

storie naturali

issue 14|2022

Special monographic issue on the Life Eremita Project



The protection of chestnut and beech forests

Restocking of *Graphoderus bilineatus* and translocation of *Coenagrion castellani*



The Pala-Eremita

European Networking



 Regione Emilia-Romagna



With the contribution of the LIFE financial instrument of the European Union
LIFE 14 NAT/IT/000209 EREMITA

storie naturali

The Journal of Protected Areas in Emilia-Romagna

Issue 14, June 2022

Editor-in-chief

Giuseppe Pace

Editorial coordination

Regione Emilia-Romagna

Settore Aree protette, foreste e sviluppo delle zone montane

Viale Aldo Moro, 30

40127 Bologna BO

tel. 051 5276080

segrprn@regione.emilia-romagna.it

www.ambiente.regione.emilia-romagna.it/it/parchi-natura2000

Edited by

Monica Palazzini and Maria Vittoria Biondi

Publishing and editorial consultancy

Articolture srl

Viale Silvani, 12

40122 Bologna

tel. 051.18899687

info@articolture.it

www.articolture.it

Edited by

Serena Magagnoli

Original graphic design

Compositori Comunicazione

Layout

Arianna Sacripanti

Translations

Maura Vecchiatti

With the collaboration of

Davide Alberti, Shade Amini, Cristina Barbieri, David Bianco, Maria Vittoria Biondi, Lucia Bolognesi, Lorenzo Cangini, Renato Carini, Giovanni Carotti, Elena Chiavegato, Ornella De Curtis, Roberto Fabbri, Gianni Gregorio, Cristina Gualandi, Benedetta Intini, Barbara Lori, Federica Milioni, Fausto Minelli, Manuel Montero Ramirez, Francesca Moretti, Monica Palazzini, Willy Reggioni, Angelo Salsi.

Printing

Casma Tipolito – Bologna

Authorization of the Court of Bologna n. 7429 of 5 May 2004

On the cover: close up of *Rosalia alpina*; photography by Francesco Lemma - The Lone Fox - Nature Photography



The magazine and the other regional publications can be requested to: Settore Aree protette, foreste e sviluppo delle zone montane, regional URP, Authorities of Parks and Reserve, Cartographic Archive of Emilia-Romagna Region, viale Aldo Moro 28, Bologna and on line on the website www.geoportale.regione.emilia-romagna.it/mapshop

Affiliations

Regione Emilia-Romagna, Settore Aree protette, foreste e sviluppo delle zone montane

Maria Vittoria Biondi, Elena Chiavegato, Ornella De Curtis, Gianni Gregorio, Monica Palazzini

Istituto Delta Ecologia Applicata Srl
Shade Amini, Cristina Barbieri, Benedetta Intini, Federica Milioni

Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna
Davide Alberti, Roberto Fabbri

Parco Nazionale dell'Appennino Tosco-Emiliano
Giovanni Carotti, Francesca Moretti, Willy Reggioni

Ente di gestione per i Parchi e la Biodiversità Emilia Orientale
David Bianco

Ente di gestione per i Parchi e la Biodiversità Emilia Centrale
Renato Carini, Fausto Minelli

Ente di gestione per i Parchi e la Biodiversità Romagna
Nevio Agostini, Gabriele Cassani

Ente di gestione per i Parchi e la Biodiversità Delta del Po
Massimiliano Costa



After seven years the activities of the Life Eremita project have come to their conclusion, after a long adventure that has given us the opportunity to reach some certainties, face many difficulties, appreciate some surprises, widen our scope from the protected areas of Emilia-Romagna to the most relevant Italian and European experiences. And all of this started with the need to preserve four rare insects, three beetles and a dragonfly, well known to experts and unknown to most of us, but symbols of forest and aquatic environments on which many other species depend in a close-knit ecosystem of relationships which careless management could disrupt. *Osmoderma eremita*, *Rosalia alpina*, *Coenagrion castellani* and *Graphoderus bilineatus* have now become species known to the general public, adults and children alike, thanks to communication and educational initiatives, but more importantly they are the focus of conservation actions taking concrete form in the preservation and expansion of their distribution area, well beyond the duration of the project, and through the consolidation of management methods making production activities compatible with the maintenance of their habitats. This is a small, concrete contribution facilitating the adoption of seemingly ordinary behaviours which are conducive to a respect for the *environment, ecosystems, biodiversity*, in compliance with the ethical values that - now more than ever - should be shared on an even wider scale. The present publication, following the 2018 release of technical-scientific documentation, intends reporting on the project and its progression from different angles, disclosing its results, as well as informing us how the regional action will continue on. The first part presents examples of interventions carried out in the forest areas, based on a changed perception of the forest ecosystem, therefore aiming at the creation of favourable habitats for the species *Osmoderma eremita* and *Rosalia alpina*. Purposes, methods and techniques were also applied in several actions for other projects financed with the structural funds of the Rural Development Programme (RDP) together with our LIFE project actions, thus expanding its scope. The section focusing on aquatic environments reports on the translocation actions of *Coenagrion castellani* in other Romagna sites, as well as on the important networking efforts involving several European research groups on the *Graphoderus bilineatus* species, which led to the successful restocking of some small Apennines lakes. The closing section describes the communication actions that were carried out, as well as the network of volunteers that were called to play the role of *opinion leaders* in their local areas and at university level, in order to see more natural sciences students and researchers engaged in making use of their expert knowledge to meet the real needs of biodiversity conservation. Breeding insects; trying to artificially age the Apennines forests after centuries of exploitation made them more uniform in structure, and depleted of micro-habitats and deadwood; installing nest boxes for *O. eremita*, and translocating insects are all actions representing absolute novelties for Italy. What is the legacy of the Life Eremita project today? Starting from the updating of knowledge, we have proven that the occurrence of *O. eremita* in the regional territory is more widespread than expected, while the absence of *G. bilineatus* is much more serious than expected in Emilia-Romagna, but surprisingly more favourable in another site outside the region, where the species was considered locally extinct. Hence the importance of field research and monitoring, carried out by experienced personnel. Another positive outcome is the realisation that we can count on a European network for the conservation of biodiversity, not only in Natura 2000 Network sites, but also on LIFE projects for a successful collaboration when facing critical issues. In addition, the cultural aspect of this kind of projects is certainly very significant and the willingness of our interlocutors to learn and be open to change should never be underestimated, if communication is well played out. Last but not least, an ongoing reflection on the environmental situation evolving as a result of climate change, and therefore any action to be planned and implemented must take into account the assessment of its effectiveness over time. Finally, the legacy of Life Eremita will be consolidated through the application of the conservation measures defined for the four target species and with the continuation of the main project activities planned in the *After-Life Conservation Plan* within the *Prioritized Action Framework* (PAF) for 2021-27 - the framework of priority actions of the Natura 2000 Network for the next programming of structural funds - recently approved by the Region.

Monica Palazzini

Department of Protected Areas,
Forests and Development of Mountain
Areas - Emilia-Romagna Region

& Cristina Barbieri

Delta Institute of Applied Ecology

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What people say about Life Eremita

Angelo Salsi

Head of LIFE Unit, European Climate,
Infrastructure and Environment
Executive Agency (CINEA)
European Commission

Millions of species live on our planet. Of these, more than 1.5 million animal species have been identified and described: 80% are insects.

Every year new species are catalogued while many will never be because they disappear without our knowledge.

This project wanted to do something to save at least some of these little visible and often forgotten - or worse, deemed useless - animals. The Hermit beetle, the Rosalia longicorn, the southern Damselfly and the Dytiscid water beetle are splendid examples of this little-known biodiversity. They raise our interest just by their names. The hermit beetle that lives for years as a larva in the trunk of old trees, the colourful Rosalia longicorn or the Dytiscid water beetle. Why protect them, you may ask? Why spend public money on an insect with long antennae or a blue dragonfly?

Because they are beautiful, and they are rare. Because they are useful in their performing a specific task in the great game of nature.

Because they have as much right to live on this planet as we do, and finally, because we, *Homo sapiens*, are depriving them of that right, by taking away and destroying their habitats.

Yet, they don't ask for much: an old tree or a pond. This project proves in fact that coexistence is possible.

I congratulate the team of this beautiful Life Eremita project for giving these fellow travellers one more chance. I hope many more will follow this example, and the LIFE programme will be ready to support them.

Manuel Montero Ramirez

Project Advisor, European Climate,
Infrastructure and Environment
Executive Agency (CINEA),
European Commission

Invertebrates are vital for providing many services to society, such as pest control, pollination, soil creation and water filtration. Yet we also know that these species are rapidly declining across Europe due to loss and/or fragmentation of natural habitats, agricultural intensification, pollution, invasive alien species and climate change. At LIFE, we have been working hard to reverse this trend.

Since 1992, more than 80 LIFE projects have targeted around 65 invertebrate species, and these efforts have undoubtedly improved the conservation status of many endangered invertebrates in Europe.

Some projects have improved open habitats, forests and wooded meadows, ponds and streams. Others have addressed pollination services, invertebrates as indicators of sustainable agriculture and forest management. And several have highlighted earthworms as soil health indicators and how urban areas can support wild bees.

More recently, the LIFE Programme has also concentrated on species listed as Endangered in the International Union for Conservation of Nature (IUCN) European Red List of invertebrate groups. Through LIFE projects, there has been a significant improvement of both the habitats and species' conservation status as a result of concrete conservation actions on the ground.

I want to congratulate you, the team behind LIFE Eremita, for your work over the past years. You have gone a long way to protect and enhance four invertebrate species, crucial for our planet.

Your conservation interventions, captive breeding work, information, and awareness-raising activities have made a big difference. These actions have helped increase knowledge of the species, enhanced available habitat for the residual populations and improved public attitudes towards the importance of their conservation. The challenge of reversing the decline of invertebrates is immense, requiring a collective effort.

I am confident that your efforts will inspire others to take up this important cause.

Barbara Lori

Councillor for Mountain and Inland Areas, Territorial Planning, Equal Opportunities, Emilia-Romagna Region

Even though biodiversity is increasingly dominating the discourse, and the term has finally been included in the Italian Constitution, in Article 9, 30 years after the *summit* of Rio de Janeiro, we can still say that it is one of the most misunderstood values.

While climate change is something that touches us concretely and we feel it almost daily on our bodies, to the point that anyone can talk about it and perceive it as an imminent danger, the silent disappearance of species and habitats, or the worsening of their threats cause little concern, if not even indifference.

All the more so when we deal, not with charismatic species such as wolves, bears, and lynxes, but those considered least important or irrelevant for cultural reasons. The entomologists and technicians of the Life Eremita project were faced with the challenge of going beyond what may appear to be a small circle of experts and enthusiasts, to highlight how rare some of these insects are, what are their optimal ecological conditions, the ecosystem services to which they are linked, and how to ensure their expansion and long-term survival in Emilia-Romagna.

This is an extremely important contribution to the success of an ecosystem-enhancing approach for the management of our forests and wetlands: thank you, Life Eremita!

Gianni Gregorio

Head of the Department of Protected Areas, Forests and Development of mountain areas, Emilia-Romagna Region.

The regional Department, which I head, includes in its tasks the implementation of the Habitats and Birds Directives and the integration of the sites of the Natura 2000 Network into the regional system of protected areas and policies, in order to protect and preserve biodiversity at a regional scale.

Our horizon is the European Biodiversity Strategy for 2030 and we are facing the ambitious goals of expanding the protected area up to 30% - today at 16% - and restoring all degraded ecosystems within this decade.

From this point of view, the LIFE projects have always been exceptional opportunities to carry out concrete conservation actions and are real milestones in the activity of an organization, as they serve to make a qualitative leap forward and consolidate experiences that will have lasting effects on the future: Life Eremita is no different. Many other successful LIFE projects have focused on the habitats and species of Emilia-Romagna, thus representing great opportunities for the conservation of natural heritage, but, for the first time with such strong commitments and resources made available, it has been possible to pay attention to a component of biodiversity already the focus of the Regional Law 15/2006 on the protection and conservation of the so-called "Minor Fauna".

From now on, our commitment in this area will continue with the implementation of the conservation measures envisaged in the *Prioritized Action Framework* (PAF) for the programming of structural funds for the 2021-27 period, also approved by our Region, which comprises the provision of specifically earmarked resources.



The Life Eremita project

Protagonists, goals and priority actions

by *Monica Palazzini,*
and *Maria Vittoria Biondi*

The Life Eremita project (European identification code LIFE 14 NAT/IT/000209), which started on January 1st, 2016, takes its inspiration from one of the four species of insects which are the focus of the project activities, “*Osmoderma eremita*”, the hermit beetle linked to the presence of large hollowed trees, whose name symbolizes the condition of isolation and rarity also shared by the other three target species.

Besides *O. eremita* (Hermit beetle), the project is centred on: *Rosalia alpina* (Rosalia longicorn), *Graphoderus bilineatus* (Dytiscid water beetle) and *Coenagrion castellani* (southern Damselfly). Two of these, the Hermit beetle and the Rosalia longicorn are wood coleoptera, living in old broadleaf forests with large veteran trees of different species, mostly oaks and beeches. In anthropized contexts, however, the Hermit beetle can also settle in areas of much reduced naturalness, such as parks and city trees, rows of willows and mulberry trees, isolated trees in the countryside, chestnut trees, farm hedges and similar environments, provided that the trees have hollows. Rosalia longicorn is typical of mature beech forests in open and sunny conditions. The other two are aquatic species: the Dytiscid water beetle in lakes and peat bogs, while the southern Damselfly lives in small sunny water courses rich in water plants. All the four species are listed in the Annex II of the Habitats Directive, and the two forest beetles are also of priority interest; all are species specifically protected by the Regional Law n. 15/2006 “Measure for the protection of minor fauna in Emilia-Romagna”, providing for adequate forms of protection and conservation for animal species which may be small in size, but no less worthy of attention.

There are several causes for the disappearance or the strong rarefaction of these species of insects, but in essence they are due to human activities causing their disappearance and still threatening their habitats. The Life Eremita project intends ensuring the best conditions for the conservation of residual populations by acting precisely on specific anthropic factors.

For the Hermit beetle, the causes of the decline are to be found in the destruction and disruption of older forest ecosystems, but also in the uprooting of rows of old willows, mulberry trees and vines along the ditches in the lowland areas, carried out in order to encourage farm mechanization, as well as in the cutting and removal of old decayed trees found in wooded areas and public parks. Rosalia longicorn, on the other hand, is affected by the felling of old trees and the removal of dead or decaying beech trees from the forest, as well as by production-oriented forest management. While the Dytiscid water beetle is mainly threatened by agricultural, industrial or construction activities, as well as by the introduction of allochthonous fish species (rainbow trout, largemouth bass, sunfish, mosquitofish) for the purpose of sport fishing and mosquito control. Finally, the southern Damselfly is in decline due to hydraulic engineering works on small watercourses, the periodic cleaning of canals, the drainage and excessive abstraction

BELOW Team members of the Life Eremita project.



SERENA MAGAGNOLI



ROBERTO FABBRI



FRANCESCO GRAZIOLI

JOSEF HLASEK

ABOVE *Rosalia alpina* is a beetle linked to mature broadleaf forests with large beech trees with a good sun exposure.

Coenagrion castellani is a small dragonfly which needs watercourses with lush aquatic and riparian vegetation with year-round flow of water. Its threats are habitat changes due to the excessive exploitation of water bodies (regular cleaning of canals, drainage and abstraction of watercourses, etc.).

Adult of *Osmoderma eremita*.

Graphoderus bilineatus, a Dytiscid water beetle, has adapted to the aquatic life typical of lakes and peat bogs. Particularly protected due to its strong rarefaction mainly due to human activities, it is included in Annex II of the Habitats Directive and protected by Regional Law no. 15/2006 for the protection of minor fauna in Emilia-Romagna.

of minor water bodies. Pesticide pollution and water eutrophication due to the excessive use of agricultural fertilizers are also relevant factors.

The project staff comprise the technical personnel of six authorities, also responsible for the Natura 2000 Network sites: four management authorities for regional protected areas and the Natura 2000 Network sites (Management Authorities for Parks and Biodiversity: western Emilia, central Emilia, eastern Emilia and Romagna Macro-areas) and two National Parks (Casentinesi Forests, Mount Falterona and Campigna, and Tuscan-Emilian Apennines), besides Emilia-Romagna Region as coordinating beneficiary.

Some of the most experienced Italian entomologists specialized in forest and aquatic odonates and beetles participated in the Life Eremita project. The scientific supervision was provided by La Sapienza University of Rome, thanks to Prof. Paolo Audisio and Prof. Gianmaria Carchini of the Tor Vergata University of Rome. Other scientific collaborators were Dr. Marco Uliana of the Museum of Natural History of Venice, Prof. Leonardo Congiu of Padua University and Dr. Sönke Hardersen of the group of the National Biodiversity Center Carabinieri of Mantua.

The project implemented several concrete actions, adopting an integrated and coordinated approach shared with all the partners. Actions comprised the following:

- **monitoring:** necessary to increase knowledge of occurrence/absence, distribution, and abundance of the target species. The results, such as the exact location of species populations and habitats, enabled to plan specific restoration actions for species conservation. The monitoring, repeated after the implementation of the interventions, helped to assess the effectiveness of the carried-out actions.

- **improvement of habitats:** increasing the availability of habitats for residual populations and improving their connectivity. In the case of forest habitats, pruning, thinning, clearing and scrub clearance actions were carried out to promote the best ecological conditions for the two target species. For *Rosalia longicorn*, in order to increase the availability of dead wood in a bright beech forest environment, interventions of bark-ringing and the setting up of tripods and disposable piles for oviposition were carried out. While for the Hermit beetle, already present tree hollows were further widened, and *Wood Mould Boxes* (WMB) were positioned. These boxes simulate the hollows of old trees and are used to host the species through the different phases of its biological cycle. Interventions for the southern Damselfly were carried out in small watercourses, by removing part of the shrubs and trees along their banks, to let sunlight in on the water and foster the growth of aquatic grasses essential for the oviposition and development of juvenile stages. For the

**WHAT IS THE NATURA 2000 NETWORK?
A SYSTEM OF NATURAL AND SEMI-NATURAL AREAS
PROTECTED BY THE EUROPEAN UNION**

The Natura 2000 Network is the main instrument of the European Union (EU) policy for the conservation of biodiversity, established under the Habitats and Birds Directives to ensure the long-term maintenance of natural habitats and threatened or rare species of flora and fauna at EU level. The two Community Directives aim to mend the rifts in a territory – Europe - which has suffered so much fragmentation of its natural environments due to urbanisation, industrial activity, intensive agriculture, and infrastructures.



It is based on the identification of areas of particular environmental value called Sites of Community Importance (SCIs) and Special Areas of Conservation (SACs), which complement the Special Protection Areas (SPAs) for avifauna.

The aims of the Natura 2000 Network are concretely pursued both through the application of specific directives, management guidelines and reviews, and through the study and assessment of impacts, which are binding for schemes, projects and interventions to be carried out within or adjacent to the Natura 2000 Network sites.

Emilia-Romagna Region is in charge of the overall management of the one hundred and fifty-nine sites of the Natura 2000 Network (71 SACs, 68 SAC-SPAs, 19 SPAs, 1 SCI), for a total area of 301,761 hectares, through the adoption - on behalf of the Ministry for the Environment and the European Commission – of guidelines and standards for their establishment, planning and management, and the coordination of actions carried out by management authorities (for the national and regional protected areas, and the Region as well).

Dytiscid water beetle, instead, it was necessary to choose basins with already suitable lentic waters, because it was not possible to obtain adequate habitats in the short term.

- **controlled breeding of Hermit beetle:** the Hermit beetle was bred in three centres set up for the reproduction of the species. Production of larvae and adults was needed for restocking, through the WMBs placed in the woods, or the hollowed-out trees. The breeding was carried out in three specific facilities, in the National Park of Casentinesi Forests, Mount Falterone and Campigna at the Santa Sofia centre, in a former icehouse; in the National Park of the Tuscan-Emilian Apennines at the operational centre of Ligonchio, in a specifically-built wooden structure, and for the Romagna Macro-area, at the Aquae Mundi centre in Russi.

- **release into the wild,** necessary to promote the expansion and increase of the distribution range of the target species. For the Hermit Beetle, the Dytiscid water beetle, and the southern Damsel fly, we intervened by reintroducing the species in suitable locations using specimens taken from healthy source populations, or from designated breeding centers. For example, to facilitate the expansion of the distribution areas of the southern Damsel fly, specimens were taken from sites where it was abundant and brought to other more distant sites to restock or increase their number, thus fostering a greater dispersion of the species.

- **organization of meetings** to raise awareness and inform the general public, of training *workshops* for forestry operators and environmental education activities involving students from kindergarten to high school across Emilia-Romagna Region. The main topics being covered were the importance of ecosystem services provided by forests and the biodiversity of forest and aquatic environments. The information and awareness-raising campaign was developed as an itinerant show, the Eremita *Tour*, a series of events organized in different sites or city squares, its main feature being the Pala-Eremita, a very colourful, modular, inflatable and transportable dome-like structure, set up with panels reproducing the protagonists of the

project, namely the target species.

- **creation of a network of volunteers:** thanks to the participation of local people, university students and nature lovers who contributed to monitoring, conservation and communication activities, by disseminating in this way the ultimate message of the project: making the sustainable management of forest and aquatic environments possible and focused on enhancing biodiversity.

The concrete actions of conservation, such as the creation of habitat trees, the restoration of micro forest habitats and habitats of lentic and lotic waters, the *ex-situ* reproduction (*captive breeding*), the release/restocking of bred specimens, together with the translocation of captured specimens, have not only fostered the maintenance of viable populations capable of supporting the dispersal of individuals to neighbouring areas, but also represent an absolute novelty in Italy.

The implementation of the Life Eremita project was a unique and important opportunity to focus with all the needed attention on a component of regional biodiversity that, although recognized as of great ecological value and at the same time in a critical state of conservation, had not yet been the subject of in-depth research, also for lack of means. It was also an opportunity to convey a positive message regarding all those silent, elusive and precious elements of biodiversity, while reaching a large number of citizens, students and operators.

The monitoring actions envisaged by Life Eremita have made it possible to increase information on the occurrence/absence, distribution and abundance of the four target species.



ROBERTO FABBRI

One of the many awareness-raising and dissemination events for children, organized by Life Eremita.



ATLANTIDE SOC. COOP. SOCIALE S.P.A.

MAIN DATA REGARDING THE LIFE EREMITA PROJECT

Approval by the European Commission:
May **2015**

Total budget of the project:
2.126.987 euros

European contribution:
1.268.863 euros
equal to **59.66%** of total budget

Regional contribution:
774.862,00 euros

Duration:
1 January **2016** – 30 June **2022**

Coordinating Beneficiary:
Emilia-Romagna Region

Associated Beneficiaries:
Ente di gestione per i Parchi e la Biodiversità Emilia Occidentale, Ente di gestione per i Parchi e la Biodiversità Emilia Centrale, Ente di gestione per i Parchi e la Biodiversità Emilia Orientale, Ente di gestione per i Parchi e la Biodiversità Romagna, Parco Nazionale dell'Appennino Tosco-Emiliano, Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna.

Participating sites of the Natura 2000 Network:
78 in total

WHAT IS A LIFE PROJECT? AN INSTRUMENT BY WHICH EUROPE FINANCES THE "ENVIRONMENT"

Through the LIFE programme, the European Union (EU) provides funding for environmental and nature conservation projects. The programme was established in 1992 to support projects in the EU and in candidate and neighbouring countries. Since 1992, several LIFE programmes have been adopted, co-financing more than 4,000 projects, up to the most recent LIFE programme for the period 2021-2027, amounting to €5.4 billion. The programme is divided into four sub-programmes: nature and biodiversity, circular economy and quality of life, climate change mitigation and adaptation, and transition to clean energy. This year, 2022, marks the 30th anniversary of the creation of the LIFE financial instrument.

In our Region, with the previous programmes and thanks to the LIFE "Nature and Biodiversity" sub-programme, it was possible to finance projects for the conservation of natural heritage, implementing actions that have become real milestones. Let us recall, just to give a few examples, the projects aimed at the conservation of wolves, the Apennines fir forests, the troglophile bats or the one focused on the Comacchio Salt Pans, up to the most recent projects such as Life "Gypsum", for the protection and management of habitats linked to chalky formations, and Life "Barbie", for the conservation and restoring of native populations of two species of barbel.



Coenagrion castellani

Roberts, 1948

Order: Odonata

Family: Coenagrionidae

Common Name:

Southern Damselfly



ROBERTO FABBRI

Geographic range: *Coenagrion castellani* is endemic in Italy, widespread along the peninsula from Piedmont to Calabria, while absent in the major islands (there is no confirmation for Sicily). *C. mercuriale* is widespread in central and western Europe, while *C. m. hermeticum* (Selys, 1872) is present in North Africa. (Riservato *et al.*, 2014).

Distinctive features: *C. castellani* differs significantly from *C. mercuriale* at a morphological level: in the male, the anal appendages are more raised and almost entirely black, with subanal laminae clearly shorter than the cerci; the black pattern of the second abdominal segment is U-shaped (and not like Mercury's helmet as in *C. mercuriale*); the other black abdominal patterns are different and more extended. Moreover, also at the genetic level *C. castellani* has significant differences from the populations of the rest of Europe and the Maghreb, as pointed out by several authors (Ferreira *et al.*, 2014; Ferreira, 2016; Galimberti *et al.*, 2021).

