation of good practices. These actions also contribute to fighting biodiversity loss

(Obj.6) and reducing indirect causes linked to the consumption of natural resources, such as water.

i. **Results linked to Grant Agreement Form B3 and B1**

The reduction of water catchments in streams and encouraging rainwater use are climate change adaptation measures, particularly in Mediterranean environments where water availability is expected to decrease. The restoration of native riparian environments will increase resilience and adaptation to a possible rise in temperature, while also benefiting the biodiversity and ecological processes of the Mediterranean ecosystem.
The effects of climate change (such as rising temperatures and decreasing water resources) could worsen the Montseny brook newt's current conservation status. The critical state of its few small populations, low dispersion capacity and dependence on pristine riparian habitats, requires to improve the connectivity between different newt groups in the same stream. The process of habitat restoration has increased the likelihood that isolated groups can link up and thus reduce the threat of the inbreeding.

6.4 Analysis of benefits

1. Environmental benefits

a. **Direct / quantitative environmental**

To apply **protection measures** to 23% of the surface area of private estates throug the signing of three land stewardship agreements (65 ha), the purchase of two estates (90 ha) of high ecological value and the stablishment of supervised management areas (65 ha) along river courses and whose purpose is to preserve the riparian habitat.

Direct benefits **to newt individuals** with the expansion and management of five breeding centres. The availability of more than 1,723 specimens for their potential release. Creation and reinforcement of five new locations with Montseny newt, and the release of more than 2,000 specimens of Montseny newt into optimal streams and annual monitoring of their evolution.

The benefits linked to **riverside habitat** and **water** have been the elimination of seven water catchments from streams. The installation of one water distribution box at the stream's bypass point with the aim of ensuring an ecological flow. The adaptation of four water accumulation tanks with self-closing systems when the tank is full. The development
of rainwater collection. Storage systems in three farms and the installation of a lagoon system for wastewater treatment. Elimination of nine exotic tree plantations in order to increase water contribution to the streams.

Linked to vegetation, benefits have been the restoration of streams' tree cover with native species such as alder, ash, hazelnut and elderberry. The construction of more than 1,000 m of terraces and palisades by implementing bioengineering techniques to reduction the erosion.

Linked to river **connectivity**, to restore the natural watercourse, through the elimination of 11 extraction tracks and the construction of different types of bridges (5 made of filter stone, 3 made of vaulted stone, 6 platform bridges and 1 wood one).

Research related, benefits has been the Creation of 3 scientific committees with regard to the newt's biology, breeding centres, new populations and the hydrological dynamics of the

Montseny massif. The installation of 9 stations to measure water flow and integration of 5 meteorological stations. Monitoring of newt populations in nature, with more than 70 field campaigns and almost 700 observations.

Direct environmental benefits related to **environmental outreach and education** have been the creation of a new educational facility at the Barcelona Zoo that has received almost 500,000 visitors since its inception.

13,800 schoolchildren have been able to participate in the educational activities related to the Montseny newt. The exhibition *"My name is Calotriton and I only live in Montseny"* travelled to 42 municipalities and has been visited by over 21,000 people since the beginning of the project. The program *"El Montseny a l'escola"* has disseminated the Montseny newt to 2.795 schoolchildren.

Dissemination of the project in 54 workshops reaching a total of 5,446 attendees. The 8 audiovisual capsules produced to disseminate the project's actions have received very good feedback and almost 30,000 views. Carrying out workshops to make plastser newts, where 613 people have taken part.

b. **Qualitative environmental benefits**

Improves water quality and quantity into Natura 2000 habitats, in application of the Water Framework Directive (2000/0/EC) and transposed into Spain (Law 62/2003).

Protection and improvement of the state of conservation of riverside habitat (alders, and laurels (44.128+; 44.316+; 44.3431+; 44.3432+; 44.515+),elms and ash (44.62; 44.637+). The habitat type codes are from CORINE classification, that is a hierarchical classification system that groups habitats into groups and subgroups with similar characteristics. It is the most used habitat classification system in the European Union is the one based on the CORINE Biotopes project. The entire Montseny is mapped on a 1:10.000 scale, and the Tordera river basins on a 1:5.000 scale.

River habitat restoration (C4, C5, C7, C8) directly benefits species and habitat of conservation concern and priority under the Directive 92/43 CEE. The conservation of certain species such as *C. arnoldi*, totally dependent on the riverside habitat.

