



LIFE EIclimA

Conservation measures to assist the adaptation of
*Falco eleonora** to climate change

After-LIFE Conservation Plan



October 2019





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«Conservation measures to assist the adaptation of *Falco eleonora** to climate change»

Project details

Project location: Greece

Project start date: 01/08/2014

Project end date: 30/09/2019

Project duration: 62 months

Total budget: 1,206,201€

EC contribution: 898,632€ (75% of total eligible budget)

Coordinating beneficiary: University of Patras – Research Committee (UOP)

Associated beneficiaries: Hellenic Ornithological Society (HOS)

Nature Conservation Consultants Ltd. (NCC)

Project website: <http://www.lifefalcoeleonora.gr>

<http://www.lifefalcoeleonora.gr>



ΕΛΛΗΝΙΚΟ
ΠΡΩΤΟΚΟΛΛΟ
ΕΛΛΗΝΙΚΟ ΠΡΩΤΟΚΟΛΛΟ



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List of abbreviations

HOS	Hellenic Ornithological Society
NCC	Nature Conservation Consultants Ltd.
UOP	University of Patras
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis

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Introduction

The present report consists an After-LIFE Conservation Plan of the LIFE-Nature project LIFE EIClima “Conservation measures to assist the adaptation of *Falco eleonora** to climate change” (LIFE13 NAT/GR/000909) which was implemented by the University of Patras, in collaboration with the Hellenic Ornithological Society and the NCC Ltd, with the financial support of the European Union LIFE+ Instrument and the Green Fund from 01/08/2014 until 30/09/2019. The project involved 8 Natura 2000 sites in the Aegean Sea, located at Mikres Kyklades (Makares), Crete (Gramvousa and Dionysades), Antikythira, Tilos, Skyros, Limnos and Karpathos.

The project aimed to facilitate Eleonora’s Falcon’s (*Falco eleonora*) adaptation to the ongoing and future climate change by the implementation of a series of conservation actions. Specifically, the objectives of the project related to:

1. improvement of breeding performance of the species, by (a) reducing egg losses and mortality rates of nestlings (b) improving the quality and increasing the availability of nesting sites and (c) improving prey availability and quality.
2. improvement of the species’ conservation status at its foraging areas both within its breeding and wintering range by (a) identifying foraging areas utilized by the species, (b) assessing the quality and impact of land use in these areas, (c) networking among experts and organization of workshops to help design and promote efficient mitigation measures.

The actions and activities described below comprise the continuation of the LIFE project after the project ends to secure the long-term sustainability of the project measures, impacts and benefits.

Eleonora’s Falcon

The Eleonora’s Falcon (*Falco eleonora*) or commonly called Varvaki in many areas of the Aegean Sea is a medium-sized migratory falcon with long wings which breeds on the islands of the Mediterranean Sea and eastern Atlantic and overwinters in southeast Africa, mainly on Madagascar. Greece is considered to be the most important country for the conservation and survival of the species as it hosts over 85% of its world population during the breeding season, which is estimated at 14,700-15,400 pairs. The breeding colonies in Greece are widely distributed in more than 300 islands and islets, mainly in the Aegean Sea, while a few can also be found in the Ionian Sea.

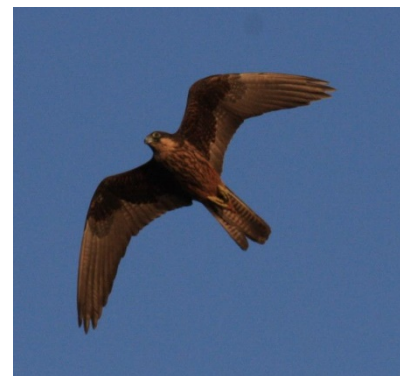


Figure 1: Eleonora's Falcon



Figure 2: Distribution of the breeding colonies of Eleonora's Falcon

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Vulnerability of Eleonora's Falcon to climate change