Habitat: lotic, oligo-to-mesotrophic waters, in small sunny streams with rich aquatic and riparian herbaceous vegetation and year-round flow, such as in springs, fountainheads, small canals, from the plain to 750m altitude. The juvenile stages develop in streams and canals with not too fast current, and in springs, slightly shaded and overgrown with marsh, mostly underwater vegetation, but also swampy areas and peat bogs can be colonized. *C.*

castellani tends to be more numerous in calcareous soils and in slightly alkaline waters.

Biology: adults fly between late March and July, depending on latitude, altitude and climatic conditions of the year. The species is bivoltine in Italy and a partial second brood appears between late August and October in areas with milder autumn (e.g., the surroundings of Rome, the Rimini area, the South) (Fabbri, 2018). Adults have a limited dispersal ability and are stationed at breeding sites. Juvenile stages live in silty sediment and, like the adults, prey on other small invertebrates.

Distribution and status in the region: at the moment its occurrence has been reported in the National Park of Vena del Gesso Romagna e in the Marecchia Valley. A recent sighting in the Regional Park of Stirone was groundless. It disappeared from the Romagna and Bologna stations where its occurrence had been reported in the past. It is seriously threatened and critically endangered in the region as the present stations are quite isolated and cover two very small areas.

Specificities: Roberts (1948) described *Coenagrion castellani* on specimens from Acilia near Rome, collected by Omero Castellani in 1946, and therefore the species is named after him. Already in 1949 Conci downgraded *C. castellani* to a subspecies of *Coenagrion*

mercuriale (Charpentier, 1840), not having detected any relevant difference to consider it a different species. However, the strong morphological differences with *C. mercuriale* and the genetic differences of Italian populations from European ones led to the reassessment of its status, and now it is again considered a proper species, although being endemic only in Italy (Dijkstra & Schröter, 2021). The dragonfly species endemic in Italy are then two; the present taxon and the *Cordulegaster trinariciae* Waterston, 1976 from the Centre-South and Sicily (Riservato *et al.*, 2014).

Conservation interest: the species is listed in Annex II (species of Community interest requiring the designation of Special Areas of Conservation) of the Habitats Directive, and as one of the species particularly protected by the Regional Law 15/2006 "Measures for the protection of minor fauna in Emilia-Romagna". It is considered a near threatened species by IUCN Italia.

Threats: the identified causes of threat are related to the hydraulic works on small streams; periodic cleaning of canals, and drainage of minor water bodies. Other causes are the excessive shading of the watercourse by shrubs and trees, pollution from pesticides and effluents from small livestock farms, excessive water withdrawal from small streams and springs. It is of primary importance to protect the areas where the species has settled, by continuously monitoring the stations, and by planning the interventions to be carried out for a good conservation of the species. In general, it is necessary to keep watch on the correct use, water withdrawal and cleaning of small watercourses with year-round flow of water.

Conservation measures: it is of primary importance to protect the areas where it has settled, monitoring the stations and planning the interventions that must be carried out for a good conservation of the species. In general, it is necessary to keep watch on the correct use, the water withdrawal and the cleaning of small streams fed by springs. It is also important to keep domestic and farm animals away, to control possible sources of pollution by organic substances and avoid using agrochemical products along a buffer zone of at least 20 meters from the streams.



ROBERTO FABBRI

ABOVE *Coenagrion castellani*.

LEFT Habitat of *Coenagrion castellani*.



Graphoderus bilineatus (De Geer, 1774)

Order: Coleoptera
Famiglia: Dytiscidae
Common Name:
Dytiscid water beetle

Geographic range: Siberian-European species. In Europe it is rare and generally in decline. In Italy it is very rare and was known only for few stations in Lombardy, Trentino-Alto Adige, Emilia-Romagna and one station in Tuscany: many of these stations are quite old or even historical and have not been confirmed.

Distinctive features: 14.0-16.0mm long. Oval, posteriorly enlarged and rather flattened, body; shiny and smooth dorsal surface. Yellowish coloration with the pronotum showing two black thin bands, along the anterior and posterior edges, while the elytra are uniformly covered with a characteristic black marmoration. Reddish legs. The males with the front tarsi transformed into a subcircular paddle, ventrally provided with large suction cup bristles. In Emilia-Romagna there are two other species of *Graphoderus*: *G. cinereus* (Linnaeus, 1758) and *G. austriacus* (Sturm, 1834). *G. bilineatus* differs from them by the particularly wide and flattened appearance in the posterior half, by the pale, yellowish or reddish-yellow undersides, the thinner black bands of the pronotum, and larger size.

Habitat: lentic waters, preferably large, clear, also deep ponds, rich in aquatic vegetation also present in peat bogs.

Biology: carnivorous species with predatory adults and larvae, which despite their size (up to 30mm-long), are specialized in hunting small organisms; the larvae are good swimmers thanks to their long legs equipped with swimming bristles. Little is known about its life cycle. It is a monovoltine species breeding in the spring and wintering when in the adult stage.

Distribution and status in the region: once present in Emilia-Romagna in several sites in the flatland area, now the species is isolated in just a few sites in the Upper Modenese Apennines.



SILVIA STEFANELLI

Specificities: in the adults, the sides of the elytra are provided with an expansion reaching its maximum width just below the median portion of the elytral length, giving a particularly wide appearance to the insect which seems provided with a sort of hull on both sides.

Conservation interest: the species is listed in Annex II (species of Community interest requiring the designation of Special Areas of Conservation) and Annex IV (species of Community interest requiring strict protection) of the Habitats Directive. Deemed as critically endangered, it is very rare in Italy and declared as declining in most of Europe. Recent monitoring exercises have ascertained the extinction of the species from the regional sites in the flatlands, where it was previously reported. Besides being rare, the species is also sporadic, and therefore is one of the specifically protected species listed in the Regional Law 15/2006 "Measures for the protection of minor fauna in Emilia-Romagna".

Threats: to our knowledge, the main causes of threat are directly of anthropic origin: destruction and pollution of habitats by farming, industrial activities, or urban settlements, as well as the introduction of alien fish species (rainbow trout, largemouth bass, sunfish, catfish, etc.). In flatland and hill stations, the arrival of the Louisiana crayfish (*Procambarus clarkii*) is another serious threatening factor, given the far-reaching environmental alterations its presence causes. We must also keep in mind that the dytiscid beetle has a rather

limited distribution in the territory: single populations are practically isolated in very circumscribed areas; their survival, therefore, is to be considered rather critical and the risk of regional extinction very high, without the possibility, or nearly so, of a natural recolonization by specimens in a phase of dispersal.

Conservation measures: in the occurrence sites of the species in the regional Apennines, it is important to prevent the excessive numbers of domestic grazing animals and wild ungulates from watering, with the creation of mud holes. Periodic monitoring for the presence of invasive species is important, as well as preventing the natural choking of ponds due to the accumulation of organic material.



JOSEF HLASEK

ABOVE Habitat of *Graphoderus bilineatus*.

IN THE CIRCLE *Graphoderus bilineatus*.

Osmoderma eremita (Scopoli, 1763)

Order: Coleoptera
Family: Scarabaeidae
Common Name:
Hermit beetle



Geographical range: European distribution. In Italy, its occurrence is in the central-northern regions up to Abruzzo and Lazio.

Distinctive features: 24 to 37mm long. The adult has a metallic bronze-black colour, or more precisely a shiny leathery colour, with stocky body, small and clavate antennae. The pronotum presents an evident longitudinal median groove. The male has a short tubercle in the upper ocular portion; the longitudinal furrow of the pronotum is deeper; moreover, the pronotum and the forelegs are more robust. It differs from related species of the genus *Gnorimus* in the anterior tibiae with three teeth toward the outer margin and by the long, sharp scutellum.

Habitat: it lives inside the hollow trunks in mature woods of broadleaf trees and in the hollows of tree stands and rows of old trees, even if topped. The species is widespread from the flatlands and low hills up to an altitude of 1500m above sea level.

Biology: xylosaprobic species, the larvae live in decayed wood attacked by fungal mycelia and in wood mould, and feed on deadwood and other organic material inside large hollows and cavities in the trunks of living trees. The same hollow is used by many generations. The preferred tree species are broadleaf trees, such as oak, chestnut, beech, linden, horse chestnut, plane tree, and locally in the region willows and poplars. It has a biological cycle of 1-3 years. Mature larvae make a cocoon in September-October, using the contents of their intestines, and pupate the following spring. Adults are active primarily at dusk in June-July, have a short dispersal range, and move little away from the tree from which they swarmed.

Distribution and status in the Region: following the monitoring of Life Eremita, reported in Emilia-Romagna Region in all provinces. It is a very vulnerable species and very rare; in some regional areas there are no recent data and it is probably locally extinct.

Specificities: adults emit an intense and pleasant aroma of ripe fruit or “old leather” and for this reason it is also called “odorous” hermit beetle.

Conservation interest: included as a priority species in Annexes II and IV of the Habitats Directive (species of community interest which requires the designation of Special Areas of Conservation and strict protection) and as a particularly protected species in the regional law 15/2006 “Measures for the pro-



tection of minor fauna in Emilia-Romagna”. Considered vulnerable in the IUCN Red List of Italian saproxylic beetles (Audisio et al., 2014).

Threats: the causes of its decline in the past are to be found in the destruction of the veteran forest ecosystems, while, in more recent years, in the felling of the rows of old willows along the ditches and in the vineyards of the flatland areas to favour the mechanization of agriculture which has further restricted habitat. Even the cutting, removal and treatment of individual old and decayed trees found in courtyards, in urban tree stands and in parks are the causes of the rarefaction of the species.

Measures for conservation: an excellent bio-indicator of the quality and maturity of the woodland environment, the presence of old, living deciduous trees and the biological richness of tree hollows. It is a characteristic species, vulnerable and in great rarefaction due to the disappearance of its living environments. Since hollow trees are becoming increasingly rare, preserving the residual populations of the hermit beetle requires the conservation of all old decayed trees, both in woodland and in tree stands, as well as willows and the topped poplars in vine rows, while leaving the trunks of living but damaged trees standing, and prohibiting the use of tree surgery on old trees in parks and tree stands. The Life Eremita project has also developed techniques to create suitable habitats for the species and thus encourage its spread.



ABOVE *Osmoderma eremita*.

LEFT Habitat of *Osmoderma eremita*.

Rosalia alpina

(Linnaeus, 1758)

Order: Coleoptera
Family: Cerambycidae
Common Name:
 Rosalia longicorn



Geographic range: species with European-Anatolian distribution. Known in Italy in almost all the regions, except for Valle d'Aosta and Sardinia, but often in old sightings; rarer in the North, it appears more abundant in the Central Apennines. Currently it is found mainly in protected natural areas.

Distinctive features: medium-large body with a length between 20 and 38 mm. Recognizable at first glance by its colours, the thick tufts of black hairs at the apex of the antennae segments. It has a sky-blue colour, with a velvety black spotted pattern on the prothorax and elytra. The antennae are very long with the same blue and black colours.

Habitat: mature mountain beech forests, up to an altitude of 1600m a.s.l. The species can also settle in the region in beech forests at lower altitudes (up to 600m a.s.l.).

Biology: xylophagous, the larvae are monophagous on beech, *Fagus sylvatica*, and only occasionally on linden, maple, and chestnut trees. The larvae prefer the woody sun-exposed parts, where they dig tunnels into the wood. Development usually occurs in three years, in recently dead or senescent trees, in freshly felled trunks or in the deadwood parts of healthy plants and even in stumps. Generally, the trees are medium to large in size. Adults are active during the day on sunny days and appear in early summer, in June-July, on the same trees where the larvae have developed, on stacks of beech logs and also on piled timber, where they camouflage very well with the beech bark.

Distribution and status in Emilia-Romagna: Before the Life Eremita project, the species was historically reported only in the provinces of Parma, Modena and Forlì-Cesena, in the latter case also by recent data, mostly in the National Park of Casentinesi Forests, Mount Falterona and Campigna. After the monitoring carried out within the Life Ere-



mita project, the species was found also in the provinces of Bologna and Reggio-Emilia.

Specificities: *R. alpina* is considered the most elegant European cerambycid and it is one of the symbol, or better flagship, species of the beech forests, because for size and beautiful livery it is easily recognizable even by people not familiar with insects. Contrary to its name, this species is not so much linked to the alpine environment, as to the presence of thermophilic beech forests more frequent in the Apennines.

Conservation interest: the species is listed as priority in the Annexes II and IV of the Habitats Directive (species of Community interest requiring the designation of Special Areas of Conservation and strict protection) and

included in the specifically protected species in the Regional Law n. 15/2006 "Measures for the protection of minor fauna in Emilia Romagna". It is in rarefaction and therefore reported as "NT", near threatened, in the IUCN Red List of Italian saproxylic Coleoptera (Audisio et al., 2014). It is considered a very good bio-indicator of the status and level of maturity of beech forests.

Threats: habitat destruction (mature and wild beech forests) due to the felling of old growth and the removal of dead or decaying beech trees from the woods, as well as the removal of beech log piles left in the forest in summer. Indiscriminate harvesting through the collection of adult specimens may result in a local threat.

Conservation measures: preservation of large, dead or decaying beech trees and all deciduous trees in general. Release of beech deadwood, trunks, large branches and stumps of beech in the forests.



SERENA MAGAGNOLI

ABOVE Poggio Fonte Murata, beech forest.

LEFT *Rosalia alpina*.

Osmoderma eremita and *Rosalia alpina* in Emilia-Romagna

Regional distribution of two saproxylic species of priority interest

by *Giovanni Carotti*
and *Roberto Fabbri*

GIOVANNI CAROTTI



The pheromone-baited traps for monitoring *Osmoderma eremita* consist of two criss-crossed black plastic panels placed over a funnel with the neck inserted inside a 0.5 l plastic bottle. The presence of a small container means that this type of trap must be checked very frequently to avoid the death of captured specimens.

The project has included two monitoring campaigns, the first one - *ex ante* - aimed at finding the distribution of *Osmoderma eremita* and *Rosalia alpina*, and took place in 2016 and 2017. At the same time, a survey of the areas and the trees suitable to host the two species was also carried out, and the two monitoring exercises brought about the definition of a plan of interventions for habitat improvement and expansion, with the aim of enlarging the distribution area of these two saproxylic beetles in Emilia-Romagna, and therefore ensuring sufficient breeding sites and, as a consequence, the long-term survival of the two species. These interventions also envisaged specific actions of restocking and/or strengthening of the present populations of *O. eremita*, through the release of specimens obtained from *captive breeding* and *in-situ* breeding operations.

The second, *ex-post*, monitoring campaign took place in 2020 and 2021 in order to assess the efficacy of already-implemented conservation actions for the long-term growth of populations. The monitoring area overlapped the areas involved in the actions aiming at setting up and improving the extant habitats.

The *ex-post* monitoring techniques were the same being used in the preliminary stage of the project; in particular for *O. eremita* the following steps were taken:

- the visual search for adults on trunks and inside the hollows of habitat trees;
- the use of pheromone-baited traps;
- the search for larvae, adult specimens and pupae in the *Wood Mould Boxes* (WMB) (the boxes are hung on trees and mimic the natural tree hollows; they are usually called nest boxes).

Regarding *R. alpina*, a visual search was carried out for adult specimens on habitat trees, established *ad hoc* through the implemented actions, together with a survey of any adults and their remains on beech deadwood naturally occurring in the intervention area and its surroundings. The monitoring was carried out along previously-identified transects (linear paths).

Beech Cerambycid, *Rosalia alpina* (Linnaeus, 1758)

In the area of the National Park of the Tuscan-Emilian Apennines, a significant increase in the number of detected specimens was reported, compared to what had emerged from the *ex-ante* monitoring. The preliminary surveys had shown the occurrence of the species, with a small number of specimens, only in three different sites of the Natura 2000 Network. A fourth site reporting the occurrence of the species was a single beech tree, cut and moved near a tourist facility, where it was possible to observe several specimens of *R. alpina* every year. Surveys on saproxylic beetles, prior to Life Eremita's findings, had highlighted the extreme rarity and localization of the species, which was present only in one site of the National Park of the Tuscan-Emilian Apennines. The occurrence of the species was reconfirmed during the *ex-post* monitoring in the three previously-identified areas, to which ten new areas of ascertained presence were added, in three different sites of the Natura 2000 Network. This remarkable increase, both in the number of observed specimens and in the distribution range of the species in the park area, is undoubtedly the result of the specifically-designed interventions carried out to establish suitable habitat trees for the species. For example, in one of the areas



The creation of suitable habitat trees for *Rosalia alpina* led to surprising results, especially in areas involved in the project where dead beech trees, either standing or on the ground, were completely absent. Thanks to the project, numerous specimens of the species were found in all monitored stations in the National Park of Tuscan-Emilian Apennines and in three adjacent areas, where the interventions were carried out.

the two sites of the Natura 2000 Network for which the presence of the species had already been reported, and a third one from a site of the Natura 2000 Network where the species had never been sighted. The *Citizen Science* campaign continued also during 2021, organized by Emilia-Romagna Region and extended to the whole regional project area; this additional monitoring phase did not produce additional results for the Western Emilia Macro-area. Here too, occasional reports, always related to individual specimens, seem to suggest the scarce occurrence of residual populations.

In the National Park of Casentinesi Forests, Mount Falterona and Campigna, the *ex-post* monitoring showed a considerable increase in the occurrence of *R. alpina* compared to the initial monitoring, both in terms of the number of found individuals, number of stations and their distribution. During the preliminary surveys of the project, the species had shown its occurrence in all the four sites of the Natura 2000 Network being surveyed in the north-eastern area of the Park, in eight out of eleven monitored stations, but not always with many individuals; in these sites the species was already known, even before Life Eremita. With the *ex-post* monitoring, thanks to the forestry operations aimed at increasing the amount of suitable deadwood, the species was found with many specimens spread out in all the eleven stations monitored

where dead standing or felled beech trees were completely absent, and the species had never been observed, a male *R. alpina* was found only eight months after the creation of the deadwood. Moreover, this confirms that the main obstacle for the conservation of the species is the extreme scarcity of deadwood and old trees, caused by past and present forest management.

In the location of the Central Emilia Macro-area, the few reports of *R. alpina*, both historical and recent, have referred to sites in the Upper Modenese Apennines, but they are sporadic and always about individual specimens; this suggests that these are now residual populations. These reports refer to four areas included in two sites of the Natura 2000 Network. The *ex-ante* monitoring, despite the considerable effort being made and the high number of monitored areas, did not lead to new findings of the species. In the *ex-post* monitoring phase as well, there were no new findings of *R. alpina*; this seems to confirm the extreme rarity of the populations in this area. However, the reports from the Emilia-Romagna Region database have made it possible to identify areas where interventions for the establishment of habitat trees could be carried out. The monitoring of these trees will continue in the *After-Life* phase, in order to assess whether in the future the artificially-created deadwood will become a suitable habitat for *R. alpina*.

In the Western Emilia Macro-area, *R. alpina* is reported in five different sites of the Natura 2000 Network, but these reports date back to almost thirty years ago. In the *ex-ante* monitoring phase, despite the efforts made and the high number of surveyed areas and plants, the occurrence of the species was not confirmed. During 2020, the Western Emilia Macro-area organized a *Citizen Science* campaign, in order to possibly collect reports of the species' occurrence, as in effect it did so: three reports were validated, two confirming

MARTINA BIANCHI



ABOVE The *ex-post* monitoring to assess the effectiveness of the restocking and reinforcement of *Osmoderma eremita* in the National Park of Tuscan-Emilian Apennines. The monitoring actions were often flanked by the dissemination of information about relevant phases of the project.

from amateur photographers and hikers.

In the Eastern Emilia Macro-area, *R. alpina* was found for the first time during the *ex-ante* monitoring in a station in the Natura 2000 site of Corno alle Scale. No historical reports are known for the area. Through the creation of suitable habitat trees and deadwood, the species was subsequently found, just after few months from the forestry operations, in four other stations of the same Natura 2000 site, however with only few adult specimens. The available data confirm the rarity and localization of the species in the Eastern Emilia Macro-area, with the site of Corno alle Scale, and in the Central Emilia Macro-area, with the Frignano Park.

Hermit beetle, *Osmoderma eremita* (Scopoli, 1763)

In the National Park of Tuscan-Emilian Apennines, *Osmoderma eremita* has been reported in the data forms of two sites of the Natura 2000 Network. However, these reports are very old, one from 1985 and the other from 1995. A survey campaign organized by the Park before the start of the project, expressly set out to search for *R. alpina* and *O. eremita*, did not confirm the occurrence of the species in the two sites, although it found the species in another site of Community importance, where the species had never been reported before. The *ex-ante* monitoring campaign reported a considerable increase the number of reported individuals and the areas of occurrence; in effect, *O. eremita* specimens were found in six different areas, distributed in three sites of the Natura 2000 Network.

The *ex-post* monitoring of the nest boxes, which followed the activity of restocking and reinforcement, found stably-settled *O. eremita* populations in seven new areas distributed in four sites of the Natura 2000 Network. These areas are in addition to the other six detected during the *ex-ante* monitoring. Also, the *ex-post* monitoring, carried out in the areas of ascertained occurrence of the species, where it was possible to carry out interventions for the establishment of hollows in trees, revealed a significant increase in the number of detected specimens. The *ex-post* monitoring showed a remarkable increase both in the distribution area of the species and in



GIOVANNI CAROTTI

RIGHT The larvae of *Osmoderma eremita* from captive breeding of the species were essential to increase its occurrence in the areas involved in the project. The release of the specimens was carried by placing individuals inside the *Wood Mould Boxes*, wooden containers installed at a height of 4m and filled with a mixture of mould and beech litter for the feeding and reproduction of the species.



Osmoderma eremita is a beetle living inside hollow trunks in mature broadleaf woods, in tree stands and in old rows of trees, including topped ones. Despite its inconspicuous appearance, in the eyes of entomologists it has an irresistible charm probably due to the extremely elusive behavior of the species.

the number of extant individuals. However, it must be pointed out that in the Park territory, the occurrence of the species is at the moment limited to chestnut woods with veteran trees with well-developed, wood mould-rich, hollows.

In the Central Emilia Macro-area, *O. eremita* has been reported in the data forms of three Natura 2000 Network sites; moreover, in the database of Emilia-Romagna Region two sightings were reported in 1997 and 2000, in an area of the Regional Park of the Upper Modenese Apennines. The *ex-ante* monitoring did confirm the presence of the species in the same site, outside the Natura 2000 Network site, where the species had never been reported before.

The *ex-post* monitoring of the nest boxes, aimed at assessing the effectiveness of the restocking and reinforcement activity, found populations of *O. eremita* living stably in five new areas, distributed in four sites of the Natura 2000 Network. Also, the *ex-post* monitoring, carried out in one of the sites where the occurrence of the species was ascertained and it was possible to carry out interventions for the creation of hollows on trees, reported an increase in the number of detected specimens. As regards the Western Emilia Macro-area, *O. eremita* was reported in the data forms of two Natura 2000 Network sites, and the *ex-ante* monitoring confirmed the occurrence of the species in one of the two Natura 2000 Network sites, with an additional reporting in the Regional Park of the Cedra and Parma Valleys.

The *ex-post* monitoring of the nest boxes, carried out to assess the efficacy of the restocking and reinforcement activity, found stable *O. eremita* populations living in five new areas distributed in three sites of the Natura 2000 Network.

In the territory of the National Park of Casentinesi Forests, Mount Falterona and Campigna, *O. eremita* is widespread, both in beech and in old chestnut woods, because here there are mature forests rich in veteran trees with well-developed hollows. The species is therefore reported in almost all the data forms of Natura 2000 sites of the park, and in the regional database it is reported in thirteen areas. The initial monitoring campaign detected the occurrence of the species in five of the ten sampled stations belonging to three Natura 2000 Network sites, but also in two stations where it had not been previously reported. The *ex-post* monitoring of the nest boxes, to assess the validity of the restocking and reinforcement activity, made it possible to find the species in all eight areas included in the two Natura 2000 Network sites, where the boxes were placed and the hollowing of trees and the restoration of old, already hollowed trees were carried out. The *ex-post* monitoring, carried out on the baited traps in the same areas with the *Would Mould Boxes* (WMB), detected the species in six stations, and in three of these with a conspicuous population, showing an enlargement of the distribution of *O. eremita* compared to the initial phases of the project.

The *Wood Mould Boxes* are wood containers, similar to nest boxes, made of oak wood with a hole at the front and a plastic tray placed at the bottom to keep the right level of humidity.

In the Eastern Emilia Macro-area, *O. eremita* was reported in the data forms of the Natura 2000 Network only for the site corresponding to the Park of Suviana and Brasimone Lakes. In the database of Emilia-Romagna Region, there were also five reports, three of which for the Bolognese flatlands in recent years. The *ex-ante* monitoring confirmed the occurrence of the species in the site of the Park of Suviana and Brasimone Lakes for two stations, one of which is new. The *ex-post* monitoring of the nest boxes, aimed at assessing the effectiveness of the restocking and reinforcement activity, found *O. eremita* settled in seven areas, six of which new, distributed in five sites of the Natura 2000 Network. The *ex-post* monitoring, carried out with baited traps in the sites where tree hollows were created, detected the occurrence of the species in two areas of two different Natura 2000 Network sites, and in one of these with a good number of specimens.

In the Romagna Macro-area, the *O. eremita* species was reported in the data forms of three sites of the Nature 2000 Network, but for the Vena del Gesso Romagnola only in its urban portion, while in the regional database the reported data go back to over thirty years ago, with at least other twelve locations outside the Natura 2000 Network. The *ex-ante* monitoring confirmed the occurrence of the species in several stations of the Natura 2000 Network sites, and produced reporting for two other new sites of Community importance, “Alta Valle del Torrente Sintria” and “Bosco della Frattona”, besides the other four areas outside the sites. The *ex-post* monitoring in the nest boxes (WMB), in order to assess the validity of the restocking and reinforcement action via the *in-situ* breeding, confirmed the occurrence of the species in stable settlements in eight new stations within four Natura 2000 Network sites, where interventions were carried out for the opening of hollows in trees and the restoration of already hollowed-out plants. The *ex-post* monitoring through the use of baited traps confirmed the presence of the species in the same sites, in at least four areas, and in two of them with a conspicuous population.