The **involvement of forest owners** to change the way they exploit their natural resources and increase the environmental sustainability of their lands. The implication of private property owners has promoted the application of good environmental practices on private lands, and will set an example for other social actors at LIC Montseny, to take advantage of natural resources (such as water or wood) in a sustainable and biodiversity-friendly way

To improve the **conservation status** of the Montseny brook newt (*Calotriton arnoldi*), an endemic amphibian classified as 'critically endangered' by the IUCN.

Drafting and approval (next months) of the **Plan for the Recovery of the Montseny Newt** and its approval in the After LIFE (2023).

The **inclusion of *C. arnoldi* in the Catalogue of threatened autochthonous wildlife,** Annex I "in danger of extinction" (DECREE 172/2022, of September 20, of the Catalogue of threatened autochthonous wildlife and measures for the protection and conservation of protected native wildlife).

The benefits for the conservation of the Montseny newt achieved through the **breeding program** (C9, C10, C11, C12, C13, C15, F1) are considered to be of high importance in the conservation strategy of this species. The increasing number of newts born ex situ, thanks to the breeding programme, is and will be a key factor to increase the effectiveness of the

conservation strategy and will make it possible to have more specimens available to periodically reinforce the in situ populations. The number of optimal aquariums dedicated to the *ex situ* breeding programme is a key factor to increase the effectiveness of this part of the conservation strategy.

The **good practices handbook** and the revision of the teaching unit (E10) make it possible to divulge and apply preventive measures against the transmission of infectious diseases in amphibians during field trips in educational and school activities.

The **educational programme** focused on the Montseny newt that is being developed by the Barcelona ZOOBCN should be considered as a benefit for the conservation of the species, as it allows to learn about a highly endangered species that is difficult to observe in the wild.

The **involvement of researchers, technical specialists and administrations** has considerably increased the knowledge on the species and its habitat, the problems associated with it and has provided possible solutions to address them.

The **installation of tertiary/Green filter treatments** (C6) will continue to be promoted in the LIC Montseny's domain, involving landowners in improving their wastewater treatment facilities.

The **improvement of catchments or their elimination and rainwater harvesting** (C4, C5) improve the flow of streams. These actions will continue to be promoted in LIC Montseny with the implication of the ACA, especially in the newt's real and potential distribution area. These actions will allow for a better adaptation to the effects of climate change.

Barriers to river connectivity have been removed (C7), but there are still many trails where the stream bed restoration is yet to be carried out. With the Land Stewardship Agreement (B2), connectivity must continue to be restored, especially within the newt's home range.

The **elimination of forest plantations** and their natural replacement by indigenous species (C8), will benefit biodiversity and increase stream flow. For this reason, this good forestry practice will continue to be promoted (E12) by getting forest owners involved (B2).

The **control of emerging infectious diseases** (D3, D4), the good practices handbook edition (E10) and the implementation of biosecurity protocols (E12) , make it possible to divulge and apply preventive measures to avoid the transmission of infectious diseases in amphibians during field work and trips by professionals, while doing research and in school activities. Thus, they must be maintained.

The **breeding program** (C10, C12, C14, F2), and EAZA's Conservation Planning Specialist Group (F2) is an ideal example of a "One Plan Approach"(by IUCN) which integrates in situ and ex situ management strategies. Furthermore, the maintenance of the ex situ reproduction program associated with the Montseny newt is guaranteed over time, thanks to the commitment by the Barcelona ZOOBCN and GENCAT to continue developing the activities programmed in it. It should be noted that the ZOOBCN's current strategic plan considers research, conservation and education actions associated with local fauna with a high threat level as an absolute priority, making, de facto, the Montseny newt project a model for the ZOOBCN itself to follow.

The maintenance of the **educational program** associated with the Montseny newt is guaranteed over time, thanks to the commitment by ZOOBCN to continue developing the activities programmed in it. It should be noted that the ZOOBCN's current strategic plan considers research, conservation and education actions associated with local fauna with a high threat level as an absolute priority, making, *de facto,* the Montseny newt project a model for the ZOOBCN itself to follow.

Answering the question: *How do you plan to continue and to develop the actions that were initiated in the LIFE project*?

LIFETM actions will continue because the administration has the legal obligation to protect species and habitats in ZEC-Montseny. LIFETM has not eliminated all the defined threats in the Grant Agreement, and therefore some actions should be carried out. It will be financed, mainly, by the Natural Park and Montseny Biosphere Reserve's budget (LIC Montseny), through Diba, and the Generalitat de Catalunya.

2. Economic benefits

River habitat restoration (C4, C5, C6, C7, C8) has favored local enterprises that implement good environmental practices, promote the training of qualified staff members and prioritise the use of local and recyclable raw materials.