Eleonora's falcon is considered to be highly vulnerable to climate change due to three main factors: exposure to climate change, its sensitivity to change and its adaptive capacity. The parameters that affect its ability to adapt to climate change are various and include the following:

(1) Its breeding sites are expected to experience increase of temperature, as well as frequency and intensity of extreme events, such as droughts and heat waves. As a result (a) the vegetation on the islets, which provides protection from weather conditions, may also be affected and reduced, leading to further degradation of abiotic conditions for eggs and chicks and (b) the fresh water sources the species uses for drinking and bathing and for hunting large insects may be impacted and reduced or extinct, affecting the birds' fitness and vulnerability to parasites and diseases.

(2) Climate change is also expected to shift the migration period of passerines, on which the species directly depends. Although no shift of the autumn migration has been yet observed, this possibility may lead to loss of the synchronization between the egg hatching and the migratory flow and subsequently to reduction of the breeding success. The same applies in the case the flow of migrating passerines is reduced, either due to reduction of passerine population or due to more birds wintering in Europe.

(3) In case Eleonora's Falcons are forced to abandon breeding sites on islets, they will also lose the benefits they provide, including (a) shelter from predation, with the species being ground-breeder and lacking terrestrial predation-defense mechanisms, (b) increased availability of prey and especially migratory birds, as the islets act as stopover sites for passerines that migrate otherwise in a wide-front, thus providing increased food availability compared to the mainland.

(4) At the wintering sites the distribution shift is expected to be into cultivated areas in the central part of Madagascar, leading to increased exposure to anthropogenic habitats and to biocides used in agriculture, leading to reduction of prey availability and increase of secondary poisoning risk.

(5) Its pre-breeding sites are expected to experience increased desertification and incidence of forest fires.

(6) It should also be noted that as a long-distance migrant with a distance between breeding and non-breeding ranges being over 7,000km, it is expected to have difficulty in adjusting to phenological changes and it will be less flexible than species that do not migrate or are short-distance migrants. Furthermore, a barrier for adaptation is the fact that the species has high site fidelity and individuals remain faithful to their breeding locations and return every year, frequently to the same territory.

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LIFE project technical summary

The project LIFE ELClimA involved a series of actions which focused primarily on the reduction of existing pressures at Eleonora's Falcon's breeding colonies through rat eradication, improvement of abiotic conditions for nesting birds, through provision of artificial nests, as well as, on increasing of prey availability, through the creation of refuelling oases for passerines, thus enhancing the species' capacity to adapt to climate change.

The project consisted of 16 actions, including preparatory actions, land purchase, concrete conservation actions, monitoring action, public awareness and dissemination actions, overall project management and networking. The preparatory actions updated the existing knowledge on the species' status within the project areas and thus provided valuable baseline information for technical planning of the concrete conservation actions. Land purchase involved a land plot on Antikythira Island for the establishment of a refuelling oasis for migratory passerines. Concrete conservation actions involved rat eradication operations and construction of artificial nests to reduce egg losses and mortality rates of nestlings, as well as to improve the quality and availability of nesting sites and improvement of prey availability and quality during the breeding period through the creation of a refueling oasis.

The dissemination actions promoted the outcomes of the project to the wider audience, but also to the scientific community and conservation agents. Networking actions were aimed to further promote exchange of knowledge and technical know-how among species' experts and interested parties in order to properly assess the species' conservation status both at its breeding and wintering grounds, and hence to formulate appropriate mitigation measures.