BELOW *Rosalia alpina* on a habitat tree.



FABIO SAVINI

NEST BOXES - WOOD MOULD BOXES

The *Wood Mould Boxes* (WMB) are artificial wooden boxes that mimic the hollow of a tree and are filled with a mixture suitable for the reproduction of the species. These structures are similar to bird nest boxes, shaped as a 70cm-high, 40cm-wide and 30cm-deep parallelepiped with a wood thickness of 3 cm. The walls of the WMB are made of oak wood and assembled with nails, screws or joints, without the use of glue. The above-mentioned dimensions are the minimum, and larger dimensions would be better, but a compromise had to be reached between the optimal size and the manageability of the boxes. On the front side, there is an inlet hole with a diameter of 50 mm. The upper side of the box (roof) can be opened for controls and is protruding on all sides by 1 cm. The possibility to insert a partition made of transparent plastic (polypropylene) to allow the observation of the activity inside has been contemplated as an experiment. This transparent panel should be in any case covered by an additional outer wood partition, which could open outwards. One or more holes (10 mm diameter) are drilled on the wooden roof to let rainwater in. In order to facilitate moisture retention, a 13cm-high plastic tray in the exact size of the cavity is placed inside at the bottom of the box. The WMBs have been installed on trees at a height of about 4 m, to avoid possible damage from grazing or wild animals, as well as vandalism.



ROBERTO FABBRI

ABOVE Mounting a *Wood Mould Box* on a tree.

The Hermit Beetle and its chestnut woods

When beauty, biodiversity and folklore merge together

by *David Bianco*

The Municipality of Camugnano houses one of the most evocative chestnut woods of our Apennines in the locality of Porranceto. The area is part of the Regional Park of Suviana and Brasimone Lakes and it is no coincidence that one can find there a very good visitor centre devoted to forest management and mountain economy.

One of the most evocative areas of the Region's Apennines are certainly the old chestnut woods, strips of "forests" scattered across the mountain areas. One of the most spectacular chestnut woods in the Bolognese area can be seen in the Municipality of Camugnano, in the locality of Porranceto (sometimes also called Porancè), inside the Regional Park of Suviana and Brasimone Lakes and the eponymous Special Area of Conservation (SAC) IT4050020. The area is also provided with a great visitor centre devoted to the traditional forestry management and the mountain economy that depended on it.

It is difficult to remain indifferent when looking at these monumental trees, with their imposing and perhaps hollow trunks, with the fairy tale atmosphere that these large trees evoke, making us travel to an unreal and magical dimension. Children grasp this atmosphere immediately and see in those trunks the same majestic silhouettes so expertly evoked by cartoons, books and films: here, at last, they can hide and chase each other among these giants, as if they were a magical playground. And nothing there is made of plastic or is virtual ...

On closer inspection, these wonderful chestnut woods are only apparently a natural forest: the trees are instead the result of a long process. It was human action that picked and transformed a tree originating from faraway places: the trees were chosen for their purposes (nuts, chestnut flour, preservation, etc.), were taken care of, planted in the most suitable spots, grafted and pruned for a specific aim, the harvesting of a once-essential crop. It is not by chance then that in these areas the chestnut was once called the "bread tree".

The social history of the chestnut tree is a matter of great importance for the mountain areas of the entire Apennines range, an area where other forms of agricultural production were severely curtailed by environmental factors. These large trees are a living proof of the importance that chestnut production had in the past, perhaps hinting and pointing at new possible destinations and management approaches. The different types of chestnuts, linked to the place of production, could have a strong appeal for people visiting the woods for their natural beauty, besides providing other products associated with the presence of chestnut groves - including in particular a very special timber, which is naturally resistant to weathering, and the production of minor fruits and other niche foodstuffs, like dark honey.

Besides the above-mentioned reasons why chestnuts woods should be preserved, especially the old-growth ones, due to their beauty, historical, testimonial and production importance, there is another one: their extraordinary importance for biodiversity and, more generally, their supplying the increasingly-mentioned

“ecosystem services” (hydrogeological defence, climate change mitigation, etc.) for our natural and semi-natural environments.

The Hermit Beetle of the chestnut woods

The robust and shiny Hermit beetle (*Osmoderma eremita*), discreet as no others and almost invisible, has continued to inhabit our chestnut woods, seemingly undeterred by the post-war economic boom that has profoundly transformed the Apennines range. Generation after generation, it has not retreated: it has “held its ground” until today in the large chestnut trees of Porranceto, largely neglected due to the very low economic value these woods have enjoyed in modern times.

Its occurrence in this area of the Upper Bolognese range, quite difficult to detect, was identified only in the 1990s, thanks to specialized entomologists, thus confirming the absolute importance - at European level - of this arboretum stretch. Fortunately, since then, the protection of the Park and the Natura 2000 Site has curtailed intrusions on this habitat and its dwellers to a minimum: the chestnut trees - more for aesthetic-testimonial reasons than for their naturalistic value - have offered a safe passage, so to speak, to the population of the Hermit beetle in the Camugnano area. Let us recall again that the Hermit beetle is for us a “flagship species”, namely the chosen representative of a long range of invertebrates which develop in rare and little disturbed environments and require multi-year cycles: a biodiversity component which is functional to the completion of the cycles in more mature environments. In my opinion, this is the spirit of the 1992 Habitats Directive: namely, identifying an “umbrella species” like our beetle, which exemplifies, on the one hand, a specific category (invertebrates inhabiting large hollows in living trees), and on the other hand, determines the protection of a complex habitat, with undoubtedly possible benefits for other saproxylic insects, fungi, protozoa, molluscs, flatworms and, of course, veteran chestnut trees.

The adult of *Osmoderma eremita* has a stocky body with a beautiful shiny leather colour. Extremely elusive, to the point of being almost invisible, it is considered a “flagship species” or, so to speak, the chosen representative of many other species of invertebrates needing rare and little disrupted environments to develop.





DAVID BIANCO

ABOVE The areas involved in the Life Eremita are identified by signs reporting objectives and methods of the actions; this is why many intervention stations were placed along trails or near visitor centres.

Conservation actions for the Hermit beetle in Porranceto

As previously mentioned, in view of the threat to *O. eremita*, and thanks to the LIFE Project, two main specific conservation actions were designed:

- Actions C.1, for the conservation and improvement of living habitats, by performing thinning on the forest area and working on the habitat trees;
- Actions C.3, envisaging the placement of specific artificial wood nests (Wood Mould Boxes or WMBs) where the species was released/restocked, by using larvae from the *ex-situ* breeding established during the project, starting from local specimens.

In our case, in Porranceto, the conservation action took place as follows.

Action C.1 – Interventions regarding Thinning around the habitat trees and the trees with WMB: the objective of the intervention was to increase the structural complexity of the forest stands and provide the habitat trees with better sunlight exposure. This is a selective felling aimed at creating openings for sunlight and favouring habitat plants over competing ones. The selective felling involved an area of approximately 2,000 square metres.

Action C.1 – Creation of hollows in trees: in order to establish future habitat trees, hollows, which would expand with time, were made on trees with a suitable diameter; special drills and chainsaws for tree surgery were used to create hollows, by avoiding as much as possible water stagnation, and providing a good sunlight exposure.

Action C.3: placement of WMBs: the intervention consisted in the installation of seven WMBs, special shelters made of seasoned wood and built for all the project partners. They mimic a large cavity and contain an artificial substrate (a previously well-seasoned mix of beech wood pellets and horse manure) which would be suitable for oviposition and reproduction. Like bird nest boxes, they are 70cm-high parallelepipeds with a base of 30cm, ensuring a capacity of about 60 litres to be filled with the above-mentioned substrate; the 5cm entrance hole is protected by a net to prevent the entrance of birds and small mammals. The boxes, placed at a height of about 4m to avoid any damage, are placed near habitat trees with hollows, or on artificially-created habitat trees; they are installed by means of galvanized steel wires anchoring them to the trunk or large branches, so that they can be adjusted and adapted over time. During the spring these boxes were stocked with larvae from the *ex-situ* breeding.

These interventions, designed and allocated in 2019, were carried out and completed in the winter of 2020.

RIGHT During the selective cutting operations, the resulting material was used to make woodpiles: these stacks are intended to benefit saproxylic fauna and flora and, more in general, minor fauna (amphibians, reptiles, small mammals). In addition to enriching the biodiversity of the chestnut forest, over time these stacks will contribute to humification processes, a perfect example of the “circular ecology” of our forests.



DAVID BIANCO



MARIA VITTORIA BIONDI

ABOVE The visitor centre of Porranceto.

The “Life Eremita Effect”: doubts, problems and new projects

The implementation of the LIFE interventions in the chestnut woods of Porranceto had two important effects: the awareness of the threats in a habitat of extreme value and the urgency to activate new projects, going well beyond the LIFE scope.

The first consequence was, in effect, the highlighting of evident and in some way “subtle” critical issues found in this semi-natural habitat protected by the European Union, and immediately after that the urgency to act: while we were planning the first intervention, guided by the monitoring which had confirmed the occurrence of the Hermit beetle in the magnificent veteran trees, we observed with increasing concern the rapid progression of their decline. Many trees now appeared to be definitively overpowered by the wild young chestnut trees and were visibly losing vitality; strong storms then brought about the fall of the most battered ones, with a resounding domino effect, harbinger of a dramatic future.

We have wondered, therefore, what would be left in five or ten years, and whether there still will be a habitat for the Hermit Beetle (and its companions). Doubts have emerged because passive protection seemed totally inadequate in this case: will what we are doing in the LIFE project really be enough, as we are focusing only on publicly-owned lands? How can we extend the area of intervention to private entities? In brief, we have realized that this area could be no longer left to “free evolution” so dear to naturalists, although in many instances it has worked quite well and does not cost practically anything.

By taking advantage of a large chestnut tree fallen to the ground, we have brought to the site our administrators, experts and colleagues. We have paused to look at the veteran tree lying on the ground, reflecting on the fate of the surrounding specimens and imagining the effects of a long-term abandonment. At that point, the destiny of the majestic chestnut woods seemed unavoidable, lacking an intervention that cannot be limited to the area we control.

Unfortunately, the area was fragmented into a myriad of private properties, and this made any plan quite difficult to implement. Many landowners lived far away, others were not interested, some were sentimentally attached to the trees, but no one was able or willing to take action. We had to do something and the opportunity was provided by a call of the 2014-2020 Rural Development Program (RDP) under operation 8.5.01 “Investments aimed at increasing the resilience and environmental value of forest ecosystems”.

After a few preliminary checks, in 2019 we called for a meeting held in the premises of the City Council of Camugnano, inviting all the owners of the critical area in order to explain our idea, consisting in taking action to save the chestnut trees of Porranceto. No one was against it in principle, but we needed to reach a formal agreement: we would carry out the project (co-financing it) and they would let us do it at no cost for them. Let’s try, then, to save the great chestnut trees, which have become an accidental rescue ark for the Hermit beetle!

BELOW Larva of Hermit beetle.



DAVID BIANCO

After many discussions, clarifications and negotiations, we put together a surface area meeting the requirements of the RDP and we set to draft a proposal consistent with the call: the application involved more than 6 hectares, which is more than thirty times the area originally participating in Action C1 of the Life Eremita project, which, as previously mentioned, had to be limited to publicly-owned lands and was about 2,000 square meters around important habitat trees. The project was called “Conservation of the century-old chestnut woods of Porranceto”.

In the winter 2020/2021, we started our work: we selectively sacrificed the wild, young and strong chestnut trees grown

DAVID BIANCO



ABOVE The project was a time to reflect on the complexity of forest ecosystems and the importance of elements such as xylobiont insects associated with veteran trees.

BELOW The nest boxes contain an artificial substrate where *Osmoderma eremita* larvae may develop. Periodically, when checking the boxes, this organic material must be supplemented.



DAVID BIANCO

since the 1960s in competition with the veteran trees, and lightened the latter's burden with careful pruning and suckering. At this stage, the project had not foreseen the creation of artificial hollows on the tree trunks or the positioning of other nest boxes, but it succeeded in restoring many chestnut trees that are habitats for *O. eremita*, other saproxylic organisms and many other species of conservation interest (for example, bats, avian species, etc.). We knew that this was a delicate intervention and that everyone was watching us: we asked several specialists of chestnut and old-growth trees to support us, to give us advice and accompany us in making difficult choices. The implementation of the RDP project and some ancillary interventions cost over 68 thousand euros. In the late spring of 2021, the Hermit beetle, whose larvae were deposited in the project WMBs, flew among the century-old veteran trees.

The Beetle of the future ...

As of today, the old chestnut trees that are the habitat of the Hermit beetle seem to have reacted well to the mix of LIFE interventions and the RDP project: the new sunlight exposure has given them back their vitality and prospects, while the larvae of *O. eremita* carry out their cycle in the natural hollows and in the quite visible wooden boxes we have hung up. Visitors to the Park stop to read the signs dedicated to this mysterious insect that has chosen - perhaps out of necessity - this magical corner of our Apennines.

On behalf of the Management Authority for Parks and Biodiversity in Eastern Emilia, we must admit that without the Life Eremita project, we would not have succeeded in doing what we did in this delicate area: we would not have seen neither the need, nor the reasons why; we would not even have had the courage! If we did act, it is mainly thanks to the small and discreet Hermit beetle, the standard-bearer of tiny but essential biodiversity.

Involving private individuals, using complex calls such as those of the RDP, risking failure did certainly make sense: the large chestnut trees now seem to have forcefully resumed their journey into the future; and they are already hundred-years old! In the coming springs, seeing them with new green growth after the winter, we will be able to continue to imagine and, if lucky, see the close relationship between them and this strange insect that communicates with an intoxicating peachy scent. In conclusion we can say that undoubtedly we have become great friends with this solitary beetle, a guest of honour of the old chestnut trees.



FRANCESCO LEMMA

Beech forests for Rosalia

Interventions for the conservation of *Rosalia alpina*

by Davide Alberti, Giovanni Carotti,
David Bianco, Roberto Fabbri,
Fausto Minelli, Francesca Moretti
and Willy Reggioni

BELOW The National Park of Casentinesi Forests, Mount Falterona and Campigna plays an essential role in protecting the habitat of *Rosalia alpina*. The veteran beech forests found in the Park and characterized by large dead or decaying plants left *in situ* provide for a suitable environment for the biological cycle of *Rosalia alpina*.

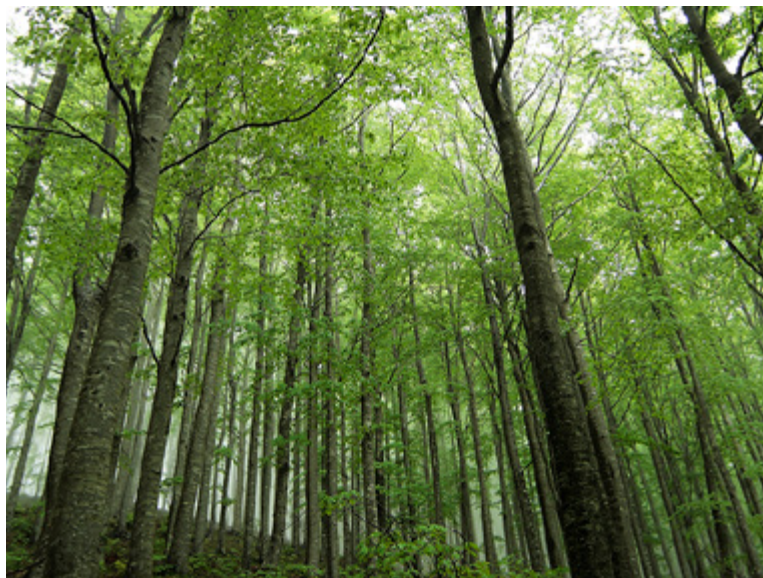
Rosalia alpina is the symbol of the beech forests in the Apennines, which in the region follow one another, in a *continuum* between the national and regional protected areas under the control of the institutions involved in the Life Eremita project.

The National Park of Casentinesi Forests, Mount Falterona and Campigna also protects the forest of Sasso Fratino, the first Integral Nature Reserve established in Italy in 1959, and an area of the State Biogenetic Forests, the so-called Casentinesi Forests, which represent one of the largest old-growth forest complexes in Europe. In 2017 it was recognized as a UNESCO World Heritage Site and became part of the site comprising the most valuable European beech forests. Overall, the territory of the Park represents an important habitat of *R. alpina*: in the context of *ex-ante* monitoring actions, the species was found in all the transects being carried out and on many habitat trees, mostly located along ridges where decaying plants suitable for its colonization are often found, thus confirming a relevant population with a fairly uniform distribution.

In the National Park of the Tuscan-Emilian Apennines, as well as in the beech forests of the Western, Central and Eastern Emilia Macro-areas, forest management has been characterized - in the past and still now - by an approach geared toward production in privately-owned lands, while in publicly-owned lands the focus was on naturalistic management. However, even in the latter case, the forest stands are young and almost completely devoid of dead wood as they were heavily exploited till recently. For these reasons, there are no old-growth forests even when state-owned forests have not been used for decades. Coppice systems, for the production of firewood, are still the prevailing management solutions on privately-owned land; therefore, even in the case of so-called “aged” coppice, the age of the suckers is particularly modest. The focus on production has therefore greatly reduced the presence of habitat trees, which are limited to old-growth saddles, large beech trees at the edge of pastures, or plants placed in patches of sparse forest on steep slopes, left standing due to the excessive incline.

The presence of *R. alpina* was found in three areas located in the central and southern parts of the National Park of the Tuscan-Emilian Apennines, where the species had not been previously reported. It appears instead to be completely missing in the northern area of the Park, bordering the territory of the Western Emilia Macro-area, where the situation seemed even more critical, as it resulted completely absent during the *ex-ante* monitoring phase.

In the Bolognese area, the beech-wood area taken into consideration was the one of the Regional Park of Corno alle Scale, inside the eponymous SAC-SPA, a wide mountain area in the Municipality of Lizzano in Belvedere. reaching an altitude of almost 2,000 m above sea level, with a large state property and several collective properties characterized by beech woods and, secondarily, by old conifer reforestations. At the drafting of the LIFE project there was no information available on the presence of the species: the few reports





GIORDANO GIACOMINO

ABOVE The *ex-ante* monitoring actions of Life Eremita focused on the detection of *Rosalia alpina* on transects and habitat trees mostly on ridgelines, and consisting in mature and decaying plants best suitable to colonization by the insect.

BELOW *Rosalia alpina* on a beech tree with ring-barking made to create habitat trees.



DAVIDE ALBERTI

referred to places near Corno and surveys have actually confirmed its occurrence through the characteristic holes on habitat trees and the finding of some specimens. In the territory of the Central Emilia Macro-area, the few reports of *R. alpina*, both historical and more recent, refer to sites in the Upper Modenese Apennines, but they are sporadic and always referring to a single specimen. In the regional database there are, however, few reports of the species relating to the area, and this has made it possible to identify intervention sites in the beech forest.

For the territory of the Western Emilia Macro-area, *R. alpina* is reported in 5 different sites of the Natura 2000 Network, but these reports date back to almost thirty years ago. In the *ex-ante* monitoring phase, the species was not confirmed, despite the efforts made and the high number of investigated areas and plants.

Finally, in the territory of the Romagna Macro-area, in two sites of the Natura 2000 Network around Forlì, the initial monitoring of 2016 did not confirm the presence of the species.

Once having defined the status of *R. alpina* in the specific territories, in the cases in which the occurrence of the species was found during the *ex-ante* monitoring activity, the institutions have adopted various strategies of action, defined on the basis of their specific context, in any case always starting from the assumption of the project to take into consideration a circular area with a radius of 3,000 m, therefore equal to the expected dispersal range of *R. alpina*, in order to obtain the maximum effectiveness of the conservation efforts and thus contribute to achieving the results of the project.

The National Park of Casentinesi Forests, Mount Falterona and Campigna has chosen as a priority to plan and carry out targeted interventions in areas where the species was not reported, or where the number of sightings was less frequent. Therefore, the interventions did not concern the heart of the Park, namely the State Nature Reserves, but were focused on the territory of the regional public property, managed by the Union of the Municipalities of the Forlì-Romagna area. The interventions were therefore aimed at consolidating, improving, and widening the distribution of the species towards secondary areas, without significantly modifying the tree crown cover. Moreover, the Park's strategy has been to reach agreements with the managing authority of the regional public property, in order to reduce



DAVIDE ALBERTI

ABOVE Partial ring-barking fostering the conservation of *Rosalia alpina*.

BELOW Ring-barking made with a chainsaw cutting all around the tree trunk.

fellings and encourage the undisturbed aging of the forest formations within the *buffer* area of the UNESCO site.

As regards the Tuscan-Emilian Apennines, beech forests, located in areas with an extension compatible with the dispersal capacity of the species, were chosen, by starting from the sites of ascertained occurrence, in order to choose the beech trees on which to intervene to create deadwood. Priority of intervention was given to state-owned areas and secondly to collective properties, in which efforts were made to speed up the regular evolutionary processes of the forest.

On the basis of the ascertained occurrence of *R. alpina* also in the Bolognese area of Corno alle Scale, the planning and implementation of conservation actions were then carried out, while the choice of the area fell on the state-owned property, except for three relevant stations under the control of a Consortium of leaseholders with which a specific agreement was signed. In Corno alle Scale all the different interventions envisaged for the conservation of the species were carried out.

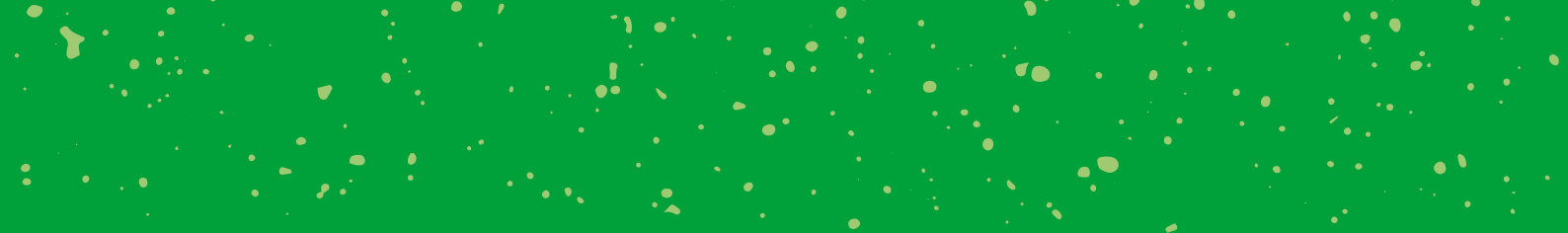
Finally, also in the case of the Central Emilia Macro-area, priority of intervention was given to state-owned areas and secondly to collective properties, while private-property areas were excluded. Precisely because of the extreme rarity of the species and the probable residual character of the populations present in the area, it was however decided to carry out interventions to create habitat trees, to ensure the survival of the species and provide the basis for its future expansion.

While referring for more information to the technical publication produced during the project (Moretti et al., 2018), in brief, the main interventions in the different project areas for the conservation of *R. alpina* were the following:

- ring-barking, or partial ring-barking, with chainsaw by removing the entire, or half of, the outer circumference of the trunk with two slanted and converging cuts;
 - creation of hanging dead trees, with a minimum diameter of 25 cm, obtained by controlling the direction of the fall so that the tree does not fall to the ground but leans against one or more nearby trees;
 - creation of upright broken boles, made by breaking the bole at a height of 3-4 meters from the ground, thus leaving a stump standing and the remaining portion on the ground;
 - construction of stacks, tripods and disposable stacks made with logs of at least 25 cm in diameter, in order to increase the deadwood on the ground in very sunny places.
- Different strategies within the LIFE project to reach a common goal: fostering the conservation of *R. alpina* and promoting a naturalistic and informed management of our forests.



DAVIDE ALBERTI



The Eremita effect

Changing paradigm through the synergy of LIFE, Structural and Regional funds

by Monica Palazzini and Cristina Barbieri

The relationship between the conservation of habitats and species, the specific objectives of the Natura 2000 Network and the development demands for agricultural, livestock and forestry activities is multifaceted, especially in an anthropic context such as the Emilia-Romagna Region.

Very often the critical elements are more emphasized than the *win-win* solutions, in which production activities effectively support biodiversity, especially in areas defined as inland, marginal and mountainous.

The scenarios that the Life Eremita project has provided to the participating *partner* institutions and as a consequence to local governments, technical staffs and businesses, have focused on management models of forests and inland freshwater marshes fostering the life of target insects, but more generally aimed at ensuring the complexity of the relationships between living organisms without hampering existing production activities.

Two meetings were organized around these topics: the first held in October 13th, 2020 “Driving forest environments toward ecological maturity through forestry interventions”; the second in December 1st, 2020, “Managing aquatic environments to benefit rare and threatened components of biodiversity” where the main actions of the project were presented, alongside their assumptions and replicability (<https://progeu.regione.emilia-romagna.it/it/life-eremita/temi/convegno-workshop/convegno-workshop-e-seminari-2020>).

Local authorities, the scientific community and companies have shared the need to operate within a broad and integrated strategy, where each component is part and parcel of a mosaic of interests to be safeguarded and balanced; components coming together in a clear design, intrinsically sustainable and long-lasting, for the conservation of biodiversity and careful management of ecosystems.