Research and monitoring programmes (D1, D2, D5, D6), have encouraged the implementation of projects, that require specialised staff and the participation of trainee researchers.

The application of good practices (E12) have encoura the specialisation of local workers and companies in the restoration of natural habitats, which are essential projects for climate change adaptation.

The development of the scheduled tasks for the development of the ex situ reproduction tasks (C10, C12, C14) entailed a dedication of new jobs which were equivalent to 1.5 FTE, throughout the year (see financial report). The continuity of breeding efforts in both breeding facilities is completely ensured by the commitment by the ZOOBCN and GENCAT to maintain this activity (and associated staff) in the long term.

The development of the scheduled tasks for the conceptual creation and latter implementation of the educational program (E11) entailed a dedication of 1.4 FTE by qualified staff, throughout the project (see financial report). In addition, 0.6 FTE of non-qualified staff (security person) was hired to protect the elements exhibited in the educational area of the new facility, during its opening hours. The commitment by ZOOBCN to maintain this activity in the long term means that these job positions will be also maintained.

3. Social benefits

The co-financing for habitat restoration (C4, C5, C8) between private owners and LIC Montseny will promote the implementation of projects by local companies that have staff who are specialized in nature restoration. They will, therefore, have a positive impact on the local economy.

The positive social effect of the website and social networks on the whole population, lies in increasing environmental awareness, in knowledge of the species and in respect for the conservation of its natural habitat.

The creation of new jobs linked to breeding program (C10, C12, C14, D2, D5) that will be maintained in the future should be considered as social benefits generated by the project.

Educational actions (E8, E9, E10, E11) are helping to raise awareness on *C. arnoldi* and its habitat, and to spread the results of the actions from LIFETM carried out during the project among local residents, visitors, and those who have an interest in the subject of nature, through social media (E3, E4).

The social benefits in terms of education primarily focus on its ability to transfer knowledge on *C. arnoldi* and its threats in a language that is accessible to the public, both adults and children, and therefore to influence people about the need for its conservation. The education actions have made it possible to reinforce and expand the teaching resources available for primary schools on the *C. arnoldi* and the river habitat, so that students can gain a greater understanding and become more involved in the conservation of this species and in the protection of nature in general. The commitment by LIC Montseny and ZOOBCN to maintain this activity in the long-term means that these social benefits are also long-term. Additionally, the creation of new jobs that will be maintained in the future should also be considered as social benefits generated by the project.

The conservation of the natural heritage, encouraged by LIFETM, promotes the well-being of the residents and ZEC-Montseny visitors alike

The co-responsibility (between different social, institutional and professional sectors and between private and public entities) employed in LIFETM, promotes the coming together of interests and synergies, and therefore improves the social benefits in the mid and long-term.

4. Replicability, transferability, cooperation

LIFETM has a high degree of replicability, transferability and cooperation.

The LIFETM project has become an example to be followed to optimise economic resources and provide a global vision of the conservation plan for a highly threatened species (as a One Plan Approach by IUCN). As it is a joint action, this project has fostered relations between the stakeholders involved (Administrations, NGOs, Universities, ZOOBCN logical entities, private land owners, etc.), which is not always easy, but when it works, it is highly effective. Therefore, this could be considered as program that could be exported to any other endangered species. This example could be of especial interest for other ZOOBCNs and aquariums to increasingly open up their collections, facilities and expertise in captive breeding, to be used in integrated conservation projects through the "One Plan Approach".

The results obtained could be beneficial for other European projects related to objectives such as the sustainable use of water in Mediterranean environments, the management and conservation of riparian rheophile streams, or the captive breeding of amphibians.

The construction of green filters (C6) and the use of rainwater (C5) is economically and environmentally efficient. It will therefore be replicated across the LIC Montseny domain as well as in all protected natural spaces ((> 100.00 ha) that are managed by the DIBA.

The ecological water distributor installed in catchments (C4) respecting an ecological flow rate, has been designed and installed by LIFETM. It's a prototype that is giving good results, which could be implemented throughout the LIC Montseny and replicate this experience in the Mediterranean mountains with similar problems such as a lack of flow in stream

A characteristic of the information disseminated through the website and social media (E3, E4) is the high dissemination speed, in digital format compatible with current and individual mobile phone use. It's an instantaneous, current and borderless dissemination.

Promotional material (E5) is important for the dissemination of a project. Its design and technical content give the project visibility at many levels. The location of the informative panels in different parts of the territory contributes to the dissemination of the conservation of the natural heritage.