Main achievements

The project partnership, with the support of local authorities and communities in the project sites in the Aegean Sea, implemented successfully several innovative and best practice management measures with significant impact on insular ecosystems and the Eleonora's Falcon at national and international level. The main achievements of these efforts include:

- Rat eradication operations for the improvement of the Eleonora's Falcon breeding success and breeding habitat in two island complexes with a total area of more than 700 hectares that host 6% of the species national breeding population. These operations were the largest ever rat eradication attempts in Greece and the Eastern Mediterranean and used methods which completely eradicated rats with minimal risk to non-target species.
- Construction and maintenance of more than 1,000 artificial nests for the Eleonora's Falcon for the improvement of availability and quality of nesting sites on 12 islets at 5 project sites which host 19% of the species national breeding population. This large-scale operation built the greatest number of artificial nests for the Eleonora's Falcon and focused primarily on colonies in the southern parts of the Aegean Sea which are most likely to be affected by climate change.
- A purchase of 1-hectare land on Antikythira Island, where a refueling oasis for migratory passerines, the main prey of the Eleonora's Falcon during the breeding season, was created and maintained. This oasis was established in one of the key Eleonora's Falcon colony sites in Greece and in the Mediterranean. The selection of the oasis site and plant species which were planted in the oasis was determined by systematic assessment of refueling pattern of migratory passerines on the island. The purchase of land is the 2nd case in Greece where land was purchased through a LIFE project for the purpose of conservation of protected species.

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ΥΠΟΥΡΓΕΙΟ ΠΕΡΙΒΑΛΛΟΝΤΟΣ ΚΑΙ ΕΝΕΡΓΕΙΑΣ



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- Update of the species baseline information, regarding the population size and breeding performance at 8 project sites in the Aegean Sea, which was a follow-up of the first national census and systematic monitoring at Eleonora's Falcon colony sites throughout Aegean Sea, which took place between 2003 and 2007 as part of the previous LIFE project on the Eleonora's Falcon "Conservation measures for *Falco eleonora** in Greece" (LIFE03 NAT/GR/000091).
- Identification and quality assessment of Eleonora's Falcon's foraging grounds during breeding, wintering and pre-breeding period in Greece and in southeast Africa, which involved a series of advanced methods and state-of-the-art technologies, including satellite telemetry of Eleonora's Falcon, visual observations, insect surveys, radar surveys, on-site wintering habitat assessment on Madagascar and toxicological analysis for testing the presence of heavy metals and investigating the species' exposure to pesticides.
- Production of a Good Practice Guide providing updated information on the conservation status of Eleonora's falcon and proposing related management guidelines, based on the results of the project's interventions and scientific studies.

The technical project actions were supported by the project website promoting the project and presenting its results and achievements, as well as through a public awareness campaign and media work at local and national level, production of an environmental education kit and its implementation at project sites, production and dissemination of project leaflets, annual newsletters, a novel on Eleonora's falcon and climate change and the project's Layman's report. Workshops and conferences either organized by the project or attended by project representatives, as well as project networking with other projects and publication of scientific papers allowed for the involvement of some of the best international experts on the Eleonora's Falcon and nature conservation in the planning of the project actions and provided opportunity for presenting project results and achievements to the scientific community.

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SWOT analysis

Effective planning of future actions and the continuation of project actions to secure its long-term impacts and benefits requires an identification and evaluation of the factors which are related to the achievement of the project’s long-term objectives. A method, commonly used for this task is a SWOT analysis which evaluates Strengths, Weaknesses, Opportunities and Threats at the end of the project.