This *modus operandi* may find concrete application mostly through the integrated management of EU funds: the Life Natura programme supports actions for the implementation of the Habitats and Birds Directives, which through the Natura 2000 Network are the main instruments of the European Union’s policy for biodiversity conservation; also the Community Regulation n. 1305/13 for the support of rural development has identified the Natura 2000 Network sites as preferential areas for

the promotion of sustainable agriculture and the protection of biodiversity linked to agricultural and forest ecosystems. Actually, the Habitats Directive intends guaranteeing the protection of nature, by also taking into account “economic, social and cultural requirements, as well as regional and local characteristics” (Article 2) and recognizes the importance of some feature of the landscape which are of major importance for wild fauna and flora (art. 10). In Emilia-Romagna a significant share of the Natura 2000 Network is represented by agricultural and forest areas hosting habitats and animal and plant species of Community interest; hence, their management is also functional to conservation.

The regional Total Agricultural Area (TAA) of the Natura 2000 Network is 93,581 hectares and the Utilised

BELOW The Rural Development Programme – RDP - is a funding instrument used to carry out a series of interventions of sustainable forest management at regional level consisting in extending woodland areas and restoring disrupted ecosystems.

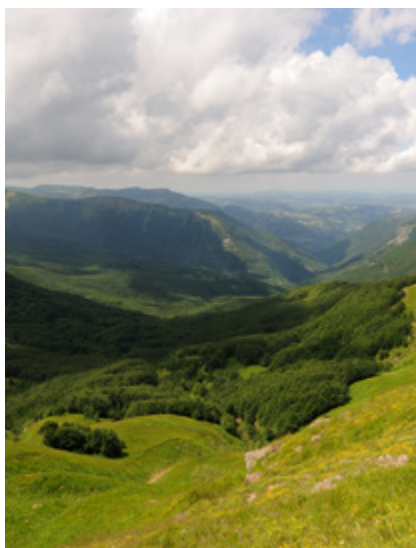


DAVID BIANCO



ABOVE The creation of woodpiles was made possible by Measure 8 of the RDP - Rural Development Programme. The increase in available deadwood on the ground is a very important asset for saproxylic organisms, i.e. those depending on the presence of decaying or dead wood for at least one stage of their biological cycle.

BELOW A breathtaking view of the Regional Park of Corno alle Scale, where some RDP actions were carried out.



SERENA MAGAGNOLI

Agricultural Area (UAA) is near 62,038.27 hectares. The Natura 2000 land area of Emilia-Romagna Region is equal to 266,285 hectares, therefore the UAA share in the Natura 2000 Network is equal to 23.29%, a significant and important share, even if below the national average (equal to 26.9%) (SIN-AGEA 2018). These areas therefore represent the privileged laboratories where the various financial instruments can be used in synergy.

The Common Agricultural Policy (CAP), envisaged since the 1957 Treaty of Rome, continues to be one of the major Community policies. In 2021, the CAP accounted for 33.1% of the EU-27 budget (55.71 billion euros) (CAP funding from the European Parliament). In the previous seven-year program, the

Regulation n. 1305/2013 envisaged the EU support for rural development, financed through the European Agricultural Fund for Rural Development (EAFRD). The Fund's implementation tool, the Rural Development Programme (RDP), includes, together with other measures, Measure 8, which provides for the activation of a series of actions for sustainable forest management in our region, aimed at increasing the forest surface, restoring disrupted environmental balances, reconstituting degraded stands, and increasing resilience as well as the economic value of forests. The opportunity of applying Measure 8 to finance additional projects in the Natura 2000 Network sites which had already been involved in habitat improvement schemes for the two saproxylic insects, *Osmoderma eremita* and *Rosalia alpina*, was seized by some Authorities which were the beneficiaries of the Life Eremita projects, in order to expand the scope of the project by carrying out additional interventions to increase the overall ecological resilience and efficiency of their forestry assets, to foster stock diversity and variability. This is the case of the Managing Authority of the Parks and Biodiversity of Central Emilia, which in four Natura 2000 Network sites (SAC/SPA IT4040002, SAC IT4030007, SAC IT4030010, SAC IT4030014) has invested in schemes to initiate high-trunk beech forest, by thinning out the surplus suckers with the release on the ground of the branches arranged in heaps or strips. The conversion of the coppice into a forest and the achievement of an uneven-age mix in the forest will favour the expansion of the distribution area of *R. alpina*. In addition, other interventions aimed at increasing the structural diversity of the forest, thanks to the structural and specific differentiation of the tree stands, will later lead to an evolutionary aging process fostering the establishment of more suitable habitats for *O. eremita*.

In the Eastern Emilia Macro-area, and in particular in the state-property forest of Lizzano in Belvedere, within the area of the National Park of Corno alle Scale and the Regional Park of Abbazia di Monteveglio, other implemented schemes within the scope of Measure 8 have widened the reach of the Life Eremita project through the setting up of several wood piles to increase the provision of deadwood mass.

The influence of Life Eremita on local administrations has made possible the involvement of some local entities, such as the Municipality of Monchio delle Corti (PR) within the Western Emilia Macro-area. In effect, thanks to a project aimed at the creation and diversification of chestnut woods micro-habitats, actions involving the clearing up of cultivated or abandoned chestnut trees were carried out, keeping dead trees on the ground in order to promote deadwood mass.

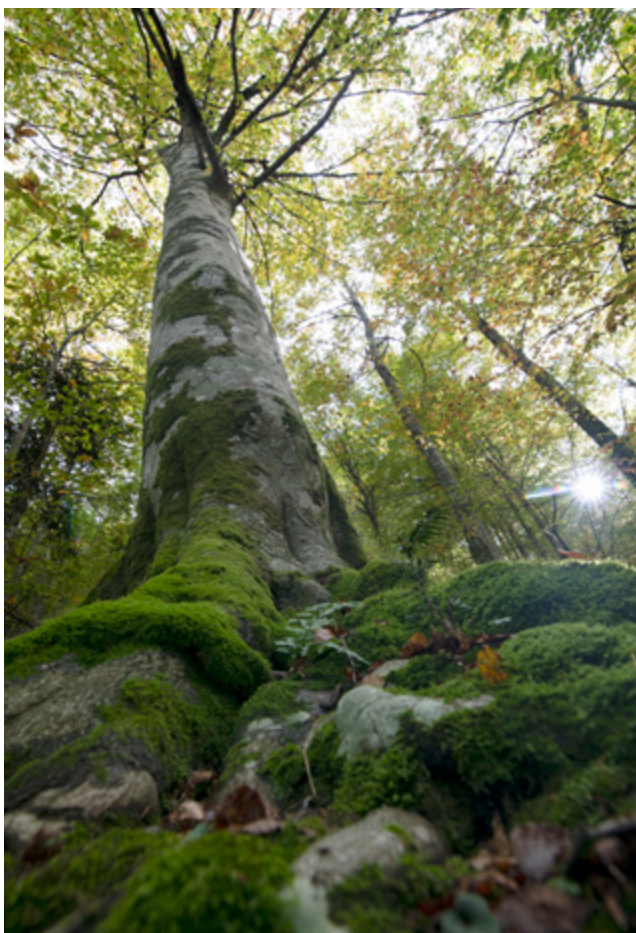
Other indirect results of Life Eremita have been found in the forest planning programme, financed in this case with regional funds and carried out through

FRANCESCO GRAZIOLI



ABOVE SAC Rupe di Campotrera, Rossena. The Management Authority for Parks and Biodiversity of Central Emilia has invested in four Natura 2000 Network sites by carrying out interventions to initiate full-standard beech forests.

BELOW A magnificent beech tree (*Fagus sylvatica*), photo taken in the Park of Casentinesi Forests, Mount Falterona and Campigna.



SERENA MAGAGNOLI

the implementation of specific conservation actions targeted to *O. eremita*, *R. alpina* and the main saproxylic organisms. Specifically, the programme outlines three forest management plans recently approved for the state-property forests of Lizzano in Belvedere (BO) and for the woods of Pievepelago and Piandelagotti-Maccheria (MO).

In these sites, the relationship between biomass and deadwood mass is not only being studied, but specific actions aimed at ecosystem maintenance are introduced, working in synergy with current forestry practices.

By means of bark-ringing, hollowing and the set-up of small deadwood piles, action has been taken precisely where excessive structural uniformity and the traditional removal of deadwood limit the availability of this precious element. For the first time, we are working to increase deadwood as a resource for the main decomposers (for the conservation of species of Community interest that are also primary indicators of the health of forest ecosystem), with the ultimate goal of developing and maintaining the long-term resilience of the forest system.

These measures, mapped, supervised and monitored by the Management Authority for Parks and Biodiversity of Eastern Emilia, have upended some misperceptions of forest management and have brought about a vision of the forest that is undoubtedly new, even for the ordinary hikers passing through the woods. The maintenance of rotting wood and veteran trees has become concrete, demonstrating the role and usefulness of the trees having suitable features to become habitat of species, for their size or hollows, even if dying, damaged, misshapen and lacking phenotype or mere commercial interest.

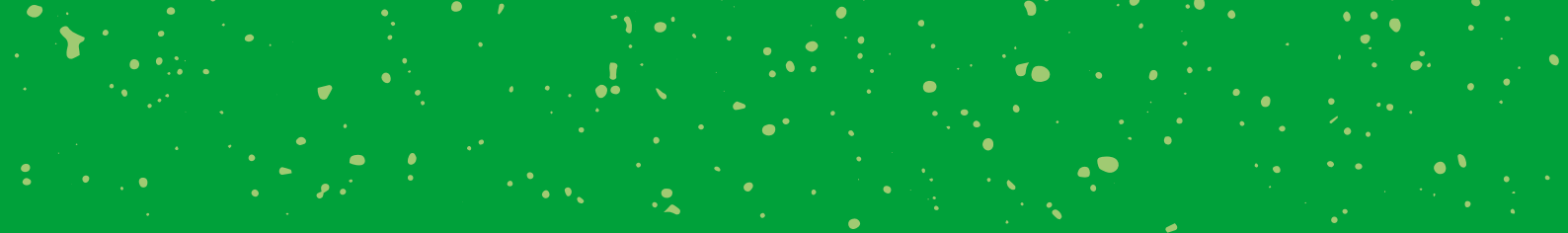
All this represents an investment for the benefit of the environment and the forest capital. Already in 2018, the consideration of the importance of deadwood for the component of biodiversity linked to it, as well as for the fertility of the forest, led to introduce in the forestry regulation of the Emilia-Romagna Region in art. 64, "General conservation measures in Natura 2000 Network sites for forests and other areas of forest importance". In art. 64 there is the obligation to leave at least three

dead or rotting plants standing per hectare, chosen among the largest ones. The presence of deadwood has thus become a real forestry parameter and not only a feature of forest habitats like, for example, old chestnut and wild beech forests.

Therefore, the actions of the project have certainly influenced the planning and design of further interventions that can be generally included in the implementation of an ecosystem vision of the forest. This has been possible also thanks to the integration with the Community structural funds, but in general a greater commitment and a wide and thorough information are surely necessary to promote the use of different financial instruments necessary to implement the conservation measures envisaged in the Natura 2000 Network.

The planning of the new funding period of the structural funds 2021-2027 must set ambitious goals in this sense; it must call for the harmonization of regional planning, enhancing territorial diversity, in order to promote maximum application to the conservation measures of the Natura 2000 Network. The PAF (*Prioritized Action Framework*), the framework of priority actions for the Natura 2000 Network for the planning of structural funds for the next period, approved by Emilia-Romagna Region at the end of 2021, and agreed with the various managing authorities of the different funds, is the complete guide of these actions.

We are counting on the fact that the virtuous experiences already implemented, for example, through the LIFE projects, can then be applied for the implementation of rural development measures, with priority to the Natura 2000 Network areas, but also with the ambition of finding application in the ecological network.



GIOVANNI CAROTTI



The Hermit's multiplication

Ex-situ breeding for the long-term conservation of *Osmoderma eremita*

by Roberto Fabbri and Giovanni Carotti

BELOW Breeding of *Osmoderma eremita* was carried out in the National Park of Casentinesi Forests, Mount Falterona and Campigna in a former icehouse, used in the past to store food. The reason was that it had low temperatures similar to those found in beech forests at an altitude of 1000m a.s.l. Many young volunteers followed and participated in the operations, and many school groups came to visit.

The isolation of the *Osmoderma eremita* populations is due to the sharp reduction of the habitat trees, alongside forest fragmentation, the length of the biological cycle of the species, and the modest mobility characterizing the adult specimens. All these elements represent serious threat factors contributing to strongly reduce the dispersion capacity and, consequently, the spontaneous recovery of the residual populations.

The program of *ex-situ* breeding and release *into the wild* is part of the wider conservation strategy developed for this species, which also includes *in-situ* conservation actions and interventions to improve and enlarge its suitable habitats in the regional territory.

The *ex-situ* breeding was necessary in order to have an adequate number of specimens for an effective release into the wild. In fact, it would have been difficult to find enough specimens, without running the risk of making excessive withdrawals, which might have compromised the conservation *status* of the source population. The production of specimens (larvae and adults) to be used for release, enables to increase the distribution of *O. eremita* at regional level, starting from the project sites, with subsequent natural and progressive dispersal of the species, due to the improvement actions on the surrounding habitats.

The *ex-situ* breeding methods have followed the techniques already tested by other researchers on similar species and applied the protocol specifically defined within the project. The breeding techniques are based on a battery of containers (large boxes, each one equipped with a card reporting the data of the hosted larvae) that simulate tree hollows containing mould and beech litter. The mould is produced in the laboratory by each of the project partners, inside large boxes where a mixture of beech sawdust, manure and peat, in pre-set quantities, is kept moist to mature for several months. For the breeding to start, it was necessary to find in nature a minimum number of adult founders, and also larvae coming from the project area. Breeding requires almost daily monitoring during the period of adult activity, and less frequently during the autumn-winter period. The objective is to obtain a large number of specimens (adults and mature larvae) to be used later in the wild for their release and reinforcement of existing populations, by taking into consideration the provenance of the founders and therefore the different ecological features of the project areas.

The breeding of *O. eremita* took place in three different facilities all in Emilia-Romagna Region, located at varying altitudes in order to mimic, as much as possible, the conditions of the founders' sourcing site: in the National Park of Casentinesi Forests, Mount Falterona and Campigna (257m a.s.l.), in the Romagna Macro-area (in the flatlands) in the National Park of Tuscan-Emilian Apennines (circa 900m a.s.l.). In the National Park of Casentinesi Forests, Mount Falterona and Campigna, the facility for *O. eremita* breeding is





MASSIMILIANO COSTA



ANDREA BONAVITA



ARCHIVE OF THE NATIONAL PARK OF TUSCAN-EMILIAN APENNINES

ABOVE The *ex-situ* breeding of *Osmoderma eremita* was carried out in three facilities in Emilia Romagna located at different altitudes, in order to maintain the founders under the same conditions of the sites of their capture.

RIGHT Larvae of *Osmoderma eremita* just taken from the breeding boxes to show one of the target species of the project to school children. The breeding facilities brought many people to fully grasp the role of these insects in forest ecosystems.

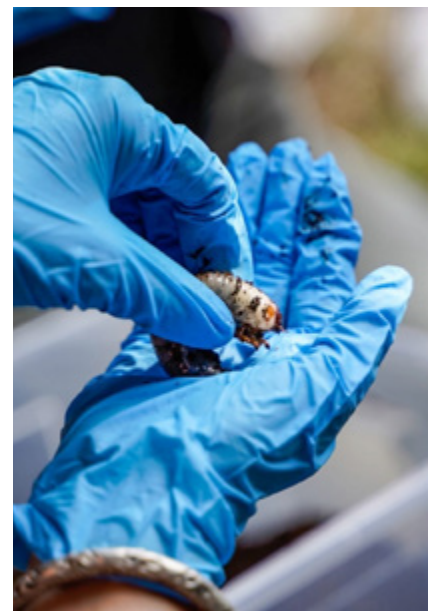
located next to the Park Community Centre, in the courtyard of the 19th-century Nefetti Palace in Santa Sofia (FC). In the past the facility, excavated from the rock, was used as an icehouse for the cold storage of food, and now has been renamed the “Hermit Grotto”. The decision to use the former icehouse was functional to the need to have an environment with temperatures constantly similar to those of mountain beech forests, around 1000m a.s.l. The works for the adaptation of the historical icehouse to the needs of the project consisted in the conservative restoration of the facility, equipped with an electrical system, running water and all the necessary equipment and suitable spaces to carry out the breeding activity. The breeding operations of *O. eremita* were managed by the technical personnel of the park, entomologists and volunteers participating in the LIFE project. The characteristic former icehouse, used as a breeding farm, was visited by many school children and many volunteers and young people engaged in the civilian service of the park, who have also participated in other activities within the LIFE project. The Santa Sofia breeding farm reproduced the species for both the National Park of Casentinesi Forests, Mount Falterona and Campigna and partially for the Central Emilia Macro-area. From the adult founders taken from the beech and chestnut forests in the Park between 2017 and 2018, 1112 specimens (899 larvae and 213 adults) of *O. eremita* were obtained. In the Park, 849 larvae and 213 adults were released in the nest boxes (*Wood Mould Boxes*), created specifically for the species and placed on trees, compared to the 350 larvae and 70 adults originally planned for the project. Another 50 larvae were released in the Central Emilia Macro-area. The second breeding centre of *O. eremita* of the Life Eremita project was set up by the Management Authority for Parks and Biodiversity – Romagna, at the operational facilities of the Aquae Mundi association, located in Russi (RA) and working for awareness-raising and conservation of smaller fauna.

Two rooms were set for the breeding, one for the management of the specimens (eggs, larvae and adults) in the period of activity going from spring to autumn; the other for the winter break period of the larvae which were placed in a cool environment, without sudden temperature changes. The area for insect management was placed inside a larger room with light and temperature monitoring devices and equipped with a workstation for operators and all the necessary equipment and several boxes suitable for breeding. The activities were managed by the technical personnel of the association, an entomologist and volunteers participating in the project. The facility has also an area with museum exhibitions and rooms equipped for environmental education activities for visitors and schools.

The Romagna breeding facility produced larvae and adults *ex situ* for its Macro-area and the Eastern and Western Emilia areas. The adult founders, and some larvae, were taken in the wild mainly in 2017 and from those 2114 specimens (1743 larvae and 371 adults) were bred.

In Romagna, 1132 larvae and 225 adults were released in the nest boxes, installed on trees and in suitable natural hollows of old chestnut trees, compared to the 270 larvae and 54 adults envisaged by the project. In Eastern Emilia, 347 larvae and 95 adults were released (compared to 230 larvae and 46 adults envisaged by the project). Finally, in Western Emilia 264 larvae and 51 adults were placed in nest boxes (compared to 130 larvae and 26 adults expected in the project).

The structure of Ligonchio (RE), located near the facilities of the National Park of Tuscan-Emilian Apennines, was specifically built for the breeding of *O. eremita*. It is a wooden structure, suitably insulated to create the best conditions for the breeding and reproduction of



EMILIA-ROMAGNA REGIONAL ARCHIVE



FRANCESCO GRAZIOLO

ABOVE *Osmoderma eremita*.

the species. The structure is divided into four communicating rooms, designed to meet various needs. The main room has the double function of teaching room for environmental education activities and workspace for entomologists and volunteers involved in the project.

Part of the partition walls of the room are covered with illustrated panels with information and images on the conservation status of the four species of insects included by the project, the threats that may locally compromise their conservation and the concrete actions being implemented to improve their conservation status. Pupils from visiting schools can therefore have access to this new teaching room, where they will meet the entomologists and park personnel, see “with their own eyes” how breeding takes place and learn more about the biology of these insects and their role in forest ecosystems. The main room leads to three smaller rooms expressly dedicated to breeding, where there are boxes with the specially prepared mould and eggs and larvae of *O. eremita* at different stages of development. The structure also hosted specific “cultural events” organized by the park to raise awareness and inform about the goals of the project. The breeding farm of Ligonchio worked as an *ex-situ* breeding centre both for the National Park of Tuscan-Emilian Apennines and the Central Emilia Macro-area. From the adults captured in the wild in the initial phases of the project, 744 specimens (610 larvae and 134 adults) of *O. eremita* were obtained. In the National Park, 380 larvae and 74 adults were released in the nest boxes on trees and plants with natural hollows suitable for the species, compared to 270 larvae and 54 adults envisaged by the project. In Central Emilia, 250 larvae and 60 adults were released (250 larvae and 50 adults envisaged by the project, 50 larvae came from the breeding of the National Park of Casentinesi Forests, Mount Falterona and Campigna).

The activity of the three facilities will not end with the closing of the Life Eremita project. In effect, alongside the actions of dissemination and environmental education, the breeding will continue in all three facilities. For this purpose, a certain amount of larvae has been retained in each breeding farm and will be bred until adult insects are obtained. The males and females bred in this way, mating with each other, will produce new larvae, which will continue the action of restocking and reinforcement of *O. eremita*. This action, together with the establishment of habitat trees specifically created during the project, will enable to further increase the distribution of *O. eremita* in the project area and more generally in Emilia-Romagna, thus favouring a subsequent natural and progressive expansion of the species. The continuation of breeding will also consolidate the conservation objectives of the species, partially compromised in the past by the loss of the network of natural environments suitable for its dispersal and settlement. The results obtained so far confirm the effectiveness of *ex-situ* breeding as a good practice in conservation projects. The breeding has also enabled us to deepen the knowledge on the life cycle of *O. eremita*, a knowledge that will be useful for additional conservation programmes.

BELOW Placing the larvae of *Osmoderma eremita* in the Wood Mould Box.



ROBERTO FABBRI



Actions for *Coenagrion castellani*

Interventions for habitat restoration and translocation of the damselfly

by Roberto Fabbri, Lorenzo Cangini,
Nevio Agostini, Gabriele Cassani
and Massimiliano Costa

BELOW Adults of *Coenagrion castellani* captured for translocation are marked on their wings. This step is essential to assess the outcome of the action. Thanks to the wing markings, in fact, the on-going monitoring of the specimens restocking new sites was made possible.

In order to assess the interventions for habitat restoration and the possible translocation of *Coenagrion castellani*, a preliminary monitoring campaign was carried out to verify the current distribution of the species in Emilia-Romagna. At the same time, a survey was also carried out to identify the waterways potentially suitable for hosting *C. castellani*. Based on the results of these exercises, a conservation programme was defined in order to expand the distribution area of the species in the region and strengthen existing populations.

In light of the historical and current distribution, which is extremely reduced compared to the past, and the low dispersal capacity of the species, it was deemed necessary to carry out concrete actions for its conservation: the restoration of environments characterized by moving - lotic - waters, to make them suitable for the development of the dragonfly and the subsequent translocation of the species, by taking the individuals from an abundant source population.

The restoration actions on the streams started from a scrupulous selection of suitable watercourses, through data collected from the *ex-ante* monitoring of the habitats, followed by interventions for vegetation control carried out during the winter period. The adopted criteria to identify the watercourses at regional level were the following: previous reports of the species; year-round water flow; chemical-physical and vegetational characteristics, for example whether the water course is not excessively shaded, or whether it is possible to mitigate the shading with appropriate actions; a distance not exceeding 3 km from the sites of the species' ascertained occurrence; preferably public control of the streams, in order to act with greater operational speed. With respect to the suitability of the habitat, represented by small streams, it should be stressed that one of the main limiting factors was precisely the excessive cover by the abundant tree and shrub vegetation, and therefore the shading.

The interventions were carried out three years ago, in some stretches of the selected streams, by cutting the trees in excess, delimiting and pruning the large trees, controlling the presence of reeds, and clearing/eliminating the shrubs, bushes and brambles, in order to increase insolation on the water and thus foster a high development of aquatic plants necessary to the biological cycle of the species. The operations of mowing and regrowth control for trees and shrubs were repeated annually and will continue with the *After-Life* project in the sections where there will be a greater regrowth of tree and shrub vegetation.

It must also be recalled that in the past the operations of vegetation control along the banks of the watercourses were carried out naturally and continuously by flocks and cattle going to the watering holes and, more historically, by the numerous herds of grazing wild animals; now the practice of sheep and cattle grazing in most of the foothills area of the Emilia-Romagna Region has been lost, or greatly reduced, and the watercourses have been choked by vegetation.





ROBERTO FABRI

ABOVE Adults to be released in other water courses were transported in suitable *fauna boxes* with some grass stems inside so that the insects could cling to the vegetation. The temperature inside the boxes was checked during the transfer to avoid thermal *shocks*.

During the *ex-ante* monitoring of the Life Eremita, water courses potentially suitable to host *C. castellani* were identified, together with the occurrence of the species solely in the Romagna area. The concrete conservation actions were therefore carried out only in the Romagna Macro-area and in particular in the Natura 2000 Network sites IT4070011 “Vena del Gesso Romagnola” and IT4090002 “Torriana, Montebello, Fiume Marecchia”.

The intervention plan in the Romagna Macro-area tried to encourage the creation of ecological corridors between the different sites where the species is present, in order to connect populations presumably not much in contact with each other, and thus create a network of streams suitable for the species.

For *C. castellani*, specific interventions were carried out in nine streams, potentially suitable to host the species, in Romagna, in five Municipalities and in two Natura 2000 Network sites, along stretches with altitudes ranging from 200m to 700m a.s.l. Some of these streams were already hosting *C. castellani* along some stretches, as reported in the *ex-ante* monitoring, but other large stretches of their course were in general not suitable, as they were too shaded by tree and shrub vegetation, and so we proceeded on those very choked stretches to create a continuity.