The exhibition about the *C. arnoldi* (E8) has increased the number of people aware of the vulnerability of the species and who could play a role in the future in the conservation of the

species and preservation of nature in other projects. The education program (E10, E11) expands the teaching resources available and the gypsum newt workshop is also a resource designed for families that are not only locals, but those visiting the park. Apart from this, this workshop is replicated in the Breeding Centre in Pont de Suert (Alta Ribagorça).

The link between LIFETM and existing educational programs (as M*ontseny and l'escola* or Zoo Barcelona) will allow for the dissemination of scientific knowledge and the application of management techniques to the local and higher-education world.

The educational programme (E11) can be adapted to any other endangered species, becoming a model for generating and disseminating knowledge about them. This is especially interesting for other ZOOBCNs and aquariums, and in fact, the educational program developed in this action has already been presented in different national and European forums, with great acceptance. As an example, Chester ZOO (UK), which keeps Montseny newts and is part of the network of breeding centres for the species, is already using some of the materials created during this action.

The experience acquired in the release methods applied (C15) could also be used in other endangered species reinforcement projects.

The development of the EZA Best Practice Guidelines for *C. arnoldi* (F2) may be useful as a reference guide for future conservation programmes for other similar species that may require ex-situ conservation programs in the future.

The Montseny brook newt has been chosen as a focal species for amphibians in an international workshop on group population management organised by IUCN (F2). Participation in the Workshop on Group-based Ex-situ Population Management, with the selection of the Montseny brook newt as one of the focal species, will be of valuable interest for the management of studbooks in other amphibian species that also require group breeding strategies.

The Manual of Montseny Brook Newt Breeding is currently in the process of being adapted to the EAZA Best Practice Guideline. as well as a reference for breeding projects with other similar species that may require it in the future.

Chester ZOO, as a partner in the captive breeding programme has been performing clinical assessment, treatment of ill animals and disease investigations on the newts that are part of their stock whenever necessary. As result of this continuous work, one case of mycobacteriosis was diagnosed in an ill captive newt. Extended studies in their stock did not detect any other suspicious cases.

To increase the knowledge on the emerging pathogen *Batrachochytrium salamandrivorans* and considering the threat of having a confirmed outbreak of this disease in amphibians in a nearby location a group of captive Montseny brook newts was donated to Ghent University for an experimental infection trial (D4).

The diversity of technicians, operators, educators, scientists, and private and public managers involved in LIFETM, guarantees the dissemination and transfer of results and experience in national and international technical forums.

5. Best Practice lessons

The preliminary assessment of the planned actions, their integration into an information system (C3) and analysing the information together, has allowed us to be efficient and to prioritise the actions that need to be implemented in order to have a greater impact

The re-use of abandoned or under-used water tanks (C5) and the use of local and natural materials (action C8), has reduced the supply of building materials (cement, machinery, gasoil…) which has minimised the environmental impact of the works.

Restoring connectivity (C7) recovering the stream's original orography is very favourable for aquatic fauna, but it's also recommended to promote hydrological dynamics of mountain streams.

The handbook "*Infectious disease in amphibians. Handbook of good practices in educational discovery activities*" (E10) is an innovative publication in Catalonia, considering the fact that there has never been an educational document for environmental education organizations and schools that listed preventive measures and sanitation techniques that must be used in field work. The goal is for them to not only be available for schools around the park, but also for the rest of schools throughout Catalonia. This is why we sent copies to schools in different parts of Catalonia and also to the Environmental Education Service, part of the Directorate General for Environmental Policy at the GENCAT. The implementation of environmental biosecurity measures (E10, E12) so as to prevent the transmission of emerging diseases among LIC Montseny's fauna and flora, has been a good practice learned. To disseminate knowledge of the species and explain the reason for its poor conservation status (E8, E9, E10) leads to learning good environmental practices when visiting natural areas.

The exhibition of LIFETM (E8) includes a section with suggestions and steps that every person can take in their daily lives. These tips and good practices can help lead people, either individually or as a group, to perform actions for the conservation of the species. This exhibition has travelled to all the municipalities in the park. In order to coordinate the tour, it was essential to work closely with local governments. This implication in the exhibition, in the guided tours, and in conferences could mean that in future conservation projects, local governments are seen as a solid alliance.