	Positive conditions	Negative conditions
Internal conditions	<p>Strengths</p> <ul style="list-style-type: none"> • The project involved some of the best experts and scientists in research and conservation of bird species in insular environment in Greece and in the world. • A wide network of collaborating scientists and experts is available at national and international level. • Highly-skilled research and conservation field teams are established. • The conservation measures implemented have been welcomed and supported by competent authorities, local government and local communities, creating local synergies and co-operations with the project teams. • Limited effort is required for maintaining the project achievements and securing long-term benefits. • Good collaboration among project partners. • Islets targeted by rat eradications are rat-free and Migratory passerine refuelling oasis on Antikythira island is fully operational. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Isolated ecosystems of uninhabited islands and islets are particularly vulnerable to external factors, e.g. human disturbance, introduction of invasive alien species, climate change • Field work on uninhabited islets is difficult and costly. • The number of field teams and researchers specialized in working in insular environment is limited. • Particular conservation measures require highly skilled and dedicated personnel. • Funding is partly secured.
	<p>Opportunities</p> <ul style="list-style-type: none"> • Eleonora’s Falcon is one of the best studied bird species in Greece. There is an extensive knowledge of the species’ biology and ecology on national and international level. • The species population trend in Greece is considered to be stable. • Know-how of the implementation of conservation measures by the project in the insular environment is available at the level of the project and the national level. • All project areas are located within Natura 2000 sites, for which the management is the responsibility of respective Management Bodies of protected areas. • Project areas of other on-going LIFE projects with the involvement of some of the current project’s partners partly overlap with the sites of the current project. • The involvement of students and new researchers creates opportunities for a new generation of researchers to continue and expand scientific and conservation efforts. • Positive impacts and evident short-term benefits enhance the transferability and replicability of the project methods to other sites and for the conservation of Eleonora’s Falcon or other biodiversity groups. • Existence of local collaborating research/academic institutions e.g. Natural History Museum of Crete • Some of project actions are included in current Priority Action Framework. Current technical plans of measures carried out by Management Bodies of protected areas in Greece include actions implemented by the project. 	<p>Threats</p> <ul style="list-style-type: none"> • Public awareness regarding the objectives, importance and opportunities provided by Natura 2000 network and biodiversity is limited. • Still unstable political and financial environment in the country. Extended financial crisis made economic development model more susceptible to changes. • Political and stakeholder interests for development on inhabited and uninhabited islands and islets may lead to degradation or destruction of protected natural habitats and to degradation Eleonora’s Falcon conservation status. • Operational capacity of the local competent authorities, namely Forestry Departments and Management Bodies is limited. • Uncertainties regarding the evolution of climate change.
External conditions		

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- Tackling climate change is one of EU top priorities.
- Increased public awareness and interest in the importance of the Eleonora's Falcon and biodiversity, as well as threats of climate change

After-LIFE Conservation Plan

The After-LIFE Conservation Plan has been developed for the continuation of project actions for a period of 5 years following the end of the project. The objectives, actions and estimated costs and funding sources have been determined based on the experience and results of the project, as well as the above SWOT analysis.

Objectives

The overall objective of the After-LIFE Conservation Plan is to maintain the achievements of the project, secure their long-term benefits for the Eleonora's Falcon and project sites, promote replication and transfer of methods and techniques applied, continue research activities and continue to raise public awareness regarding the Eleonora's Falcon, natural environment and nature conservation of the Aegean Sea and Natura 2000 network.

Technical objectives:

- Maintain Makares and Dionysades islet complexes rat-free
- Maintain constructed artificial nests in good condition
- Maintain and operate migratory passerine refuelling oasis on Antikythera island
- Promote replication and transfer of methods and know-how to other sites

Research objectives:

- Monitor breeding performance and population trends at selected project sites, particularly those where conservation measures have been implemented i.e. Makares, Dionysades and Antikythera
- Continuation of telemetry of Eleonora's Falcons that were tagged in the framework of the project, whose transmitters are still operational
- Continuation of toxicological analysis of Eleonora's Falcon's tissue samples
- Continuation of production of scientific papers based on data collected through the project and its results

Dissemination and public awareness objectives:

- Operation of project website and facebook page
- Dissemination of project's information material
- Continuation of application of Environmental Education Kit

Actions

Listed below are technical, research and dissemination actions which are planned to be implemented over a 5-year after LIFE period. For each action the list provides a description of activities, sites of implementation, project partners involved in the implementation (responsible partner in marked with bold), estimated annual cost and indicative financial sources.