The translocation of *C. castellani* adults in suitable streams took place only in the years following the conclusion of the conservation measures on the concerned sites. The release of the specimens was carried out in the spring from May to June, according to the phenological pattern of the species and climatic conditions.

The number of specimens released into the individual streams was assessed case by case, according to the width of the suitable stretch, the environmental features, and the result of previous releases.

The translocation of the specimens took place only within the territory of Romagna, to exclude the risk of genetic pollution between distant populations; moreover, the sampling was conducted in very similar environments, with negligible altitudinal and phenological variations. In the last century, however, the various subpopulations of Romagna were probably connected to each other, as shown by the various historical sightings reported between the areas of Bologna and Rimini.

The species has a low dispersal capability and is typically sedentary, with short-range movements of adults, usually not exceeding 300m in open space. Moreover, in the hills these movements are further hindered by the presence of woods and rocky outcrops that make the population present in the Rimini area certainly isolated from that of the Vena del Gesso Romagnola.



ROBERTO FABRI

RIGHT Release of *Coenagrion castellani*.

ROBERTO FABBRI



Coenagrion castellani.


Through the release of adults in the streams made suitable by the project interventions, we wanted to reintroduce the species in the waterways where it had recently become extinct (reintroduction), while also replenishing the populations of those sites where the species was declining.

The two stations where the species was present in the Vena del Gesso Romagnola had very small populations (counted over the 2016-2017 period in a few dozens of adult individuals) and could not withstand a natural dispersal in other streams, or even the operation of taking specimens for translocation purposes. These stations with small populations underwent operations to foster greater environmental suitability along large stretches of the streams for subsequent restocking. The adults of *C. castellani* were transferred, by taking them from the “source population” of the Rimini site IT4090002, where several thousand individuals were present, as reported during the *ex-ante* monitoring. The adults were captured with an entomological net, marked on the wings as per protocol and then placed in large *fauna boxes* with grass stalks inside. In order to avoid excessive increase in temperature inside the containers, they were kept inside the carrier at a temperature similar to the one of departure, with checks at regular intervals in order to ensure the success of the restocking operation. Captured individuals were immediately transported to the new site and released, so that adults could rapidly disperse to suitable stretches of the waterway. Translocation activities were carried out in five streams in the Vena del Gesso Romagnola for a total number of 589 specimens. In the watercourses where the translocations took place, the species was subsequently monitored and in all of them the species’ settlement was confirmed the year after the translocation. At present, after the interventions carried out via the project, the species is established in nine streams with a fairly good population.



Actions for *Graphoderus bilineatus*

The restocking programme of the water beetle

by Cristina Barbieri, Ornella De Curtis, Giovanni Carotti, Roberto Fabbri, Francesca Moretti, Willy Reggioni and Monica Palazzini

The choice of *Graphoderus bilineatus* as the target species of the Life Eremita project was dictated by the need to take action to improve the conservation status of a species in critical condition and strong decline. In Emilia-Romagna, the conservation *status* of the *taxon* is inadequate and has been assessed according to the IUCN criteria as Critically Endangered (CR) in both the regional (Agnelli et al., 2010) and national Red Lists (Nardi et al., 2015).

In 2015, when the project application was presented, the distribution of the species in Italy was poorly known and limited to a small number of Natura 2000 Network sites. By analysing historical data, from the 1900s to 30 years ago, *G. bilineatus* was reported in some area in Piedmont, Lombardy, Trentino, Emilia-Romagna and Tuscany (Rocchi 2005; Mazzoldi, 2009; Mazzoldi et al., 2009; Nardi et al., 2015; Brandmayr et al., 2020), but at the time of the project candidature, the only station of ascertained occurrence in Italy was in Emilia-Romagna, in the Modenese Apennines.

Because of this situation and with the aim of knowing the real distribution of the species in the Region, never investigated in depth on a large scale, one of the first actions implemented by the LIFE project was a monitoring campaign carried out in environments potentially suitable to host the species, extended to almost all the regional territory.

The next step would have been to widen the distribution area, through a *captive breeding* programme, articulated in different phases: the collection of individuals in the sites where the populations were abundant, in order to establish breeding farms for the reproduction of the species, and, with the new-born specimens, the restocking of suitable areas scarcely inhabited by the species, or where the population had disappeared.

However, the results of two years of monitoring, carried out at regional scale in 2016 and 2017, showed that the originally designed plans were unfeasible. Therefore, the objectives of the conservation project had to be modified during the course of the project. Although the survey on *G. bilineatus* was developed on twenty-two Natura 2000 Network sites and, in particular, on one hundred and twenty-four water basins, the stations of historical occurrence of the species in the Emilia-Romagna territory were not confirmed, nor were new ones identified. It was possible instead to confirm that the only ascertained station of the species is in the Modenese Apennines. Moreover, further investigations carried out on this population showed that it was quite reduced in number and the few individuals sampled during the monitoring were not sufficient to determine its size. Therefore, as a precaution, the possibility of taking founders for *ex-situ* breeding from what was believed to be the only population still occurring in Italy at that time was excluded (Fabbri et al., 2018). In addition, the monitoring made it possible to confirm the threats causing the decline of the species; they are mainly: the eutrophication of aquatic environments (also due to livestock watering and grazing around the basins); water pollution; the spread of highly invasive alien species (such as the invasive decapod *Procambarus clarkii*), and the presence of predatory fish species, which can cause the disappearance of



ROBERTO FABBRI

Graphoderus bilineatus is a species in steep decline both regionally and nationally. During Life Eremita, in order to know the real distribution of the species in Emilia-Romagna, a monitoring campaign was carried out to find environments potentially suitable for the species, or with historical reports of its occurrence. The situation that emerged was rather worrying and led to profound changes in the actions envisaged by the Life project for the conservation of *G. bilineatus*. In fact, due to the low number of individuals sampled in the regional sites, the capture of founders for *ex-situ* breeding originally planned by the project could not be carried out. However, thanks to the research teams working in the Life project, important results were attained leading to the release of several specimens in a few sites of the northwestern Apennines.

local populations of Dytiscid beetles (Bamuel, 2013; Trizzino et al., 2013; Nardi et al., 2015). Considering that the species is a glacial relict and its only reconfirmed station of occurrence is located in a raised peat bog, adding climate change among the factors playing a role in the progressive reduction of its distribution range was considered feasible.

In order to immediately implement an alternative strategy, Emilia-Romagna Region set up a special *focus group*, composed of technical representatives of all the project beneficiaries, the *project manager* and entomologists in charge, under the scientific direction of Prof. Paolo Audisio of La Sapienza University in Rome, and Prof. Leonardo Congiu of Padua University. This *task force* then proceeded to assess the feasibility of a new work programme based on the hypothesis of finding the specimens of *G. bilineatus* to be introduced in the regional territory, starting from extra-national source populations.

However, it was necessary to identify populations in a good state of conservation that were compatible with the Italian population from an ecological and genetic point of view. To this end, the University of Padua carried out a survey on the genetic diversity of the Modenese population, using the sequence of the mitochondrial cytochrome oxidase I (COI) gene and comparing it with that of other European populations. For this study, during the LIFE project, biological samples of the local population were collected, also researching in museum collections, and receiving samples of other European populations, through specific collaborations with research groups active in Europe.

The study found that the Modenese population is composed of few individuals with an extremely reduced genetic diversity and characterized by a haplotype without correspondence with any studied European populations. In short, due to a long reproductive isolation and the consequent phenomenon of *inbreeding*, the population of *G. bilineatus* suffered a bottleneck causing a strong reduction of its genetic variability over time.

The survey did also show that there was no significant relationship between the genetic distance and the geographical distance of the different European populations being investigated. Therefore, the indications resulting from the study for a correct design of the work programme were to select the source populations from which to transfer the specimens intended for possible reintroduction in the Italian site, based mainly on ecological considerations, sustainability of the chosen habitats and the study of existing communities.

From the genetic point of view, in order to avoid problems of *outbreeding*, the assumption on which to operate was to take the founders by paying attention to ensure a good genetic diversity, while avoiding to release specimens from populations too genetically different from each other.

In order to find the source populations abroad from which to take the founders, a networking with more than 15 research groups in Europe was activated, resulting in a collaboration with the research group in Latvia, coordinated by Mārtiņš Kalniņš, entomologist and specialist in environmental design for the “The State Forests of Latvia” organization, and Prof. Uldis Valainins of the Institute of Life Sciences and Technologies of the University of Daugavpils. The research team was chosen based on the above guidelines and on the availability of viable populations located in Latvia that could guarantee the collection of *G. bilineatus* founders.

This alternative strategy was unfortunately also hampered by the COVID-19 health emergency, which restricted international travel and prevented the entomologists of the Life Eremita project from traveling directly to Latvia to make the captures. We then tried to activate a team of Latvian entomologists who could take the specimens and send them to Italy, but in 2020 the monitoring carried out directly by the Latvian research team, perhaps due to the late organization and specific ecological and climatic conditions, failed to collect sufficient individuals for restocking operations in Italy.

BELOW Habitat of *Graphoderus bilineatus*.



SILVIA STEFANELLI

BELOW Future releases of additional specimens of *Graphoderus bilineatus* in the sites participating in the project will be carried out only after a thorough assessment of the already-implemented restocking operations.



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As it was impossible to foretell the concrete possibility of finding the specimens abroad, the work programme was again revised. Instead of the alternative scenario of using founders of *G. bilineatus* from other European populations, we chose to return to investigate some known Italian sites, particularly in Lombardy, still considered suitable for the presence of the species, based on the absence of the main threat factors. Although the occurrence of the water beetle had not been confirmed in the last thirty years in this region, considering the suitability of some sites, we questioned whether the absence of the *taxon* was not due to an actual disappearance, but rather to an inadequate sampling, in terms of sampling efforts and technical skills.

Extensive sampling conducted in July 2020, by experienced entomologists, Roberto Fabbri, Gianluca Nardi, Stefano Aguzzi and Giovanni Carotti, with the authorization of the Ministry of the Environment, led to the confirmation of the occurrence of *G. bilineatus* in a site of the Natura 2000 Network at the border between the provinces of Sondrio, Como and Lecco.

The first results of the catches made it possible to posit the occurrence of a population of a certain size, this consideration deriving from the relationship between sampling effort and capture of specimens. Moreover, the genetic analysis of the mitochondrial COI region of the samples taken in the Lombardy site, also carried out by the University of Padua, enabled to identify two different haplotypes, different from the one previously found in the individuals sampled in Emilia-Romagna Region, but within the diversity range observed in this species across Europe.

In 2021, the survey at the Lombardy site produced positive results, leading to the collection of a sufficient number of founders for the restocking of a site in the north-eastern Apennines. This result was followed by an equally incredible outcome related to the collaboration, which had remained active also for 2021, with the research group of Prof. Uldis Valainis of the University of Daugavpils, which in August collected several specimens of *G. bilineatus* in ten different locations, Reserves and Parks in Latvia. Thanks to the development of an effective transport method, about 90 specimens were shipped to Italy and released in other two lakes in the north-western Apennines of Emilia-Romagna Region.

The environments suitable for the release were chosen starting from the results of the *ex-ante* monitoring of the species' habitat, carried out in Emilia-Romagna within the Life Eremita project. On the basis of a set of parameters for the assessment of suitability, one hundred and twenty-four basins distributed across twenty-two Natura 2000 Network sites and four, already monitored, external sites were analysed. The chosen sites, following appropriate inspections, had the following features: absence/low persistence of threats for the target species; eco-morphological characteristics more similar to the source sites; long-term guarantees of the maintenance of a regime of protection for the species; logistical features suitable for the restocking operations, as well as their being publicly owned.

In conclusion, although the initial assumptions of the LIFE project were based on the optimistic view of being able to easily restore the conservation *status* of the Emilian population, we were soon confronted with a situation that turned out to be more critical than expected. In fact, the general reduction of the species' range is an aspect which also emerged from the networking with other European countries, a situation underlining the importance of what was carried out within the LIFE programme. In particular, in the years of the project, a second station of ascertained occurrence of the species was confirmed in Italy, in addition to the one in Emilia, assigning to Italy the role of southern limit of distribution of the species. *G. bilineatus* is absent in the Iberian Peninsula and in the United Kingdom, while it is extremely rare in the Netherlands,



showing a markedly Eastern-European range, where the non-anthropized areas are wide enough to ensure a better conservation.

The experience of the LIFE project, which we can claim to be the first in-depth research carried out in Italy on this *taxon*, confirmed that *G. bilineatus* is a very problematic species from every point of view, both in terms of monitoring and conservation, breeding, and restocking.

The status of the Italian populations is extremely precarious, perhaps with the only exception of the population in the Lombardy site located between the provinces of Sondrio, Como and Lecco, which was “rediscovered” during the activities of the Life Eremita project, although in the coming years it could be jeopardized by the invasive Nearctic decapod *P. clarkii*, now encroaching at a few kilometres away from this site in lower Valtellina.

The possible future releases in the sites of the Emilia-Romagna Apennines will be carried out only after a careful assessment of the already implemented restocking operations. At the moment, on the basis of what has emerged from monitoring and genetic investigations, the Lombardy population seems to be the right candidate for future captures. This operation would also bring about the safeguard of at least a portion of the genetic pool of the population, in view of the spreading of *P. clarkii*, which could seriously jeopardize the local survival in the next few years.

The long-term goals for this species, to be implemented with the *After-Life* actions, will be to enhance the existing populations and expand the southern distribution area of the species in Europe.

THE MONITORING CAMPAIGN IN LATVIA

The objective, in compliance with the authorizations of the Latvian Agency for Nature Conservation for the capture and collection of individuals of *G. bilineatus*, was to get 120 live specimens in various locations across Latvia. The purpose of the collection was to restock the population of *G. bilineatus* in Italy as part of the Life Eremita project.

Three methods were used to capture the beetles: displacement with a hydrobiological net in the coastline area of the water bodies - envisaged as the main method in the guidelines prepared by the LIFE project (Sampling protocol for the collection of individuals of *G. bilineatus*); placement of modified 5l bottle traps and shrimp traps.

In 2020, only 6 individuals of *G. bilineatus* were captured during fieldwork. There are currently no clear reasons explaining the small number of beetles. However, this is thought to be due to the merging of several circumstances - seasonal differences in the population dynamics; a relatively small number of days of trap activation, and the presence in the traps of larger and more aggressive dytiscid beetle species (*Cybister lateralmarginalis*).

Based on the sampling results, the number of individuals of *G. bilineatus* was initially insufficient for restocking and sending the specimens to Italy. However, in the summer of 2021 the Latvian research team, overcoming the limitations of the previous year with an improved sampling technique, managed to capture and send to Italy about ninety specimens of *G. bilineatus*.

G. bilineatus was searched in the following water bodies: Lake Macitajmuižas, Ruģeļi fish ponds, Lake Ivušku, Lake Iseru, Lake Sāls, Lake Muižnieku, Lake Ummeru, Lake Gauja.

Graphoderus bilineatus was searched in the following water bodies: Lake Mācītājmuižas, Ruģeļi fish ponds, Lake Ivušku, Lake Iseru, Lake Sāls, Lake Muižnieku, Lake Ummeru, Lake Gauja.





ABOVE Lake Mācītājmaļas, habitat of *Graphoderus bilineatus*. The natural eutrophic lake with habitats of *Magnopotamion* or *Hydrocharition*-type vegetation - habitat 3150 – lies in a relatively wide coastal area rich in aquatic plants. They are mainly: *Carex* spp., *Equisetum fluviatile*, *Nuphar lutea*, etc.

Lake Brenkūzis habitat of *Graphoderus bilineatus*. The natural eutrophic lake with habitats of *Magnopotamion* or *Hydrocharition* - type vegetation - habitat 3150 – lies in a relatively narrow coastal area rich in aquatic plants. They are mainly: *Phragmites australis*, *Carex* spp., *Typha* spp., *Nuphar lutea*, *Stratiotes aloides*.



MĀRTIŅŠ KALINIŠS

DURING 2021, 89 SPECIMENS (55 MALES AND 34 FEMALES) WERE COLLECTED IN THE FOLLOWING LOCATIONS OF NATURA 2000 NETWORK SITES.

Lake Mācītājmaļas, habitat of *Graphoderus bilineatus*. The natural eutrophic lake with habitats of *Magnopotamion* or *Hydrocharition* - type vegetation - habitat 3150 – lies in a narrow coastal area rich in aquatic plants. They are mainly: *Carex* spp., *Menyanthes trifoliata*, *Sphagnum* spp.

Capture of the specimens of *Graphoderus bilineatus* in Lake Mācītājmaļas (“Talsu Pauguraine” Natural Park) and in Lake S ls (Gauja National Park). Inside the traps there are several specimens of *Cybister lateralmarginalis*. This large-size, Dytiscid beetle is particularly aggressive with the other species of the same family.

WATER BODIES	NATURA 2000 SITE	NUMBER OF INDIVIDUALS OF <i>G.BILINEATUS</i>		
		TOTAL	♂	♀
Tītmaņu Oxbow	Gauja National Park	7	4	3
Drišķins lake	Gauja National Park	11	5	6
Skujiņu lake	Protected landscape area “Augšzeme”	6	4	2
Teirumnīku lake	Nature reserve “Lubāna mitrājs”	11	8	3
Mazais Kivriņu lake	Nature reserve “Lubāna mitrājs”	9	5	4
Oxbow	Nature reserve “Lubāna mitrājs”	11	7	4
Oxbow	Nature reserve “Dubnas paliene”	12	8	4
Oxbow	Nature reserve “Dubnas paliene”	11	7	4
Oxbow	Nature reserve “Dubnas paliene”	3	2	1
Ruģeļu ponds	—	8	5	3
TOTAL		89	55	34



GIOVANNI CAROTTI

ABOVE Preparation of containers for the safe transportation of *Graphoderus bilineatus* toward the water courses of destination.

PROTOCOL FOR THE TRANSFER OF SPECIMENS OF *GRAPHODERUS BILINEATUS*

MATERIALS

Plastic containers, polystyrene boxes, cardboard boxes, newsprint.

PREPARATION

1. Place the collected beetles in small plastic containers with ventilation holes.
2. During the transfer, in order to ensure the survival of the adults, a ratio of 1-to-5 beetles per container should be maintained, by inserting some sphagnum moss inside the container to keep the right level of humidity. It is not recommended to add water because, during transport, it is impossible to ensure the stability of the shipping containers, and the water sloshing inside (waves, vibrations) could injure the animals and prevent them from breathing normally. Another important feature is the temperature of the water, which must be kept between 15-18°C.
3. The beetles transported under controlled humidity conditions can be introduced, without problems, into the water bodies of destination; however, they must first be acclimatized to the new location.
4. The acclimatization phase involves keeping the specimens in a container with a low water level and a large number of aquatic plants for about half an hour while checking that the temperature is the same as during the transfer. This will prevent the accidental death of beetles weakened by the journey.



GIOVANNI CAROTTI

RIGHT *Graphoderus bilineatus* inside the container used for the shipping from Latvia.

Getting to know four species

Communicating the beauty of insects: a difficulty, but not impossible, mission!

by *Cristina Barbieri, David Bianco, Renato Carini, Maria Vittoria Biondi and Elena Chiavegato*

The LIFE projects all envisage information, communication and dissemination actions, and in particular priority has been given to the dissemination of information about pursued objectives, adopted methodologies, results and products, also in a non-technical, specialistic fashion.

With Life Eremita, we have shared the honour and duty to talk about insects, animals which – although formally protected, at least in part – pay the price of being considered obnoxious, useless or even dangerous and harmful. Changing this ingrained and widespread bias has probably been the main cultural goal of the project. In effect, starting from the features and the ecological role of the four target species, the project has pursued a new awareness based on the complexity of ecosystems, on the often-misconceived relationships between organisms, the scope of the ecosystem services offered so generously by nature, which the human management of the environment can either boost or, instead, strongly limit.

In the first stage of the project, we have defined the features of the main communication tools: we created the logo, the website, as well as the *Facebook* page. The website, integrated with a section in English, works also as an archive for the entire technical and informative documentation; visitors have grown with time, reaching more three thousand single contacts. The *Facebook* page, constantly updated, has been useful and supportive in the promotion of the project actions in a more informal and concise way.

The communication activity has been developed addressing both a public with technical-scientific interests and a wide category of curious, nature-loving people, using for the most part also printed publications and videos.

The Pala-Eremita – Hermit Hall - was certainly the most singular “means of communication” for the project: an impressive inflatable structure for the hosting of events intended to disseminate the project, which was set up in many public squares and urban parks of the Region, in a long *tour* that included at least forty-six stopovers

from 2017 to 2021. A significant result, if we consider the forced suspension caused by the pandemic, which moved the events outdoors with a *tour* called “Antennae”, with a space, open to the public, that provided eight evening events to talk about forests and insects in the National Park of the Tuscan-Emilian Apennines, between August and October 2021

The Pala-Eremita is a modular, dome-shaped structure, 6m-high and 13.5m-diameter; it has several entrances and can accommodate up to 100 people. The Pala-Eremita is completed by two additional inflatable structures (4m high and 6.5m in diameter) suitable for displaying information materials and used as information centre. Thanks to

The Pala-Eremita was the focus of a *tour* involving many town squares and parks in Emilia- Romagna Region.





GIOVANNI CAROTTI

ABOVE The Pala-Eremita attracted the attention of adults and children, thanks to its multidisciplinary approach. Whoever, moved by curiosity, entered the structure would live an unforgettable experience in the discovery of the four target species of the project and their habitat.



ABOVE Many information materials were made for the promotion of the project activities, including scientific publications, information posters, magnets and stickers.

RIGHT Schools were some of the priority targets of the communication and dissemination actions of the Life project. Thanks to the co-design of specific educational schemes with teachers who collaborated with the project staff, it was possible to organize meetings, lectures, workshop activities and field trips.

the colorful and playful presence of the Pala-Eremita, which undoubtedly attracted the attention of passers-by wherever it was placed, the project became real and concrete in many squares and city centres, inviting people and children to enter under the canopy of an imaginary forest, to meet the icons of the tiny standard-bearers of boundless biodiversity.

In order to raise awareness and to provide support for the various information, outreach, and educational activities, specific materials were produced:

- 1 leaflet presenting the project and the target species, both in Italian and English;
- 1 technical-scientific publication (De Curtis *et al.*, 2018), in Italian and English, describing the actions for the establishment and management of habitats, the *in-situ* and *ex-situ* conservation actions, and the activities for the reintroduction of the target species;
- 1 educational *kit* comprising one publication, 1 *poster* and 4 magnets depicting the target insects;
- the monographic issue of the publication “Storie naturali” entirely devoted to the project;
- 1 series of posters and bookmarks depicting the target species;
- 1 series of notebooks dedicated to the 4 target species;
- 1 game of *Memory* with the target species and their habitats;
- 20 outdoor information panels, installed in the sites where the project interventions were carried out;
- 20 *rollups* displayed in the premises of the Region and Park Authorities, and in the main visitors’ centre;
- 3 information panels installed in the three breeding facilities made by the project;
- 160 information nameplates placed on the nest boxes for *Osmoderma eremita*;
- 8 films about the species, the breeding sites, the conservation interventions made with the project;
- 1 video *storytelling*, video “pills” and a video for the conclusion of the seminar;
- the *Layman’s report* for a general public describing the objectives, actions and results of the project (in Italian and English).

The coordination of dissemination and information activities has been managed through the creation of a real project agency/press office, which has worked in close collaboration with the representatives for communication of each partner, thus ensuring a synergic coordination. In this context, educational, training and awareness-raising activities were carried out focusing on the bio-ecological characteristics of the project species, on the importance of forest biodiversity



ATLANTIDE SOC. COOP. SOCIALE P.A.

conservation (with explicit reference to the species and the Natura 2000 Network), focusing on the objectives, actions, and results of the project.

The priority targets of the communication, information and environmental coordination activities have involved the following:

- schools, with priority given to those operating within the project area;
- local authorities with specific competences in the field of forest management, Natura 2000 Network and more in general in the field of “conservation of natural heritage”;
- companies and trade associations in the agricultural and forestry sector (companies, cooperatives and forestry consortia, civilian use, and agricultural entrepreneurs);
- trade associations in the environmental field (environmental associations, animal welfare associations);
- all the citizens, with particular attention to residents in the Natura 2000 Network sites.

As regards schools, the educational project comprised the following stages:

- promotion of the educational project in schools;
- co-planning of the course with the teachers participating in the project;
- inclusion of the project in the curriculum of each individual class, in order to encourage students’ learning and participation;
- meetings, lectures, laboratory activities and field trips with students.

Given the difficulties linked to the pandemic, which has impacted on the project in its most mature stage, the courses for the schools were rethought and readapted to the new school organization. In addition, a specific awareness-raising action was addressed to technicians in public entities (municipal administrations, reclamation consortia, river basin services, etc.) and interest groups (forestry companies and cooperatives, consortia for the administration of civilian use properties, agricultural cooperatives and companies, agricultural associations, etc.).

At the same time, with specific theme-based *workshops* for the training of personnel working in forest management (forestry companies, farms, forest cooperatives, civilian use, forestry consortia, etc.), forty-three technical-dissemination meetings promoted the

exchange of skills, best practices and innovative management formats, with the transfer of *know-how* from the world of research in order to increase biodiversity of forested environments.

It was an opportunity to present the project through the target species, their habitats and their main threats, reflecting on the fundamental role of the Natura 2000 Network in the conservation of biodiversity and the important contribution of institutions and companies in carrying out a careful management of the territory. From this point of view, in its targeting a wider audience, the project was also presented at specialized fairs, such as Entomodena and Ecomondo.