The real coordination of all the breeding centres achieved thanks to LIFETM (F2) could be considered a key factor, especially to share improvements in management protocols, overcome recurring problems and optimise the ex situ reproduction of the species. The breeding aquaria were designed by following a common model for the three newt breeding centres involved in the project. This innovative design has proven to be successful (Action C9, C11, C13), and can therefore be considered as an example of Good Practice in captive amphibian breeding.

Good Practice Guidelines in forest activities, in management of river habitats (E12), in management of new populations (C15) or in management of breeding population (F2), have been documented, which establishes the management protocols for the habitat and for the specie in captivity. All of them give recommendations for wildlife managers in protected areas and private forest owners.

6. Innovation and demonstration value

The land stewardship agreements (B2) are a very good tool, perhaps the best, to implement good environmental practices on private **farms**, to involve private owners, to improve the

relationship between the administration and the public, and to demonstrate that synergies and consensus must be established in the management of natural resources.

Actions taken to restore the riparian habitat (C4, C5, C6, C7, C8) , which in most cases are also to adapt to the effects of climate change, are a good demonstration of how to promote land stewardship agreements (action B2) and to disseminate their benefits to all owners and visitors to the LIC Montseny. They are also a good demonstrative example in the application of good environmental practices ant its positive effect on the conservation of the biodiversity of Mediterranean rheophilic habitats. Once the effectiveness of these actions has been assessed (in the After LIFE), it will be demonstrated that these actions improve ecological sustainability exploitation of natural resources such as water or timber, and that rainwater storage is a good measure when facing the consequences of climate change (especially in LIC Montseny where, until now, no house has water storage tanks).

The ecological water distributor installed in catchments (C4) and which respect an ecological flow rate, has been designed and installed by the LIFETM. It's a prototype that is providing good results, which could be implemented throughout the LIC Montseny and replicate this experience in the Mediterranean mountains with similar problems such as a lack of flow in streams.

Many of the methods applied in LIFETM actions have a high demonstrative value (C4, C8). At the national level, they are innovative or reinforce some previous pilot actions that have already been carried out, linked to the working groups at the Europarc-Spain Federation, where its effectiveness should be disseminated in order to replicate it throughout Spain.

The large number of people and institutions that have been joining the LIFETM project (F3), ensures its demonstrative nature, because the methodologies will be incorporated by the participants in their future projects. If the results are positive, the same methodology will be applied or further refined. If the results have been negative, it's also of high demonstrative value, because it will allow the methodology to be corrected and to find solutions to the problems and mistakes made during the project.

The efficiency of aquarium models (C11, C9, C13) made ad hoc for captive breeding of newts has been demonstrated, optimising space, energy and resources. It should be noted that ZOOBCN's current strategic plan considers research, conservation and education actions associated with local fauna with a high degree of threat as a priority, making, *de facto,* the Montseny newt project a model for the ZOOBCN itself to follow.

The genetic tools used (A1) have proven their effectiveness in studbook management and are of great importance in the conservation of genetic diversity in ex-situ conservation. The research carried out in the breeding centres (A2, A3) is innovative in amphibian conservation programs. Their contributions are very useful in improving this species and other amphibian husbandry protocols. Breeding protocols for species with biological characteristics such as the Montseny newt are not well defined. The research carried out in these actions has been very significant and even so, there are many things that have not been sufficiently clarified. Many of the data obtained in the captive breeding programme will be useful for the knowledge of the species in its natural environment, given the difficulty of studying this species in the wild.

Active participation in an international workshop on group population management organised by IUCN is ongoing. The Montseny brook newt has been chosen as a focal species for amphibians in this workshop.

One of the great challenges facing the ZOOBCN is to reach out to all actors with the capacity to generate an impact on conservation, to inform and inspire them in the conservation of

species, thus meeting the social expectations of ethics, transparency and responsibility expected of public servants. The products through which this transmission of knowledge to the general public takes place must have an important emotional component, but at the same time maintain the values of elegance, rigour and being avant-garde that are linked to science and conservation efforts. Action E11 action was conceived "only" as an educational programme, but it has ended up being an educational programme developed in a real interpretation centre of the Montseny newt.

7. Policy implications

LIFETM contributes towards the development and implementation of EU policy and legislation in the area of nature and biodiversity, and more particularly, to the objectives of the EU Strategy on Biodiversity 2020. It focuses on the maintenance and restoration of ecosystems and ecosystem services. It improves the conservation status of the riparian ecosystems, especially with regard to environmental flow and Water Framework Directive objectives. It contributes to the establishment of priorities for ecosystem restoration services and to preventing the loss of ecosystems and their services.