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Action	Activities	Sites	Implemented by	Average estimated annual cost	Funding sources
Maintaining rat-free islets	Quarantine measures by annual monitoring and replacing bait in bait stations along the coast to prevent rat reinvasions	Makares, Dionysades	NCC, HOS	2,000-2,500€/site/year	NCC, HOS on-going projects and own funds with the use of existing materials and in cooperation with local institutions and organizations. Potentially, Green fund co-financing.
Maintaining artificial nests	Making repairs to damaged artificial nests	Antikythira, Makares, Dionysades, Skyros, Tilos	NCC, HOS		NCC, HOS on-going projects and own funds with the use of existing materials and in cooperation with local institutions and organizations. Potentially, Green fund co-financing.
Maintaining refuelling oasis	Annual maintaining oasis infrastructure, plant watering, sewing	Antikythira	HOS	4,000€/year	HOS on-going Antikythira project with the use of existing materials and assistance of volunteers. Potentially, Green fund co-financing.
Replication and transfer of methods	Cooperation with organization and institutions to transfer and replicate conservation measures applied by the project		NCC, HOS, UOP	2,000€/year	UOP, HOS and NCC core activities, expected to be partly covered by cooperating organizations
Monitoring Eleonora's falcon colonies	Monitoring breeding success (annually or biannually) and census (after 5 years)	Antikythira, Makares, Dionysades	HOS, NCC, UOP	2,500 – 3,000/site/year	NCC, HOS on-going projects and own funds with the use of existing materials and in cooperation with local institutions and organizations. Potentially, Green fund co-financing.
Telemetry	Downloading and analysis of data from tagged birds		HOS, UOP	1,000€/year	HOS and UOP core activities with own funding.
Toxicological analyses	Collection of tissues samples and their laboratory toxicological analysis		UOP	1,500-2,000€/year	UOP core activities with own funding.
Scientific publications	Preparation and publishing of scientific publications		UOP, HOS, NCC	3,500-4,000€/year	UOP, HOS and NCC core activities with own funding.

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Action	Activities	Sites	Implemented by	Average estimated annual cost	Funding sources
Website	Maintaining project website		UOP, NCC	2,000-3,000€/year	UOP and NCC own funds.
Dissemination	Dissemination of project's information material through core communication and networking activities of project partners		NCC, UOP, HOS	1,500€/year	UOP, HOS and NCC core activities with own funding.
Environmental education	Continuation of application of Environmental Education Kit via HOS core environmental education activities		HOS	2,000€/year	HOS core activities with own funding.
Total				35,000-41,000€/year	





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Financial outlook

Most of the projects actions that need to continue after the end of the project will be implemented by the project partners at their own expense. This includes primarily the cost of personnel, which to a large degree will be incorporated into core activities of the project partners. Another substantial cost will be travel expenses to project sites for which additional funding will be sought. In order to minimize travel costs, joint missions for annual bait station monitoring and maintenance of artificial nests are foreseen. The cost of travel and subsistence has been partly secured through core projects e.g. permanent Hellenic Ornithological Society's Antikythira project, while actual travel costs can also be reduced by collaboration with other LIFE projects e.g. LIFE project on the Bonelli's Eagle (LIFE Bonelli eastMed), which is also being implemented in Mikres Kyklades. The equipment and materials for the continuation of the field activities, i.e. monitoring of bait stations and replacement of bait, maintenance of artificial nests, maintenance of the refuelling oasis on Antikythira island have been secured through the project. Additionally, the continuation of the project's actions will attempt to involve to the largest possible degree the cooperation the Management Bodies of protected areas responsible for the project sites in Cyclades, Dodecanese, Sporades and on Crete. Co-funding of activities, which are not covered by the University of Patras and Hellenic Ornithological Society core activities and own funding, will be requested from the Green Fund.

Conclusions

LIFE EIClimA project has been an ambitious project, which despite various unexpected challenges that it faced, managed to achieve all its initially set objectives. The selection of conservation methods applied by the project and the collaborations it has established ensured that the required effort for the continuation of project actions will be limited and will optimally utilize cooperation and synergies with local institutions and organizations.

Additionally, the project has laid ground for further expansion of the conservation efforts initiated by the project which has already resulted in transfer of knowledge and know-how acquired through the project's implementation to other sites in the Aegean Sea.

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The project LIFE13 NAT/GR/000909 is being implemented with the financial support of the European Commission and the Hellenic Green Fund.