Several local initiatives, organized directly by the Parks, covering almost the entire regional territory, involved both the general public and specific target audiences, such as environmental guides, environmental associations, Voluntary Ecological Guards, etc..

Finally, at the closing of the project, two events were organized in order to share the reached results, one centred on the organization of a characteristic “Hermit Party”, and the other targeting an “expert” audience with more technical-scientific contents.



ARCHIVE OF THE NATIONAL PARK OF TUSCAN-EMILIAN APENNINES

At the closing of the project, a typical “Hermit Party” was organized with many educational laboratories for children.

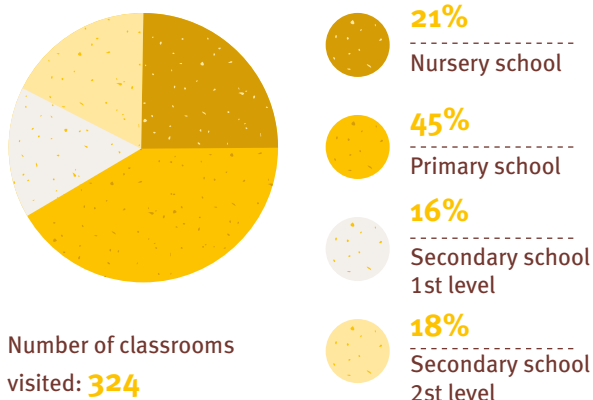
Today the Hermit is no longer alone!

The Hermit and its travel mates have found many friends. In the *box* below we present a few figures to better illustrate the impact these actions have produced.

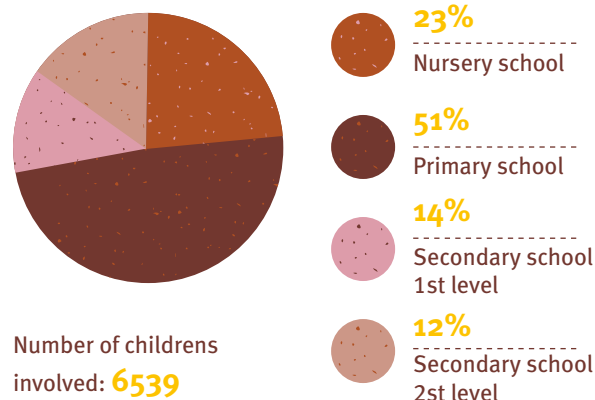
THE HERMIT AND THE SCHOOLS

Interventions consisted in two meetings, each two-hour long, one in the classroom and one in the field.

CLASSROOMS VISITED BY THE HERMIT AND ITS FRIENDS



NUMBER OF SCHOOL CHILDREN WHO HAVE MET THE HERMIT AND ITS FRIEND AT SCHOOL



THE EREMITA TOUR

The tour of the Hermit and its friends has traveled extensively. They have stopped everywhere and now they are international celebrities.

N. EDITIONS	APPROXIMATE NUMBER OF PARTICIPANTS
46	3880

THE HERMIT AND THE DISCOVERY OF ITS WORLD

Below we have listed the more technical *workshop* for professionals in the field, and the more informative initiatives for a wider audience.

N. MEETINGS	APPROXIMATE NUMBER OF PARTICIPANTS
43	951

PUBLICATIONS

Maria Vittoria Biondi and Elena Chiavegato

The project envisaged the design, production and dissemination of promotional and information (posters, cards, memory games, etc.), to be used during the various information and awareness-raising initiatives and campaigns, such as the Eremita tour, as per action “E.2: Communication, dissemination and environmental education actions”

The first step with respect to communication involved the development of the project logotype that distinguishes all subsequent products. The logo reproduces graphically the silhouettes of the four target insects of the project, each identified on a different coloured background; the wording “Life Eremita” features the letters “er” in green to recall the initials of Emilia-Romagna Region.



Memory game

EMILIA-ROMAGNA REGIONAL ARCHIVE

In agreement with the project partners, various publishing products were designed:

- **Two leaflets presenting the project:** the first, produced in 2016, with a three-page format (an A4 divided into three parts) summarising the objectives and actions of Life Eremita; the second produced in 2018 with a 21x21cm format describing the target species, the main project actions, the area involved, the aims of the Natura 2000 Network and LIFE projects in greater detail. Both available in Italian and English, they target a wide audience of adults and children.
- **A technical-scientific publication** “Coordinated actions for the conservation in Emilia-Romagna of *Osmoderma eremita* (Scopoli, 1763), *Rosalia alpina* (Linnaeus, 1758), *Coenagrion mercuriale castellanii* (Roberts, 1948), *Graphoderus bilineatus* (DE Geer, 1774)”, 80 A4 pages, produced in 2018, which collects the results of the main project actions carried out in the first years, from *ex-ante* monitoring to *ex-situ* breeding of *O. eremita*, to the actions for the improvement and establishment of forest and aquatic habitats, and the genetic investigations of *G. bilineatus*. The publication is available in Italian and English and is intended for operators from local authorities, protected areas and Natura 2000 Network sites, as well as the coordinators of other LIFE projects.

Posters



The Wood Mould Box sign

For schools, particularly for children in the last two years of primary school and those in the first two years of secondary school, an educational kit was designed, consisting of the following:

- a 70x100 cm **poster** made using a few schematic drawings to visually communicate the phases of the project in a simple way;
- **four magnets** (for each insect) used to present the target species in a playful way, also as gadgets to be used to hang the poster on magnetic boards;
- **a didactic notebook with comic strips** illustrating the main concepts of the project in a simple and intuitive way. The notebook also includes *stickers* featuring two “little” entomologists, Emma and Carlo.



Papers

The educational *kit* was designed specifically for children, in order to overcome commonplaces and paradigms about insects, and to raise the awareness of the importance of the role of invertebrates for humans and the ecosystem.

All publications can be accessed on line through the official project website in the “Communication-Products” section, while hard copies can be requested by contacting the following: Settore Aree Protette, Foreste e Sviluppo zone montane della Regione Emilia-Romagna, Viale Aldo Moro, n. 30, 40127 Bologna, e-mail: segrpm@regione.emilia-romagna.it.



Stickers



Youth at the service of nature

Volunteers' participation in the project actions

by Shade Amini and Cristina Barbieri

In general the world of insects is not very popular, while in most cases the interest for these species is restricted to a small number of specialists.

The project has then attempted to involve directly in the project volunteers' associations, by offering the opportunity to perform some activities firsthand. The volunteers of the Life Eremita project, adequately trained, have then contributed to the implementation of project actions and, in the future, will be able to offer their contribution to the pursuance of already-set conservation policies, along with their support as *opinion leaders* in local communities.

The project saw the participation of amateur entomologists, university students, Voluntary Ecological Guards (VEG), environmentalists, nature lovers, photographers and ordinary citizens living in the project areas. This has enabled volunteers to approach a world usually little, or just superficially, known, and to live at times a highly training experience, with the merit and satisfaction of having contributed to the implementation of a European project of biodiversity conservation, in many ways innovative and exciting.

The first expression of interest for the selection of volunteers was published in 2016, together with the "Charter and catalogue of volunteering activities" prepared by all partner institutions to illustrate the activities, tasks and priorities that the volunteers would encounter. Overall, throughout the years, there were four expressions of interest and catalogues of activities, and they were met with considerable participation.

In fact, thanks to an adequate action of information and a progressive involvement of voluntary associations, it was possible to obtain numerous applications. Participation was open to all citizens, aged 18 or older, who could reach the project areas on their own. The selection of volunteers was made according to criteria designed to assess the aptitude and interest of candidates in the project activities. The first training course comprising six meetings for a total of 32 hours was held in December 2016. During the opening seminar, the programme of the training course was introduced and some basic aspects were explained, concerning the purpose of the project, its contents, the role of volunteers in the implementation of the planned actions. This objective was achieved thanks to the use of concrete examples from other European projects in which volunteers had been successfully involved. The other topics were the following: the Natura 2000 Network; the protected areas of Emilia-Romagna Region and its reference legislation; biology and ecology of the species; monitoring of habitats and species; breeding; concrete interventions on forest and aquatic environments; the use of the database; translocation and release of species, and activities of dissemination, awareness-raising and communication. Theoretical training was followed by practical training and, at the conclusion of the course, the chosen volunteers were assigned tasks for a minimum of 12 hours per month. In the following months, training continued in the field during the monitoring exercises, in the breeding sites, or during training events, thanks to the teaching of the technical personnel of the project, and in particular the *senior* entomologists. The training was based on observation and practice that was open to ongoing recruitment of trained volunteers to meet the project needs. A second recruitment campaign, with a training programme divided into on line classes and field experiences, was carried out in September and October 2020. In five years, volunteers have offered their support by helping to implement the actions of the project, assisting technical staff



ABOVE Brochure designed to promote volunteers' participation in the Life Eremita activities.

ANDREA BONAVIDA



The volunteers who were chosen on the basis of their aptitude and interest in the project participated in a 32-hours training course exploring in depth the actions of Life Eremita.

in field activities or in the breeding facilities, developing the activities described below:

Monitoring of the species

Different sampling methodologies and monitoring locations were planned for each of the 4 target species. Volunteers collaborated with the entomologist in charge, by providing support for various operations: use of probes, search for specimens, use of entomological instruments, habitat identification, sampling of tree hollows, etc...

Interventions of active conservation

The volunteers took field trips aimed at assessing the implementation state of the various interventions carried out in the woods, ponds and along small waterways. One of the tasks consisted in checking the wooden boxes for *Osmoderma eremita* and in reporting to the authorities in charge any alleged non-authorized activities (illegal withdrawal, illegal discharges, removal of wood, etc...) carried out in the intervention areas.

Reproduction through breeding

The volunteers actively participated in the management of the *ex-situ* breeding of both *O. eremita* and *Rosalia alpina*, by checking and monitoring the installed *Wood Mould*

Boxes (WMB), the prepared wood pile and tripods. They were also involved in the upkeep of the piles (which undergo a natural decay) for the entire duration of the project, and will continue to do so in the *After-Life* period.

Dissemination, awareness-raising and communication

Volunteers participated in public initiatives for the presentation of the project (e.g. some editions of Entomodena, fairs, festivals and village festivals, etc.), in environmental education activities with schools, results presentation and awareness campaigns of the *Hermit tour*.

Database updating

The volunteers, as authorized users, can access the database for a simple data consultation or data implementation, in support of the conservation of the target species.

The experience of Life Eremita has confirmed how volunteering is an essential ingredient for the implementation of such an articulated and wide-ranging project. It is not only a resource for the territorial authorities, but also a means to convey the importance of nature conservation to the local community. It is a venue of group aggregation and sharing, which the European Union has also recognized by establishing with Regulation 2018/1475 the European Solidarity Corps (ESC), which aims to promote and foster the value of solidarity in European society. An objective being pursued with the involvement of young people and organizations working in the area of youth and mobility, in order to build a more inclusive society, attentive to natural values.

ACTIVITY/YEAR	2016	2017	2018	2019	2020	TOT.
<i>Campaign of volunteers' recruitment</i>	July				August	
<i>Volunteering Catalogue</i>		March	February	May	February	4
<i>Number of training hours performed in the field (practical activity)</i>		48			40	88
<i>Number of total training hours (theoretical activity)</i>	8		2		11	21
<i>Number of participating volunteers</i>	65	33	43		25	138



ABOVE The activities of Life Eremita saw the participation of many university students who decided to do their *pre-lauream* internship and final dissertation on the project activities.

BELOW Volunteering is a great resource for local Authorities and local communities, becoming an essential ingredient for wide-scope projects such as Life Eremita.



EMILIA-ROMAGNA REGIONAL ARCHIVE

Academic internships

A specific group of volunteers were university students, who were further involved by turning their experience in a real *pre-lauream* academic internship, on which they later wrote their final dissertations. The students' dissertations focused mostly on the following: data collection about the target species; monitoring of species and habitats carried out during the internship; data analysis; the study of populations for the possible translocation of specimens, and finally data collected during the activities of *in-situ* and *ex-situ* breeding of *O. eremita*.

The dissertations refer mainly to monitoring and breeding activities carried out in the territories of the Romagna Macro-area, the National Park of Casentinesi Forests, Mount Falterona and Campigna, and the National Park of Tuscan-Emilian Apennines:

- **“Monitoring after translocation interventions of the dragonfly *Coenagrion castellani* Roberts, 1948 within the Life Eremita project in the area of the Management Authority for Parks and Biodiversity, Romagna”**. Supervisor Prof. Antonio Martini; co-supervisor: Roberto Fabbri; candidate: Mattia Morini. Alma Mater Studiorum University of Bologna, Department of Agricultural Sciences, Degree Course in Technologies for the Land and Agroforestry Environment, Academic Year 2020-2021
- **“*In-situ* conservation of the saproxylic beetle *Osmoderma eremita* (Scopoli, 1763) in Romagna within the Life Eremita project”**. Supervisor: Prof. Andrea Pasteris; co-supervisor: Roberto Fabbri; candidate: Michela Bremec. Alma Mater Studiorum University of Bologna, Department of Biological, Geological and Environmental Sciences, Degree Course in Environmental Sciences, Academic Year 2019-2020.
- **“Translocation interventions of the dragonfly *Coenagrion mercuriale castellani* Roberts, 1948 within the Life Eremita project in the area of the Management Authority for Parks and Biodiversity, Romagna”**. Supervisor: Prof. Giovanni Burgio; co-supervisor: Roberto Fabbri; candidate: Luca Rasi. Alma Mater Studiorum University of Bologna, Department of Agricultural Sciences, Degree Course in Agricultural Technology, Academic Year 2019-2020.
- **“Breeding of the beetle *Osmoderma eremita* (Scopoli, 1763) for reintroduction purposes within the Life Eremita project in the National Park of Tuscan-Emilian Apennines”** Supervisor: Prof. Ivano Ansaloni; candidate: Manuele Pedrazzi. University of Modena and Reggio Emilia, Department of Chemical and Geological Sciences, Degree Course in Natural Sciences Academic Year 2018-2019.
- **“Breeding of the species *Osmoderma eremita* (Scopoli, 1763) within the Life Eremita project in the National Park of Casentinesi Forests, Mount Falterona and Campigna”** Supervisor: Prof. Marco Passamonti; co-supervisor: Roberto Fabbri; candidate: Nicole Paolucci. Alma Mater Studiorum - University of Bologna, Department of Biological, Geological and Environmental Sciences, Degree Course in Natural Sciences, Academic Year 2018-2019.
- **“*In-situ* conservation by means of Wood Mould Boxes of the species *Osmoderma eremita* (Scopoli, 1763) within the Life Eremita project in the National Park of Casentinesi Forests, Mount Falterona and Campigna”**. Supervisor: Prof. Marco Passamonti; co-supervisor: Roberto Fabbri; candidate: Filippo Magni. Alma Mater Studiorum - University of Bologna, Department of Biological, Geological and Environmental Sciences, Degree Course in Natural Sciences, Academic Year 2018-2019.
- **“First translocation experience of the dragonfly *Coenagrion mercuriale castellanii* Roberts, 1948 within the Life Eremita project in the area of the Management Authority for Parks and Biodiversity, Romagna”**. Supervisor: Prof. Alessandro Chiarucci; co-supervisors: Roberto Fabbri, Prof. Barbara Mantovani; candidate: Diletta Di Paolo. Alma Mater Studiorum - University of Bologna, Department of Biological, Geological and Environmental Sciences, Degree Course in Biological Sciences, Academic Year 2018-2019.
- **“Breeding of the species *Osmoderma eremita* (Scopoli,**

1763) within the Life Eremita project”. Supervisor: Prof. Daniela Prevedelli; co-supervisor: Roberto Fabbri; candidate: Jacopo Cristoni. University of Modena and Reggio Emilia, Department of Life Sciences, Degree Course in Biological Sciences, Academic Year 2017-2018

- “Capture methods of the beetle *Osmoderma eremita* within the area of the National Park of the Tuscan-Emilian Apennines in the context of the Life Eremita project”. Supervisor: Prof. Alessandro Chiarucci; candidate: Mattia Ferrari. University of Bologna, Department of Biological, Geological and Environmental Sciences, Degree Course in Biological Sciences. Academic Year 2017-2018.

- “Monitoring and conservation of the species *Coenagrion mercuriale castellanii* Roberts, 1948 within the Life Eremita project”. Supervisor: Prof. Daniela Prevedelli; co-supervisor: Roberto Fabbri; candidate: Riccardo Poloni. University of Modena and Reggio Emilia, Department of Life Sciences, Degree Course in Biological Sciences, Academic Year 2016-2017.

- “Fauna monitoring and conservation techniques adopted by the Management Authority for Parks and Biodiversity in Romagna”. Supervisor: Prof. Adriano Martinoli; co-supervisors: Roberto Fabbri, Fabrizio Borghi, Massimo Bertozzi; candidate: Martina Brunetti. University of Parma, Department of Chemical, Life and Environmental Sustainability Sciences, Inter-university Master’s Degree in Management and Conservation of the Environment and Fauna, Academic Year 2016-2017.



ANDREA BONAVITA

Volunteers' training.

CIVILIAN SERVICE IN THE NATIONAL PARK OF CASENTINESI FORESTS, MOUNT FALTERONA AND CAMPIGNA

The Universal Civilian Service (UCS) is an important training opportunity for young people, as well as a chance to grow professionally. Every year, the National Park of Casentinesi Forests, Mount Falterona and Campigna organizes civilian service projects, with the participation of young men and women, in order to promote the preservation and protection of one of Italy’s most important naturalistic areas, through activities for the conservation and monitoring of the natural heritage, and the protection and improvement of the ecosystem and its main animal and plant species. Five young people, doing civilian service work in two facilities of the Park - Pratovecchio (AR) and Santa Sofia (FC) – participated as volunteers in the recruitment campaigns carried out by the Life Eremita project; they were joined by 2 university interns. Their participation provided support to the entomologists in the monitoring activities of the target species and in the implementation of interventions. Their role in the dissemination of the project was likewise important, as a valid support to the Hermit tour campaign.

Integrated information system

Three integrated GIS-supported databases aiding the conservation of the target species

by Ornella De Curtis, Benedetta
Intini and Cristina Barbieri

One of the actions included on the project was the creation of a data storage system which, by adopting *Web Technologies* solutions, would be used not only by the project's participants and experts, but also by all the potential stakeholders, either already involved or yet to do so, in the management of the target species: *Osmoderma eremita*, *Rosalia alpina*, *Coenagrion castellani* and *Graphoderus bilineatus*.

Ecological data and geographical and territorial information regarding the four insect species of the Life Eremita project have been stored and ranged in an integrated Information System comprising the databases and the *web GIS* of Emilia-Romagna Region.

The information System mainly includes three databases, interconnected and linked to the *web GIS* platform, dealing with: species monitoring, habitat monitoring, carried-out conservation actions. The system is equipped with *input* and *output* interfaces aimed respectively at archiving data and disseminating information to the general public and/or more specific recipients.

The creation of this archiving system does not only aim at the simple cataloguing of data and information produced by the project, but also at providing a tool for the analysis and management of the territory for a correct planning - also in the future - of the indispensable actions for the conservation of the four species of insects. In the future, this archive could be extended to other species protected by the Habitats and Birds Directives and become a precious support for the understanding and management of the Natura 2000 Network in Emilia-Romagna Region. At the moment, the use of the database enables the processing of geo-referenced information of ecological nature, related to the populations of the four target species and their habitats, which are essential for the monitoring of their conservation status over time.

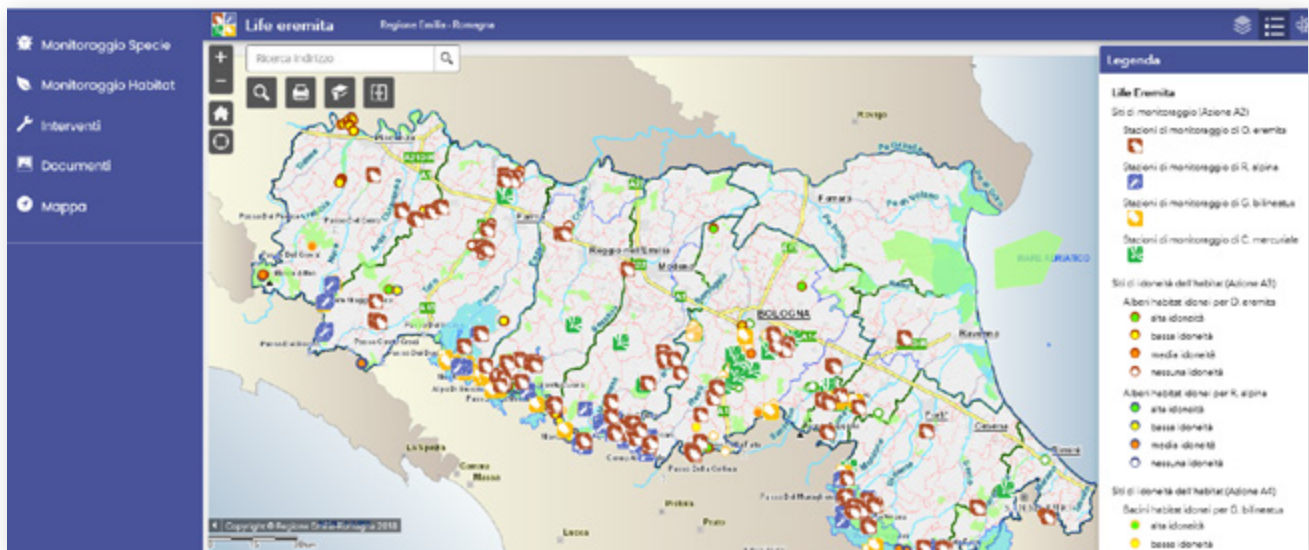
An additional function is represented by the archiving of acquired scientific information and the cataloguing of technical and dissemination materials produced during the project.

The system is single and centralized in the facilities of the Emilia-Romagna Region, in order to ensure the homogeneity of data at regional level. However, in order to allow the consultation and the implementation of the database, also by subjects outside the administration, a special web interface has been created, which can be accessed remotely by the team of each project partner.

Data entry, through the *extranet* web interface, is structured with open and closed fields, a choice that avoids fragmentation of knowledge, typical of cases in which information is managed independently by different participating parties, and thus ensures the standardized entry of reports.



Example of graphic interface of the web GIS platform.



Monitoring of the Species

TOTAL N. RECORD	N. RECORD			
	<i>Osmoderma eremita</i>	<i>Rosalia alpina</i>	<i>Graphoderus bilineatus</i>	<i>Coenagrion castellani</i>
4760	1797	2584	227	125

Monitoring of the Habitat

TOTAL N. RECORD	N. RECORD			
	<i>Osmoderma eremita</i>	<i>Rosalia alpina</i>	<i>Graphoderus bilineatus</i>	<i>Coenagrion castellani</i>
3110	1766	1115	136	93

Intervents

TOTAL N. RECORD	N. RECORD			
	<i>Osmoderma eremita</i>	<i>Rosalia alpina</i>	<i>Graphoderus bilineatus</i>	<i>Coenagrion castellani</i>
1861	936	925	0	0

The database is updated regularly with the reports coming from the monitoring of the species. The data, then, can be easily displayed by using the extranet web interface.

How to enter data?

After the log-in, the authorized users access the system and can then enter data related to a report or a specific monitoring. In the data entry form being opened, they will have to select the reference species from the menu and, after filling in the general information, they will have to provide the specific information of the survey. The fields vary according to the species selected during the creation of the form. Once the fields have been filled in, it will be possible to complete and save the form by clicking on the button “create new form” displayed at the bottom of the page.

How to view data?

The database enables an easy and intuitive display of all the inserted forms. After the *login*, the users access the system and select the monitoring of interest (species or habitat), or the report, from the side menu. At this point, all the inserted forms within the chosen section will appear in a drop-down list window where it will be possible to access the chosen one, thanks to the filters on the results list. The users will view the form in read-only mode and will be able to download, if needed, the attached documents.

How much is the Hermit worth

The socio-economic impact of the project and citizens' participation through Citizen Science

by Federica Milioni, Renato Carini, Shade Amini and Cristina Barbieri

The Life Eremita project aims to reduce the threats to four species of insects of conservation importance, mostly represented by the conflict with traditional human activities of forest management for production purposes, water abstraction from springs and interventions for the “cleaning” of small streams, factors that directly and indirectly affect the local socio-economic context.

In order to get significant data for the assessment of the socio-economic impact of the project activities, a research study was set up envisaging the administration of an *ex-ante* questionnaire in the first year of the project to assess the basic level of knowledge and awareness; while, in the last year, an *ex-post* questionnaire was administered with the aim of measuring the impact of the project actions on the territory, at economic level and on public opinion. Both questionnaires were developed and shared by the technical project group.

The survey enabled to collect the understanding and level of knowledge about the conservation of these four species, two of which are insects linked to woodland environments and two to aquatic environments.

The questions were presented to people living in the Apennines and in the flatland area of Emilia-Romagna Region, with the aim of monitoring and assessing the impact of a well-run conservation and management of natural resources on economic and social sustainability, by taking into account the positive outcome for the local community, in terms of monetary but also ecosystem benefits.

Ex-ante and *ex-post* questionnaire: goal, distribution and model of the survey, its structure and results

In the initial phase of the project, and in order to get a representative survey sample, the distribution of the questionnaire took place in the schools of the territory; this enlarged the survey sample and further increased the number of participants.

The schools belonged to the catchment areas of the various project partners; twenty-five schools were involved, of which sixteen are Comprehensive Institutes and nine are High Schools, where the questionnaires were delivered to teachers in charge, who in turn distributed them to the sample classes, two per student.