The project ensures effective management of ZEC-Montseny (cod.ES5110001) and promotes the use of best practices linked to natural resources (especially water and forest products). It completes the implementation of the Natura 2000 network, as it developed the *C. arnoldi* Recovery Plan. It will improve forest management plans and promote mechanisms to involve private owners. Finally, it promotes measures against biodiversity loss, addressing those causes linked to natural resource consumption, such as the reduction of water extraction and its link to the Montseny brook newt's critical status.

The project helps to apply the Habitats Directive, as it is aimed at improving the priority habitat conservation status, that is, those habitats linked to the aquatic environment (alder, laurel and ash groves, and vegetation near springs, wetlands, ponds and underwater).

LIFETM promote good forestry practices, especially in the *C. arnoldi* distribution basins and in general in the entire ZEC-Montseny (cod.ES5110001), thanks to the commitment of the Forest Property Centre to collaborate in the conservation of the biodiversity of riverside habitats.

The forestry legislation should incorporate the obligation to restore riparian habitats in particular because they are HICs and for their biodiversity conservation value. It should be prohibiting the plantation of exotic species in the river environment, due to its effect on flow reduction and distortion of ecological processes.

The construction of green filters (action C6) or the removal or modification of water catchments (C4) are examples that have benefited from certain environmental laws, and have strengthened them so that they can be applied without delay throughout Catalonia.

At the After LIFE stage, a dissemination campaign should be started, with the technical and ranger teams at LIC Montseny, to inform the owners of the law that obliges them to improve the quality of their discharges and forces them to respect ecological flows. Legal action should be considered against those landowners who refuse to comply with the rules laid down by law.

The contract law and all the permits required from different administrations, is an important bottleneck for the processing of the projects and for their implementation. It would be advisable to establish some kind of regulation to speed up the processing of environmental

projects, guaranteed by public administrations, that could be implemented in a few months once drafted.

The sectoral and local legislation should incorporate the restoration of ecological connectivity in watercourses, once LIFETM has demonstrated its effectiveness on the hydrological dynamics of streams, which is entirely beneficial to aquatic fauna such as *C. arnoldi*.

European restrictions on the transport of amphibians to reduce the impact of infectious diseases as Bsal have caused problems with the transfer of specimens between the breeding centres of the EEP. We are awaiting a decision by the European Union on whether it will relax these restrictions in the case of transactions between centres participating in conservation programmes in enclosed facilities with guarantees of implementation of appropriate biosecurity measures. This move has now been further complicated by Brexit.

The methodology applied in the LIFETM to provide data on the water levels of mountain streams and the values that have already been calculated are of great interest for the enforcement of environmental legislation (MAH/2465/2006, Act 1/2017) to respect minimum ecological flows, and are contributing to the application of the Water Framework Directive (D. 2000/60/CE).

7. **Key Project-level Indicators**

The final actual values of the KPIs for this project have been updated in the online KPI database (https://webgate.ec.europa.eu/eproposalWeb/kpi). There are significant deviations from the targets set initially and most of the final KPIs updated with the final report have been modified from the initial ones in order to meet the criteria of the databse. An analytical comparison with the targets defined at the beginning of the project is has not been possible due to the modificatons already comented.

At the end, 36 KPI have been successful updated. Although the indicators do not reflect the totality of the actions carried out during the project, the specific results for this KSIs show a good evolution of the evaluated parameters.

In general, the trend has been positive. It has been possible to carry out conservation actions throughout the affected area. People influenced by the project, in several ways has exceeded our expectations in all value inidcators. The partnership with Barcelona ZOO increased tremendously the capacity to reach out general public, and the educational programs and workshops favoured the local residents. We considered this a great success.

In addition, the involvement of serveral administrations and stakeholders involves show great interest in the project, and we expect to grow or at least maintain this interest during the next years to continu working together, and improving the conservation status of the *C.arnoldi*.

Articles published in the media, including informative, technical and scientific articles published in specialized journals, media products, displayed information, website, have better results than expected inicially, and shown a greate interest in the project (more than 200 in print media, 80 in audiovisial media).

Considering the indicators representing the actions carried out in the natural habitats, although the results show a positive trend, the numbers could be better, and probably we were probably overly optimistic about the expected results, especially considering the difficulties experienced during the project, mainly with the management of private properties and the administration's capacity to execute construction projects. Even so, we have managed to act in critical areas for the protection of this species and its habitat and have established the basis for continuing conservation actions, reducing water extractions from critical streams, protecting riverside habitats, and improving connectivity between diferent newt locations.