The target audience was over sixteen years old: the questionnaires were filled out by students, parents or their relatives.

The data were then recorded and processed through a *database*.

The questionnaire consisted of twelve closed-ended, multiple choice questions, which considered the following aspects:

- Knowledge about insects, habitat rarefaction, species' release, Natura 2000 Network and LIFE projects;
- knowledge about the management of forest areas and water bodies and awareness of their impacts;
- willingness to contribute to protection actions;
- knowledge and opinion about the Life Eremita project.

At the beginning of the questionnaire, five additional questions of a socio-demographic nature were entered to analyse and register users, and to verify the coverage of the desired target. The compilation was autonomous, without interaction with the interviewer so as not to influence the answers, anonymous and with an estimated compilation time of about ten minutes.

13,736 questionnaires were distributed, with a 28,3% response rate, according to the following area distribution:

The results of the survey showed that during the Life project the understanding of certain issues did improve concerning, for example, the role of biodiversity and the importance of proper forest management.



EMILIA-ROMAGNA REGIONAL ARCHIVE

AREA/ AUTHORITY	DISTRIBUTED QUESTIONNAIRES	RETURNED QUESTIONNAIRES
Romagna Macro-area (MAR)	1.500	406
Western Emilia Macro-area (MEOC)	3.500	1.435
Eastern Emilia Macro-area (MEOR)	4.800	678
Central Emilia Macro-area (MEC)	350	172
National Park of Casentinesi Forests, Mount Falterona and Campigna (PNFC)	2.646	868
National Park of the Tuscan-Emilian Apennines (PNATE)	940	331
Total	13.736	3.890

Overall, 3,890 people were interviewed, a much larger number than the 1,000 people expected at the start of the project.

The target audience of interviewees represented the interest groups envisioned by the project, specifically: local administrators, supervisors, environmental associations, students, and farmers.

In the results, it emerged that in 2016 there was a lack of knowledge about the Natura 2000 Network and the financial tools for Nature conservation, such as the LIFE European Regulation. In addition, the survey revealed a lack of awareness of the actual expenses involved in forest or stream maintenance, as well as an unclear idea of existing threats to the species of the project. The idea that the economic investment in nature conservation is an obligation of public entities remained widespread. These responses were useful in driving the information, awareness and training actions provided by the project towards the deeper understanding of the concepts of Natura 2000 Network, the need to protect insect species and the opportunity to improve their habitats.

The *ex-post* survey, in the last year of the project, was launched through an on line questionnaire in *google form* format, in full compliance with the health regulations in force as a consequence of the Covid-19 pandemic.

The distribution of the questionnaire took place during the 2021/2022 school year, by sharing the *link* with the same previously-involved schools. To increase the survey sample, the distribution of the questionnaire was expanded to the general public through on line communication channels (website and social media).

The questionnaire was structured in thirteen closed-ended multiple-choice questions, similar to those of the *ex-ante* questionnaire, in order to carry out an *ex-ante/ex-post* comparison and assess the effectiveness of the communication actions implemented during the project.

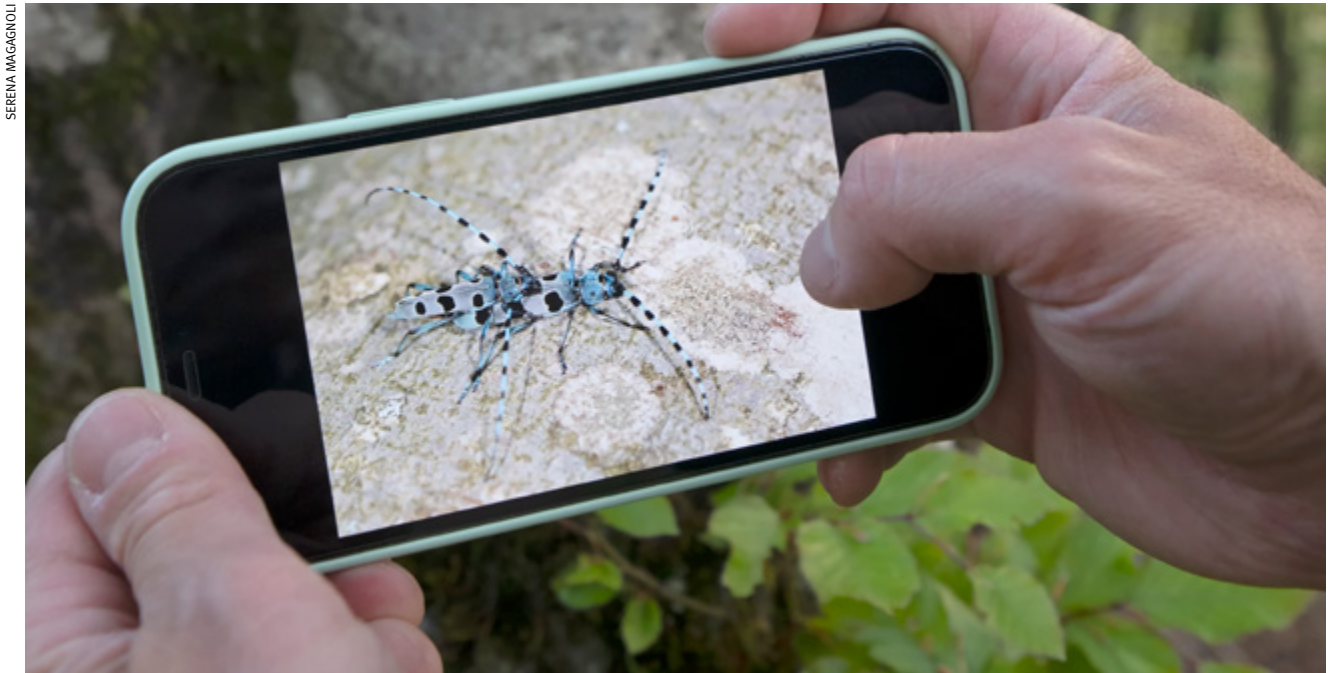
In the opening section of the questionnaire, information of socio-demographic nature was requested, as in the previous survey, and three questions were inserted to investigate the geographical areas of origin and the information tools most familiar to users, in order to better tune future communication actions. The compilation - also in this case autonomous and anonymous - was set on an estimated time of about fifteen minutes.

More than 350 questionnaires were returned. The target of respondents expanded the interest groups of the first survey; in addition to local administrators, supervisors, environmental associations, farmers, students, there were also teachers, cultural operators, workers, employees, professionals, researchers, retirees, unemployed, homemakers, sales clerks, health personnel and law enforcement personnel.

The respondents were male and female of all age groups, almost equally distributed, probably due to the dissemination of the questionnaire through web channels.

The answers enabled us to assess that the knowledge of the Natura 2000 Network and the LIFE instrument had increased. From data analysis, it is evident that there was greater awareness of the link between the reduction of saproxylic insects and the removal of timber: In the previous questionnaire 47% of answers focused on the link with the excessive use of insecticides as the main threat to these species, while only 31% of respondents had answered correctly. In the *ex-post* questionnaire,

BELOW Due to the situation brought about by the Covid-19 pandemic, it was necessary to revise the way the questionnaire was administered in the last year of the project. From the classic paper format, we switched to an online document that could be easily sent to the schools already involved in the project.



SERENA MAGAGNOLI

ABOVE The *Citizen Science* (CS) promotes the participation of people willing to collect data and actively contribute to the dissemination of knowledge. In Italy, the LIFE and CS projects go often hand in hand, as it happened, for example, with Life Eremita and the CS project called “i-Rosalia” which shared the objective of disseminating the knowledge about *Rosalia alpina* in Emilia-Romagna.

the percentages shifted to 35.3% for insecticides and 52.4% for wood removal from the forests, respectively. The willingness to invest in nature conservation increased, not leaving it exclusively to public institutions. There was still little awareness of the real cost of forest management or maintenance of waterways. Many answers stressed how public opinion perceives environmental protection as positive, and stated a spontaneous request to carry out more activities for environmental education in schools, as well as activities aimed at more adult targets. As a measure of the effectiveness of the implemented communication actions, there was a clear increase in the percentage of respondents who were aware of the Life Eremita project and its implemented protection activities. The sample surveyed declared to have been contacted through web channels, social networks and awareness-raising events.

Citizen Science and Life Eremita

Citizen Science (CS) refers to the system of scientific research activity where amateur, non professional scientists participate voluntarily in data collection and analysis, in the development of technologies, assessment of natural phenomena, and the dissemination of scientific knowledge, thus actively contributing to the expansion of science. CS refers, in fact, “to the general engagement of the public in scientific research activities when citizens actively contribute to science either by their intellectual effort or knowledge or by their tools and resources”. The term CS was coined in the mid-1990s by Rick

RIGHT The *Citizen Science* campaign of “i-Rosalia” was launched thanks to Emilia-Romagna Region and the creators of InNat, a project which wants to facilitate citizens’ participation in the surveying and reporting of insects protected by the Habitat Directive, through a portal and an app. Thanks to the tools designed by InNat, the same channels were also used to report the occurrence of *Rosalia alpina* from the “i-Rosalia” project.

LE 3 REGOLE D'ORO DELL'OSSERVATORE PERFETTO DI i-ROSALIA

REGOLA N. 1

Fai attenzione, la specie è del tutto innocua per l'uomo, tuttavia non va né toccata né spostata dal suo habitat, in quanto potremmo danneggiarla. Ricorda che stiamo interagendo con una specie classificata come specie protetta a livello europeo!

REGOLA N. 2

Scatta una foto ben a fuoco e che comprenda l'individuo per intero, in modo che i nostri validatori possano effettivamente accertarsi che l'individuo avvistato sia proprio Rosalia.

REGOLA N. 3

Oltre alla foto, per inserire l'osservazione sono essenziali data, ora e posizione geografica della foto. Se scatti la foto con il cellulare, carica direttamente nell'app o nella piattaforma web [i-Rosalia](#) e tutti i dati verranno inseriti in automatico, altrimenti abbi la premura di annotare queste informazioni e inviaci tutto via e-mail.

LE TUE OSSERVAZIONI SONO PER NOI IMPORTANTISSIME E VOGLIAMO ESSERE SICURI DI NON PERDERE NESSUN DATO



SERENA MAGAGNOLI

The pictures of *Rosalia alpina* sent by citizens increased the reporting of this species at regional level.

Bonney (USA) and Alan Irwin (UK) although the earliest known example dates back to Christmas Day 1900, when ornithologist Frank Chapman proposed the first “Christmas Bird Count”.

CS is increasingly recognized as a distinct field of research (Jordan *et al.*, 2015) fueled by many scientific disciplines and supported by numerous projects and publications (Kullenberg & Kasperowski 2016). In Italy, LIFE projects and CS have often gone hand in hand; it is thanks to LIFE co-funding that one of the first Italian CS projects on biodiversity was conceived and then implemented in 2013: CSMON-LIFE (*Citizen Science MONitoring*), which involved citizens in the study, management and conservation of biodiversity, creating an active collaboration between citizens, the scientific community and institutions. This was followed by many other projects, including the Life MIPP project with the development and testing of methods for monitoring five species of beetles of conservation interest, and collecting faunal data through CS using a special app and a web portal.

In order to expand the scope of the Life Eremita objectives and in response to a necessary involvement of citizens “remotely”, due to the COVID-19 pandemic, a CS campaign, called “i-Rosalia”, was designed and launched. The campaign, established thanks to an agreement between Emilia-Romagna Region and the designers of the InNat project, started in May 2021 and initiated a “participatory research” on one of the four species of vulnerable and rare insects, target of the project: *Rosalia alpina*. The aim of the campaign was to expand knowledge about the occurrence of *R. alpina* in Emilia-Romagna. With the help of the InNat platform, citizens can provide reports in addition to the data already recorded by entomologists in the project database. The campaign was coordinated by the Delta Institute of Applied Ecology, Emilia-Romagna Region and the Management Authority for Parks and Biodiversity of Western Emilia that, since June 2020, had designed a data collection campaign spread through the social channels of the Authority, named “SOS Rosalia” inviting citizens to send images of the target species by e-mail or SMS. This initiative was a great success because in a short time

INFOGRAPHICS REGARDING THE
FACEBOOK “I-ROSALIA” CAMPAIGN

12

posts

193,921

reached people

1,000

interactions

505

reactions, remarks,
sharing

487

clicks on the post

it managed to acquire data, also from previous years. Of the reports reviewed by the experts, two were particularly interesting because they confirmed, for the first time, the occurrence of *R. alpina* in the territory of Parma, where the entomologists had not found specimens, although the habitat was deemed suitable.

The “i-Rosalia” campaign was disseminated through the web and social channels of the project and specifically through some on line meetings involving groups of the Italian Alpine Club (CAI) and other hiking associations, environmental guides and local scout groups, reaching about eighty participants. The use of the InNat platform made it possible to expand the audience of possible interested volunteers, through the channels of the InNat project.

The volunteers were provided with useful instructions on how to recognize the species, as well as indications on how to treat specimens found in the wild. In addition, an explanatory video on how to report and use the InNat application was prepared and disseminated in order to make it more accessible to the widest possible audience.

The “i-Rosalia” campaign was also recently included in the list of CS projects at national level and within the informal group of scientists and supporters of CS Italy, which decided to create a space for sharing existing initiatives, divided into categories, and active in Italy (official page of CSI, *Citizen Science Italia*: <https://bit.ly/3sBNH02>).

The first season, although started while the pandemic was raging, brought about the collection of six reports which are good news for the species, as well as representing a stimulus and incentive to promote a new series of awareness-raising meetings, and the organization of real *bioblitz* in the search for *R. alpina*. Volunteers continued to be engaged until the last months of the project and beyond, in the communication activities of the *After-Life* plan of the Eremita project.

THE INNAT PROJECT

InNat, established in 2017 from the collaboration between the Ministry of Ecological Transition, the Research Council for Agriculture and Analysis of Agrarian Economy CREA – Research Centre of Defence and Certification of Florence, with the Carabinieri National Biodiversity Centre as coordinator, pursues as main objective the setting up of a *Citizen Science* (CS) programme. The tools of the programme are a portal and an app (InNat) enabling citizens to collect and provide reporting, at first, of thirty selected species of insects protected by the Habitats Directive. InNat is therefore an important tool fostering people’s participation in nature conservation, and has facilitated the acquisition of additional data on biodiversity in our territory. The collected data, validated by expert, can be found in the project portal and shared with the national database of the Ministry of Ecological Transition and the National Biodiversity Network (NNB). The collaboration with “i-Rosalia” was warmly welcomed: when you share the same goal, the best thing to do is to join forces! For this reason, the InNat team was pleased to share its platform for the collection of reports, and so the team of “i-Rosalia” was provided with the monthly briefs concerning the reports of *Rosalia alpina* in Emilia-Romagna.

The InNat project continues and with the start of the START2000 project, the CS programme has been expanded by adding additional protected animal species to be reported. At the moment it includes: 34 insect species (eight dragonflies, two grasshoppers, seven beetles and seventeen butterflies) and one freshwater crustacean (the crayfish *Austropotamobius pallipes*). In addition, three plant species and two habitats present in the Annexes of the Habitats Directive have been included in the programme. In short, with a total of forty protected species and habitats to report, InNat is flying with full sails towards its main goal: increasing data on biodiversity in our territory, involving and educating the public. In this regard, the InNat team hopes that the collaboration with “i-Rosalia”, or with other similar initiatives, will continue and develop further.

Edited by Silvia Gisondi, Alessandro Campanaro (InNat team)

SERENA MAGNOLI



A network of collaborations

Networking activities supporting the project actions

by Monica Palazzini, Ornella De Curtis, Cristina Barbieri, Shade Amini and Roberto Fabbri

BELOW During Life Eremita, collaborations with other projects were intense and crossed national borders reaching halfway across Europe. The value of these networking actions was enormous, leading to expanding and integrating the wealth of knowledge shared by the parties involved. One example above all is represented by the cooperation between Life MIPP and Life Eremita that led to the sharing of monitoring protocols for *Osmoderma eremita*.

During the six years of the project, collaborative relationships were established and maintained with the participants in LIFE schemes, but also with other stakeholders, involved in still-in-progress or already completed projects, all relating to Life Eremita. The sharing and exchanges with other entities working on the needed actions for the conservation of forest- and aquatic-dwelling insects, with particular reference to the order of coleoptera and odonata, have provided insights and support to the choices made, and generally contributed positively to the achievement of the project objectives.

The networking developed through the participation in the discussion *forums* of the Technical Committee, the thematic and training *workshops*, the information and awareness-raising campaigns, of the representatives of the various projects, and through the participation of technical teams of the Life Eremita project in similar initiatives organized in other Italian and European contexts.

The networking cooperation activities have focused on the following topics:

- Operational techniques and protocols adopted to monitor the target species;
- Methods used to monitor the habitats of the target species;
- Operational techniques and protocols adopted for the *in-situ* and *ex-situ* breeding of the target species;
- Methods used to reduce the negative effects of the traditional forestry management for production-only purposes;
- Management of broadleaf forests compatible with the conservation of the target species;
- Techniques for the restocking of *Graphoderus bilineatus*.

The networking has also enabled to maximize the effectiveness of the project for the communication and dissemination of results.

Particularly significant was the exchange with the Life MIPP project, which consisted mainly in the transposition and subsequent adaptation to our requirements of the monitoring protocol for *Osmoderma eremita*. In its turn, Life Eremita has provided the Life Rosalia project with the monitoring protocols for forest beetles and provided the

Life4OakForests project with protocols for breeding, release and restocking of the species *O. eremita*. The networking has been extremely effective with respect to the actions to be carried out in favour of the target species *G. bilineatus*. In this instance, representatives of other LIFE projects or research institutions, from other European countries, have stepped forward to provide the necessary specimens, both for genetic analysis and the definition and implementation of the restocking plan in the project locations. Starting from 2018, more than fifteen research groups from different countries were involved in the comparative analysis of the genetic characterization of the relictual population of *G. bilineatus* in the Modenese Apennines with other European populations, a preliminary operation for the identification of some source sites where to find founders for the restocking plan in some suitable sites in Emilia-Romagna region (Table 1).



EMILIA-ROMAGNA REGIONAL ARCHIVE

TABLE 1 Countries of origin of the specimens of *Graphoderus bilineatus* used for genetic investigations.

COUNTRY OF ORIGIN (ACRONYM)	LOCATION
Hungary (UNG)	Drava
	Bodrog
	Danube
Lithuania (LIT)	Klimbalés durpynas
	Nevėžio senvagės
Croatia (CRO)	National park Kopacki
	River Drava, Dsijek
	Lonnjsko Polye Nature Park
Italy (ITA)	Modenese Apennine

BELOW The information exchange on the occurrence and health of European populations enabled to acquire relevant information on the status of *Graphoderus bilineatus* in Europe



EMILIA-ROMAGNA REGIONAL ARCHIVE

The exchange of information on the extent and health status of other populations enabled to outline a rather worrisome picture on the conservation status of *G. bilineatus* in Europe. Therefore, the expectation of retrieving founding individuals from other countries, where the species was supposed to be rather abundant, was in most cases disregarded for several reasons. Today, the species seems to be going through a general contraction of its distribution range, and at the same time, due to the species' elusive character, its status has been poorly investigated both in biological and phenological terms.

After several *mail* exchanges and on line meetings, replacing the usual “*study visits*” during the pandemic, an on line *workshop* was organized on September 30th, 2021, which fully achieved the goal of encouraging an international discussion on the possible causes of population reduction, and on the actions to be taken for the medium to long-term protection of the species. The *workshop* recorded a large participation of the various research groups, with fruitful sharing and convergence of objectives, in view of the increasingly urgent need to preserve this elusive Dytiscid beetle, which raises red flags on the sudden change of climatic and environmental conditions.

BELOW Meeting of the Life MIPP project in Bosco Fontana (MN).



EMILIA-ROMAGNA REGIONAL ARCHIVE

The following institutions have participated:

- CINEA – European climate, infrastructure and environment executive agency;
- Department of Biology, University of Padua, Padua;
- Department of Biology and Biotechnologies “C. Darwin”, Sapienza University, Rome;
- JSC - “Latvia’s State Forests”, Latvia;
- Nature Studies and Environmental Education Centre, Daugavpils University, Latvia;
- NIB - National Institute of Biology, Department of Organisms and Ecosystems Research, Slovenia;
- Department of Forest Genetics, Dendrology and Botany, Zagreb University, Croatia;
- CAS - Institute of Entomology, Biology Centre, Czech Republic;
- University of South Bohemia České Budějovice, Czech Republic;
- Department of Systematic Zoology, Faculty of Biology, Adam Mickiewicz University, Poland;
- ISPRA – Higher Institute for Environmental Protection and Research;
- Lombardy Region – Environment Sector;
- Piedmont Region - Biodiversity and Natural Areas Sector;
- Tuscany Region - Environment and Biodiversity Sector;
- ISPLA spa.



ABOVE Presentation of representatives of the “Latvia’s State Forests” and the Centre of Nature Study and Environmental Education studies and environmental education of Daugavpils University on the conservation status of *Graphoderus bilineatus*.

“*Graphoderus bilineatus* in Latvia: State of current knowledge and monitoring”

The representatives of “Latvia’s State Forests” and the Nature Studies and Environmental Education Centre, Daugavpils University, Mārtiņš Kalniņš, Uldis Valainis and Maksims Balalajkins, reported on the current knowledge about the species and the monitoring methodologies followed in Latvia. *G. bilineatus* is currently present in two hundred and sixteen locations, of which one hundred and ninety-nine are in Natura 2000 Network sites. Monitoring is carried out every six years, in the period from 1 May to 30 September, by using a transect, inside which ten *bait traps* are positioned at a distance of 20m from each other. Monitoring data are reported in data collection forms, which specify the number of individuals and the *sex ratio*. The factors impacting negatively on the occurrence and spread of the species, and the description of the vegetation cover in the riparian area along the transect are also reported (assessing the percentage coverage of *Carex* sp., *Myriophyllum* sp., *Elodea* sp., *Potamogeton* sp., *Stratiotes aloides* and *Phragmites australis*). The data sheets also report the factors impacting negatively on habitat conditions, and an expert judgment on the extent of the impact of each factor (high, medium, low). The good conditions and extensions of the habitats in Latvia provide for a good conservation status of the species, so that it was possible to collect almost one hundred founding specimens for their release in Italian sites. The collaboration was quite effective and in this case the networking was successful as it contributed to the achievement of the Life Eremita results.



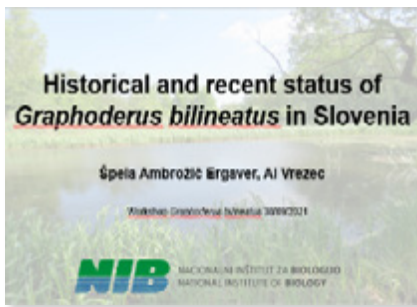
ABOVE Presentation by the Department of Forest Genetics, Dendrology and Botany, University of Zagreb, Croatia, illustrating the experiences regarding *Graphoderus bilineatus* in recent years.

“*The status of Graphoderus bilineatus in Croatia and our experience*”

Martina Temunović, teacher at the Department of Forest Genetics, Dendrology and Botany, Zagreb University, provided data and experiences resulting from the work carried out in recent years. Since 2009 the species has been included in the list of protected fauna in Croatia. From 2010 to 2013, monitoring was carried out in eleven sites of the Natura 2000 Network, with two hundred and five areas of importance, where 905 traps were distributed. In Croatia, the species was found in seven of its one hundred and eleven Natura 2000 Network sites, as well as in twenty-five monitoring areas out of two hundred and five. *G. bilineatus* is currently present in fourteen quadrants (10x10 km). The monitoring also made it possible to collect a lot of information on the features of the habitat suitable for the species. Human presence has proved to be a negative, heavily impacting factor, while the variety of the environment, and in particular of the water bodies (for example, areas of different sizes), have been shown to have a positive impact, as long as the habitats are connected and heterogeneous. In 2015, the monitoring programme was published; initially, it was carried out with *bottle traps* and later with *crayfish traps* (this type of trap keeps the insect alive, even if the capture efficiency is ten times



RIGHT Habitat of *Graphoderus bilineatus* in Croatia.



ABOVE Presentation by Slovenian researchers from the National Institute of Biology, Department of Organisms and Ecosystems Research, on the monitoring methods used for *Graphoderus bilineatus*.

lower). Although the diversity, extension and quality of the monitored habitats make them suitable, the rarefaction of the species' occurrence recorded in the monitoring shows how much *G. bilineatus* is significantly threatened even by slight changes caused by human activities, and confirms the crisis of the species in the southern limit of its distribution range in Europe.

“Historical and recent status of *Graphoderus bilineatus* in Slovenia”

The Slovenian researchers Al Vrežec and Špela Ambrožič Ergaver from the National Institute of Biology, Department of Organisms and Ecosystems Research, presented the methods being applied during their monitoring activity, such as *baited bottle trap* and *net sampling*.

In Slovenia *G. bilineatus* is not on the National Red List, but a transition to threatened *status* has been proposed. The most recent findings of the species in Slovenia date back to 2011 and 2013 in the Mura region. From 2008 to 2020, the species' monitoring was carried out on two hundred and sixty-eight sampling sites. In 2011, 2017 and 2020 its occurrence was confirmed only in some of these sites: this result highlighted the great vulnerability of the species. One of the most important threats are the invasive alien fish species used for sport fishing. In conclusion, the species appears to be at risk of extinction, underlining the need to implement greater conservation measures and in-depth genetic analyses of the relictual population. There is the possibility of reintroducing the species, but at first a renaturation of the water bodies would be necessary, thus fostering their connection and eliminating the threat factors. The experience carried out in Italy could represent a good practice to be implemented in future projects also in Slovenia.