Several indicators have been very difficult to incorporate into the database. Some of them because they do not have the necessary information in the established units, as in the case of the amount of water not extracted, since there is no initial information on the extractions from the system, but there is information on the amount of water saved as a result of the actions carried out. In other cases, such as the operation of the breeding centers, there is no specific indicator to evaluate it. In this last case, we consider necessary to evaluate it, since, as the reports of the experts in the field indicate, the survival of this species in the current situation is directly linked to the success of ex situ breeding, and the capacity of release new individuals.

To conclude, we shoud considered the negative trend presented by the specific indicators of the species. Despite all our efforts, this species, due to its range of distribution and population estimates, both very low, remains, and will remain for a long time, as critically endangered and the trend calculated up to now is not very optimistic. Even so, it is our obligation to continue making all possible efforts to improve its state of conservation.

8. Comments on the financial report

Summary of costs incurred
This report details the costs incurred by each partner in each action of the project, the contracting method, the amount contracted and a justification of any deviations from the proposal if necessary.

Accounting system information and relevant issues of the Partnership Agreements
Each partner has recorded the accounting transactions using accounting systems that allow to identify which costs are related to the project. Moreover, the approval of the extension meant that the agreements with the partners were signed again with the new ending date of the project 31/12/2022. (See Annexes AF0 Addenda agreements attached)

Allocation of costs per action

All partners have detailed in the financial report the action to which each of the declared expenses corresponds and in many cases the action code has also been reflected on the invoice. In addition, for personnel costs, the actions have also been detailed in the timesheets. Except for staff working for the LIFE project less than 2 full days per month on average within a calendar year as they are exempted from the time registration obligation for that year.

8.1. Summary of costs incurred

Budget breakdown categories	Budgeted costs in €	Costs incurred from the start date to 31/12/2022 in €	% of Budget
1. Personnel	1.034.899,00 €	1.440.190,34 €	139,16%
2. Travel and subsistence	26.279,00 €	1.067,76 €	4,06%
3. External assistance	988.411,00 €	779.968,59 €	78,91%
4. Durable goods			
Infrastructure	401.203,00 €	525.164,75 €	130,90%
Equipment	178.184,00 €	178.059,20 €	99,93%
Prototype	52.960,00 €	0,00 €	0,00%
5. Land purchase / long-term lease	150.002,00 €	190.000,00 €	126,66%
6. Consumables	73.538,00 €	71.208,11 €	96,83%
7. Other Costs	54.200,00 €	52.275,25 €	96,45%
8. Overheads	11.600,00 €	11.752,00 €	101,31%
TOTAL	**2.971.276,00 €**	**3.249.686,00 €**	**109,37%**

Table 1.1 Project costs incurred by 31/12/2022
There are no deviations of more than 20% (cf. Article II.22 of the General Conditions).

8.2. Accounting system

As explained in previous reports, to facilitate the traceability of accounting operations, a special code has been registered in the accounting system for each partner. (except for GENCAT staff costs)

	DIBA	ZOO	FC	DIGI	GENCAT
Accounting system codes	1723B	622231	4020-3B	CODI2017/3/MA/2	none

A screen print is provided showing the codes reflected in each partner's accounting system. See Annexes AF1, AF2, AF3 and AF4.

Regarding the inclusion of the "project acronym" and the "project number" on all invoices, this has been done in a regular basis, except in specific cases which have been rectified by applying the "project stamp".

Invoices, contract documents, accounting documents, payment receipts, lists of tenders submitted, etc. have been archived and reviewed periodically. Before the Covid-19 pandemic, these documents were printed out by the coordinating partner and physically filed in folders in an archive located in the Directorate of Natural Areas. After the pandemic the archiving system was changed to electronic mode and finally all documentation has been grouped in a corporate OneDrive of the DIBA.

8.3. Partnership agreements

The Partnership Agreements govern the relationship between the Coordinating and Associated Beneficiaries, and each of the parties' obligations. For this reason, after the approval of the two-year extension, these agreements had to be amended.

Financial information: The coordinating beneficiary has periodically requested financial information from the partner beneficiaries in meetings or by email. In most cases the partner beneficiaries have provided the information via Dropbox and in case of exceeding the storage capacity via WeTransfer.

The coordinating beneficiary has carried out financial monitoring and periodically reviewed the costs declared by each partner. The final financial information has been grouped in the Coordinated Financial Report which is attached to the report as Annex AF5 Excel Consolidated Financial Report and Annex AF6 Signed Consolidated Financial Report.

The partners have made their financial reports following the indications of DIBA, NEEMO, the "Financial and Administrative Guidelines" and the Specific Conditions set out in the "Grant Agreement".

In addition, although it was not mandatory, the coordinating partner DIBA contracted, for internal purposes, an external review of the expenditure declared by the partners, which was carried out during 2021. It should be noted that 100% of the partners declared amount has been considered eligible by the Auditor and no exceptions have been noted.

At the beginning of 2023 DIBA obtained the certificate on the financial statements and the approval of 100% of the amount tested by the Independent Report of Factual Findings. Both reports are attached "AF14 Partners Financial Audit" and "AF7 Certificate on the financial statement".

The financial statements of each partner have been electronically signed by means of a valid and legal electronic signature in accordance with the Public Sector Legal Regime Act. See Annexes AF8 DIBA Excel Financial Report, AF9 FC Excel Financial Report, AF10 ZOO Excel Financial Report, AF11 DIGI Excel Financial Report, AF12 GENE Excel Financial Report.

Payments: The following table shows the financial transactions that have taken place so far, corresponding to the first (30%) and second (40%) pre-financing payment from the European Commission (1.247.935,12 EUR), according to the contributions established in the Partnership Agreements for each associated beneficiary and for the coordinating beneficiary.

Beneficiary name	Total Proposal Costs	Union Contribution	First and Second Pre-Financing payment
Diputació de Barcelona	1.771.411,00 €	1.046.801,04 €	743.991,80 €
Forestal Catalana	737.562,00 €	469.537,00 €	309.775,98 €
Zoo de Barcelona	408.348,00 €	234.645,51 €	171.505,92 €
Diputació de Girona	50.635,00 €	30.381,00 €	21.266,70 €
Generalitat de Cataluña	3.320,00 €	1.399,45 €	1.394,40 €
Total	**2.971.276,00 €**	**1.782.764 €**	**1.247.934,80 €**

In relation to the budget of the A3 action foreseen in the proposal for the DIBA partner, the FC partner was finally in charge of the technical development of the naturalised aquariums. As explained in previous reports, FC saw the possibility of speeding up the contracting process since they already had the aquariums. This aspect was consulted with our NEEMO monitor who indicated that it should be explained in the monitoring reports. See Annex AF13 Budget shift action A3 justification.

Partner	Description	Proposal Costs
DIBA	**I + D MIMESIS UNIDAD DE CONTROL**	**35.000,00 €**
DIBA	**WEB MIMESIS**	**7.500,00 €**
DIBA	**ESPECTRÓMETRO**	**2.500,00 €**
FC	2 ACUARIOS NATURALIZADOS	7.960,00 €
Total		**52.960,00 €**

This change means that the budget of 45,000 euros would have to be transferred between the partners. 27,000 euros have been adjusted in the DIBA and FC funding to compensate for the distribution of the final payment.

8.4.Certificate on the financial statement

According to Article II.23.2 (d) Certificate on the financial statements:

> *'For beneficiaries for which the total contribution in the form of reimbursement of actual costs as referred to in Annex III is at least EUR 750,000, a certificate on the financial statements and underlying accounts ("certificate on the financial statements");'*

As shown in the table above, the only project partner exceeding the amount of 750,000 euros of Commission contribution is DIBA.

Last September 2022, offers were requested from three auditing firms to formalise the service contract for the final audit of the DIBA partner. After evaluating the bids, the contract was awarded to CET Auditores S.L., who, after an exhaustive review of the documentation provided by DIBA, in March 2023, issued its report in accordance with the model established by the Commission. It should be noted that almost 100% of the declared expenditure has been accepted as eligible expenditure. See annex "AF7 Certificate on the financial statement".

In addition, although it was not a requirement of the project, during 2021 and to have more guarantees, an audit firm was also contracted to review the expenses declared by the rest of the project partners, which was also positive for the 100% of the declared expenses. See annex AF14 Partners Financial Audit.

8.5.Estimation of person-days used per action

Absortion of budgeted time

Action type	Budgeted person-days	Estimated % of person-days spent
Action A: Preparatory actions	133	233%
Action B: Purchase/lease of land and/or compensation payment for payment rights	152	25%
Action C – Concrete conservation actions	5604	85%
Action D: Monitoring and impact assessment	974	40%
Action E: Communication and Dissemination of results	862	86%
Action F: Project management (and progress)	893	123%
TOTAL	**8618**	**85%**

Table 1.2 Absorption of budgeted time by 31/12/2022

A specific annex has been drafted to respond to the financial issues raised in the letters, see Annex AF15.