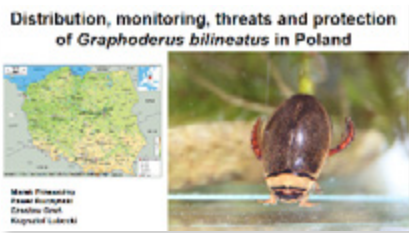
“Habitat preferences of endangered diving beetle *Graphoderus bilineatus*: Implications for conservation management”

David Boukal and Vojtech Kolar from the Institute of Entomology, Biology Centre, Czech Republic, and České Budějovice from the University of South Bohemia, have reported how *fish ponds* and *temporary pools* are the ideal habitat for *G. bilineatus*. However, these environments have now disappeared from the Czech landscape due to

BELOW Habitat of *Graphoderus bilineatus* in Slovenia.



anthropogenic pressure. The monitoring was carried out in the protected area of Trebonsko between 2008 and 2009. The sampling technique involved the use of both *bottle traps* and *baited funnel traps* (activated for 24 hours) and led to the identification of *G. bilineatus* in fourteen sites, one of which was a new reporting. Two small populations were located in northern Bohemia, while three others were found in southern Moravia. Statistical analyses showed how *G. bilineatus* prefers natural and semi-natural environments, preferably close to water bodies, thus highlighting the negative effect of crops growing near water bodies (probably due to the high concentration of nutrients found in the water), and the fragmentation of the habitat. The low propensity of the species toward dispersal is a limiting factor for its survival in conditions of fragmented environments. The ecological study on the favourite habitats of *G. bilineatus* provided an interesting contribution to the knowledge of the species and of the causes possibly leading to rarefaction and its local disappearance.



ABOVE The representatives of the Department of Systematic Zoology, Faculty of Biology, Adam Mickiewicz University, Poland, spoke about the conservation status of *Graphoderus bilineatus*.

BELOW Habitat of *Graphoderus bilineatus* in Poland.

“Distribution, monitoring, threats and protection of *Graphoderus bilineatus* in Poland”

From the Department of Systematic Zoology, Faculty of Biology, Adam Mickiewicz University, Poland, Marek Przewoźny reported that *G.bilineatus* does not seem to be the rarest species of the *Graphoderus* genus in Poland. Most data on its distribution refer to eastern Poland; they are also recent and mainly resulting from the conservation strategy initiated with the establishment of the Natura 2000 Network. The monitoring was carried out twice: in the 2010-2011 period and in 2016; and a third one is expected. The *net sampling* method was mainly used for the capture. In Poland, the species is not endangered, although it is subject to different pressures and threats.

The good status of the species’ conservation in the country, mainly due to the conservation measures implemented in Natura 2000 sites, offers a reference model for acting with more suitable and effective tools to protect the survival of the species in southern European countries, where *G. bilineatus* is in critical condition, highly threatened, and at risk of extinction.

Although the conservation status of *G. bilineatus* was a topic of common interest at European level, thus facilitating the exchange of information, genetic material and effective collaboration for restocking actions in Italy, the networking was also involved in other project themes, from the sharing of monitoring methods of the two saproxylic species to the management of wetlands and forest.



Below, we present an overview of the LIFE projects with which there was an opportunity for contact and exchange of information:

NETWORKING					
COUNTRY	PROJECTS	COD.	COMPLETE NAME	START DATE/END DATE	BUDGET
Denmark	RigKilde Life www.rigkildelife.dk	LIFE14 NAT/DK/000606	Restoration and conservation of petrifying springs (*7220), calcareous fens (*7210) and alkaline fens (7230) in Denmark	01/08/2015 - 31/12/2022	Total budget: 6,220,049 UE Contribution: 3,732,029
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project, established in 2015, aims to save the rare and vulnerable natural habitats called petrifying springs, alkaline fens and calcareous fens. Interventions were carried out on the drainage canals in order to manage the water level of the existing habitats and interventions for the restoration and expansion of these habitats in areas deemed suitable. In addition, livestock was used for the long-term conservation of grazing environments. All the interventions were carried out in agreement with the owners and local authorities. With Life Eremita, the exchange of knowledge developed on <i>Graphoderus bilineatus</i> . Both projects had in common the conservation of areas where the species is present with the aim of restocking.		
Italy	Life MIPP www.lifemipp.eu/mipp/new/index.jsp	LIFE11 NAT/IT/000252	Monitoring of insects with public participation	01/10/2012 - 30/09/2017	Total budget: 2,734,430 UE Contribution: 1,599,906
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project, completed in 2017, aimed at developing and testing standardized monitoring methods for assessing the conservation status of insect species included in the annexes of the Habitats Directive. The species being considered were: <i>Osmoderma eremita</i> , <i>Lucanus cervus</i> , <i>Cerambyx cerdo</i> , <i>Rosalia alpina</i> , <i>Morimus funereus</i> . Between the two projects, MIPP and Eremita, there was an exchange concerning the sharing of monitoring protocols and the occurrence data for the two species of mutual interest: <i>O. eremita</i> and <i>R. alpina</i> .		
Italy	Life GoProFor www.lifegoprofor.eu/it/	LIFE17 GIE/IT/000561	GOod PRactices implementation netwOrk for FOrest biodiversity conservation	01/09/2018 - 30/09/2022	Total budget: 2,517,130 UE Contribution: 1,506,452
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The Project intends identifying and disseminating forest management tools aimed at increasing uses compatible with the Natura 2000 Network. It encourages the exchange of experiences and good practices for the management of biodiversity in forest habitats with the aim of raising awareness both on the part of institutional managers and on the part of all operators exercising an influence on the conservation of habitats and species with their activities. The breeding protocols and techniques concerning <i>O. eremita</i> and the practice of introducing the bred specimens were shared with Life Eremita. In 2021 the GoProFor project organized the fourth edition of the theoretical/practical training Course for experts in "Forest management for biodiversity conservation". The training activity was presented to the technicians and volunteers of Life Eremita.		
Italy	Life WetFlyAmphibia www.lifewetflyamphibia.eu/	LIFE14 NAT/IT/000759	Conservation of amphibians and butterflies of open wet areas and their habitats at the Foreste Casentinesi National Park	01/09/2015 - 31/12/2021	Total budget: 1,596,342 UE Contribution: 948,057
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project, which ended in 2021, had as its objective the improvement of the conservation status of amphibians and butterflies of Community interest, of wet lands and their habitats within the National Park of the Casentinesi Forests, Mount Falterona and Campigna. The target species were: Apennines toad, the Savi salamander and the Italian crested newt, as well as the eulaglia quadripunctaria moth and the eastern eggar. The interventions consisted in the setting up of new wetlands, in the restoration and creation of drinking troughs, in the improvement of existing pools, for a total of more than one hundred and thirty interventions in the Park. The researchers participating in the WetFlyAmphibia project indicated suitable sites for <i>O. eremita</i> , where its occurrence was later reported by the Eremita entomologists. Other collaborations between the two projects developed with local dissemination actions, such as the information workshop on LIFE projects, held on 29-30 October 2016.		
Lithuania	Life Osmoderma www.osmoderma.it	LIFE16 NAT/LT/000701	Ecological network for <i>Osmoderma eremita</i> and other species dependent on veteran tree	01/09/2017 - 31/03/2022	Total budget: 1,378,000 UE Contribution: 1,033,180
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The main objective consisted in creating a functional ecological network for the <i>O. eremita</i> and other saproxylic species through adequate management of veteran forests, the creation of migratory corridors, the eradication of alien species and the creation of temporary artificial habitats. Life Eremita shared its experiences: monitoring protocols and the creation of the nest boxes and their management methods.		

Scotland	EcoCo Life www.ecocolife.scot	LIFE13 BIO/UK/000428	Implementation of integrated habitat networks to improve ecological coherence across the CSGN	1/09/2014 - 31/03/2019	Total budget: 3,132,695 UE Contribution: 1,566,344
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The goal of the EcoCo Life Scotland project was to provide for the management of habitats in the "Central Scotland Green Network (CSGN)" area to improve ecological coherence. A series of concrete conservation activities were implemented to better connect the habitats and increase the biodiversity they host, with consequent improvements in the quality and functionality of the landscapes. This project hosted an important Platform meeting in Stirling, Scotland: "Bringing bugs back to Life: action for threatened invertebrates". The conference was organized by the European LIFE unit, to which various LIFE projects concerning invertebrates were invited, in order to discuss specific actions for their conservation. The Life Eremita project was invited to participate in Working Group 4 "Essential Enablers", due to the role that the target insects of our project play in the ecosystem. The entomologist of the National Park of Casentinesi Forests, Mount Falterona and Campigna then presented the project, presentation which was then followed by a discussion with the participants of the working group on the topic of useful insects for ecosystems and conservation actions. Critical elements and key points of the Life Eremita project were also analysed, as well as the results obtained up to that moment. The event was also important because representatives of other European projects for the conservation of some target species of our project were present, with whom it was possible to have an exchange of views and experiences about some activities.		
Slovenia	Life Slovenija www.lifeslovenija.si/it/	LIFE14 CAP/SI/000012	LIFE Capacity Building Slovenia	01/01/2016 - 30/06/2019	Total budget: 1,218,146 UE Contribution: 981,330
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The main objectives of the project were: 1) strengthening the activities of the Ministry for the Environment and Territory for the implementation of the LIFE programme, at a qualitative and quantitative level; 2) increasing the efficiency of Slovenia in the implementation of the LIFE programme (more accepted applications and better connection with policy implementation), and 3) improving the promotion of results by including them in specific policies. The Eremita experience was shared during a visit to some sites in the project area, in Campogalliano (MO) in April 2017. During the meeting with the Slovenian delegation, made up of 13 members of the Ministry of the Environment, of the Institute of Fisheries and the Institute for Conservation of Nature, the objectives and main actions of the Life Eremita project were presented. Many of the members of the delegation showed interest in the Eremita project and in particular there was a discussion on the ecology and conservation status of the aquatic species of <i>G. bilineatus</i> present in some sites in Slovenia.		
Italy	Life 360 ESC www.life360esc.eu/it/	LIFE17 ESC/IT/000001	360 volunteers for monitoring forest biodiversity in the Italian Natura 2000 Network	01/11/2018 - 31/10/2021	Total budget: 2,886,082 UE Contribution: 1,820,479
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The Life ESC360 project offered 360 volunteers, aged 18 to 30, the possibility of actively participating in nature conservation through the monitoring of invertebrates, amphibians, birds and mammals of Community interest, in the 22 Italian Natura 2000 Network sites, managed by Arma dei Carabinieri. The specific goals of the ESC360 projects were: 1) Increasing the monitoring data for species of Community interest, plant species and habitats in the Reserves of Maremma, Fogliano, Western Murge, the State Nature Reserve of Bosco della Fontana, the State Nature Casentinesi Reserves and the State Natural Reserves in Abruzzo and Molise. 2) Creating an integrated biodiversity monitoring system through the application of standard protocols within the study areas for forest and upland habitats. The experiences in involving volunteers and sharing monitoring protocols were the points of contact with the Life Eremita project.		
Italy, Hungary	Life4Oak Forests www.life4oakforests.eu	LIFE16NAT/IT/000245		01/07/2017 - 31/12/2026	Total budget: 7,980,586 UE Contribution: 5,895,289
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The goal of the project consists in promoting the regeneration and restoration of forest structural diversity, native species composition and microhabitats. The results will have a positive impact on the habitats of some species protected by the Habitats Directive (mammals, birds, insects, plants and fungi) related to forest habitats, in terms of maintenance and increase of their populations. Restocking activities with <i>O. eremita</i> , envisaged in the project, were based on the experience and protocols provided by Life Eremita.		
Romania	Life Rosalia www.liferosalia.ro/	LIFE19 NAT/RO/000023	Conservation of saproxylic beetles in the Carpathians	01/09/2020 - 31/05/2025	Total budget: 2.943.428 UE Contribution: 2.207.571
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project aims at stopping and reversing the loss of priority and non-priority saproxylic beetle populations in the Carpathians by implementing conservation actions to increase connectors for favourable habitats in ROSC10208 Putna Vrancea (Eastern Carpathians, Romania) and the transfer and replication of appropriate actions in other Romanian Natura 2000 sites. Among the target species of the project are <i>O. eremita</i> and <i>R. alpina</i> . Life Eremita shared the method of construction of nest boxes for <i>O. eremita</i> for the <i>in-situ</i> breeding activity, in order to test the method in Romania as well. The networking continues with the participation in the final conference of Life Eremita project.		
Denmark	Life Raised bogs www.webgate.ec.europa.eu/life/publicWebsite/project/details/4256	LIFE14 NAT/DK/000012	Raised bogs in Denmark	01/08/2015 - 31/12/2023	Total budget: 5,592,198 UE Contribution: 3,355,319
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The main goal of the project is to achieve a favourable conservation status for raised bogs. Actions, which are still ongoing, aim to strengthen the significant potential of active raised bogs by letting them develop both qualitatively and spatially in the project sites. The conservation status of aquatic beetles and dragonflies (<i>Dytiscus latissimus</i> , <i>Graphoderus bilineatus</i> and <i>Leucorrhinia pectoralis</i>) could also benefit from habitat regeneration. The experience in managing these habitats is providing a useful comparison to better identify improvement interventions in wetlands for target species.		

In the last decade in Europe, other Life projects were developed that directly or indirectly dealt with topics related to the Life Eremita project, as they aimed to restore aquatic or forest environments in favour of invertebrate fauna. There were no direct contact with these projects, but it is still useful to identify them for possible collaborations to be developed not only to expand knowledge but also to undertake new conservation actions in favour of this group of fauna that in general seems to be viewed as yet of little interest, but it is of fundamental importance for its ecosystem role in some forest and wetland environments.

Denmark, Germany, Sweden	SemiAquaticLife www.semiaquaticlife.se/en/semiaquaticlife-2	LIFE14 NAT/SE/000201	Re-creating habitat complexity for semi-aquatic fauna	01/01/2016 - 31/12/2021	Total budget: 5,805,123 UE Contribution: 3,478,377
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project was concerned with the creation and restoration of wetlands and terrestrial habitats for semi-aquatic fauna in a number of Natura 2000 Network sites to improve their conservation status. It targeted several species of amphibians, dragonflies and water beetles protected under the Habitats Directive and listed in Annexes II and IV.		
Slovenia	Life LiveDrava www.lifeslovenija.si/en	LIFE11 NAT/SI/000882	Riparian Ecosystem Restoration of the Lower Drava River in Slovenia	1/09/2012 - 31/12/17	Total budget: 4,409,483.00 UE Contribution: 2,188,741.00
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The objective of the project was to preserve and expand populations of species listed in Annex I of the Birds Directive (typical birds of lowland rivers) and Annex II of the Habitats Directive (fish and beetles) through the management of floodplain forest habitats (Annex I) along the lower Drava River in Slovenia.		
Italy	Life Carabus www.lifecarabus.eu	LIFE11 NAT/IT/000213	Protection and species habitat conservation for the consolidation of the <i>Carabus olympiae</i> population in Valsessera	1/06/2012 - 31/12/2015	Total budget: 1,097,480 UE Contribution: 552,353
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project aimed to reduce the threat of extinction of the <i>Carabus olympiae</i> species. The main actions carried out by the project comprised: 1) the improvement of forest, bush and grassland habitats, 2) the development of a forest management model for the conservation of the species in 300 ha, and 3) the establishment of animal shelters and nurseries for the species.		
Sweden	Life Bridging the GAP www.lifebridgingthegap.se/english	LIFE15 NAT/SE/000772	Bridging the Spatial and Temporal Gaps in Threatened Oak Habitats	03/10/2016 - 30/09/2022	Total budget: 8,343,675 UE Contribution: 4,999,784
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The project aims to reconnect the fragmented landscape of Fennoscandian wooded pastures, therefore reducing extinction rates of local beetles that depend on wood as habitat. Specific objectives include initiating the process of recovery to a satisfactory conservation status for the following Annex II species: <i>O. eremita</i> , <i>C. cerdo</i> , <i>L. cervus</i> and <i>Anthrenochernes stellae</i> in 30 Natura 2000 Network sites through the creation of habitats with marcescent wood.		
Portugal	BEETLES Life www.lifebeetlesazores.com/en/	LIFE18 NAT/PT/000864	LIFE BEETLES Bringing Environmental and Ecological Threats Lower To Endangered Species	01/01/2020 - 31/12/2024	Budget totale: 1,772,632 UE Contribution: 974,948
			OBJECTIVE OF THE PROJECT AND CONTACT POINTS WITH LIFE EREMITA The goal of this project is to improve the population size, range, and conservation status of wild populations of <i>Tarphius floresensis</i> , <i>Pseudanohomenus aptinoides</i> , and <i>Trechus terrabravensis</i> by implementing measures to increase land cover and implementing nature-based solutions to prevent runoff and erosion.		



After the Eremita project

ANDREA BONAVITA

The continuation of the project actions through conservation measures and the *After-Life Plan*

by *Monica Palazzini and
Cristina Barbieri*

The closing of a Life Natura project never means the end of the implemented conservation actions, but rather the start of the *After-Life Conservation Plan* which will ensure the long-term management of the site(s) of the habitats and species.

The conservation action in favour of four insects will continue after the closing of the Life Eremita project, thanks to the commitment of all the *partners* and the specific and priority conservation measures adopted by Emilia-Romagna region.

The closing of a LIFE Natura project never entails the stop of the adopted conservation measures, although it marks the time when the strongest investment stage usually ends, namely the period when the mechanisms are activated to produce the medium to long-term effects of the inversion of the negative *trend* meant to be countered for the conservation status of the target species and/or habitats. The tool ensuring the maintenance of the conservation action in the period following the end of the project is the *After-Life Conservation Plan*. This is a plan establishing the continuation of the actions initiated in the project to be developed in the following years, and the processes ensuring the long-term management of the habitat and species site (s). The *After-Life Plan* is an obligation that the beneficiaries of European funding take at the early application phase, and a mandatory scheme to be defined before the end of the project.

The Eremita's *After-Life Plan* pursues two main goals: the maintenance and assessment of the efficacy of actions implemented for the species' habitat restoration, and further strengthening of the target species' populations.

With the project, as extensively described in the previous articles, forestry interventions were carried out in order to artificially "age" the forest with the creation of either on-the-ground or standing deadwood; their effectiveness - in terms of the objective of expanding the availability of suitable habitats - would only be fully assessed in the next few years. The same can be said for the forestry interventions carried out in order to keep alive the old-growth chestnut trees rich in hollows that represent the habitat of choice of *O. eremita*.

Regarding wetlands, the attention paid to the many aspects of their management with the aim of preserving and possibly increasing biodiversity, starting from the target species, highlighted once again the fragility of these ecosystems, but also the necessary in-depths and analysis to be carried out when dealing with the maintenance going beyond the mere control of vegetation.

All the carried-out interventions are also representative of practices with a high illustrative value, while the awareness-raising and information activities for local authorities, owners and the production world did focus on their replicability.

One of the legacies of the LIFE project are also the specific conservation measures that will strengthen the *After-Life* activities, thus becoming the reference standard for the conservation of the four target species in thirty-seven Natura 2000 sites in Emilia-Romagna.

In order to be valid, the conservation measures are approved according to the procedure provided for by the Regional Law 7/2004 and subsequent regulatory



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amendments, and are divided into obligations or prohibitions, and active interventions.

Last but not least, the legacy also includes the knowledge of the project, acquired during the monitoring carried out in the first two years of LIFE and mainly aimed at knowing the distribution area of the target species in the Region. This first phase actually contributed to the updating of the Standard Data Forms of nine Natura 2000 sites: eight in which the *O. eremita* species was found and two in which *Rosalia alpina* was found.

SPECIES	KNOWN SITES BEFORE THE PROJECT AND CONFIRMED BY THE PROJECT	SITES UPDATED AFTER THE PROJECT
<i>Osmoderma eremita</i>	IT4040003 Sassi di Roccamalatina e di Sant'andrea; IT4040004 Sassoguidano, Gaiato; IT4040001 Monte Cimone, Libro Aperto, Lago Di Pratignano; IT4040002 Monte Rondinaio, Monte Giovo; IT4020001 Boschi di Carrega; IT4020026 Boschi dei Ghirardi; IT4020003 Torrente Stirone; IT4030003 Monte La Nuda, Cima Belfiore, Passo del Cerreto; IT4070011 Vena del Gesso Romagnola; IT4020021 Medio Tarò; IT4080003 Monte Gemelli, Monte Guffone.	IT4080002 Aquacheta; IT4030002 Monte Ventasso; IT4030003 Monte la Nuda, Cima Belfiore, Passo del Cerreto; IT4050004 Bosco della Frattona; IT4070016 Alta Valle del Torrente Sintria; IT4090003 Rupi e Gessi della Valmarecchia.
<i>Rosalia alpina</i>	IT4080003 Monte Gemelli, Monte Guffone; IT4030004 Val D'Ozola, Monte Cusna; IT4030005 Abetina Reale, Alta Val Dolo; IT4080003 Monte Gemelli, Monte Guffone.	IT4080002 Aquacheta; IT4050002 Corno alle Scale.
<i>Coenagrion castellani</i>	IT4090002 Torriana, Montebello, Fiume Marecchia IT4070011 Vena Del Gesso Romagnola.	
<i>Graphoderus bilineatus</i>	IT4040001 Monte Cimone, Libro Aperto, Lago Di Pratignano.	With the Life Eremita project, the species was released also in the following sites: IT4030001 Monte Acuto Alpe di Succiso; IT4030005 Abetina Reale Alta Val Dolo; IT4050015 - ZSC - La Martina, Monte Gurlano.

TABLE 1 Sites of the Natura 2000 Network hosting the target species.

The project results contributed to outline a clear picture of the conservation status of the four insect species and the possible priority conservation measures to be included in the PAF (*Prioritized Action Framework*) document for the Natura 2000 Network in Emilia-Romagna Region, with respect to the 2021-27 structural funds programme and approved with the Deliberation of the Regional Council n. 2021 of 29/11/2021.

Under Article 8 of the Habitats Directive 92/43/CEE, the PAFs are pluri-annual strategic planning tools, aimed at providing a complete overview of the measures necessary to implement the Natura 2000 Network in the European Union (EU), and the related green infrastructures, specifying the financing needs for these measures and linking them to the corresponding EU funding programmes. In line with the objectives of the EU Habitats Directive on which the Natura 2000 Network is based, the measures to be identified in the PAFs will mainly be designed “for the

ABOVE The effectiveness of interventions for the creation of either standing or on the ground deadwood will be assessed in the years after the closing of the Life Eremita project through the *After-Life Plan*.

RIGHT During the project many awareness-raising and dissemination activities were carried out with the participation of local Authorities, property owners and businesses.

maintenance or re-establishment at a favourable conservation status, of natural habitats and species of Community importance, taking into account economic, social and cultural needs, and regional and local characteristics”. The specific conservation measures in favour of the saproxylic species *O. eremita* and *R. alpina* in the Natura 2000 Network sites where they are present, intend to:

- Increase the availability of habitat trees, by encouraging the release of dead and living plants with hollows during forestry operations;
- Promote the conversion of coppice into tall tree forest;
- Promote the re-establishment of abandoned chestnut groves;
- Speed up the ordinary evolutionary processes leading to the formation of standing, or on the ground, dead trees in forests with a prevalence of beech trees;
- Promote non-intervention policies and the identification of freely evolving areas inside the forests.

BELOW The results of the project helped to outline a clear picture of the conservation status of the four insect species and the priority conservation measures to be included in the *Prioritized Action Framework (PAF)* document for the Natura 2000 Network in the Emilia-Romagna Region.

Many obligations were identified for the conservation of the two insects, alongside measures to protect large trees in the woods and topped rows in the flatlands, and to control alien plant species that can shade the habitat trees; also, in the forestry uses in woods larger than one hectare, the obligation was introduced to provide for the construction of at least 5 hollows per ha, or the expansion of pre-existing hollows and the release of dead trunks in forests with a prevalence of beech trees. Regarding aquatic species, the measures concerning *Coenagrion castellani* referred to the banning of livestock breeding, extensive agriculture near the stretches of waterways where the species is present. Furthermore, to ensure the integrity of



EMILIA-ROMAGNA REGIONAL ARCHIVE



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The volunteers took hiking trips to monitor the species and assess the progress of implemented actions; for example, the cleaning operations of small water courses vital for *Coenagrion castellani*.

these areas, water abstraction is not allowed. The restoration of swampy areas near waterways and interventions similar to those carried out with Life Eremita are instead promoted, which makes it possible to maintain or extend areas suitable for the southern Damselfly. As for *Graphoderus bilineatus*, in the few sites of its occurrence, it is mandatory to intervene quickly if the wetlands are colonized by alien animal species representing a threat to the species, and to promote actions to maintain its vital habitat.

In the regional territory and in particular in the Romagna Macro-area, for the Regional Park of Vena del Gesso Romagnola, thanks to the transfer of good practices developed during the Life Eremita project, several actions of the Life 4Oakforest project, started in 2017, are currently underway in order to promote forest regeneration and restore their structural diversity, the composition of native species and microhabitats, also continuing conservation actions for *Osmoderma eremita*. A Life Eremita effect can also be that the defined and implemented practices are shared not only through the action of project networking, but also extended beyond the project area in neighboring regions, as the reference for a species' conservation is its entire range, which obviously goes beyond administrative boundaries. The hope is therefore that strategic LIFE projects covering the entire Po river basin could be financed, and bring about coordinated system actions and the exchange of good practices with other regions, also including the conservation of our hermit beetle species.

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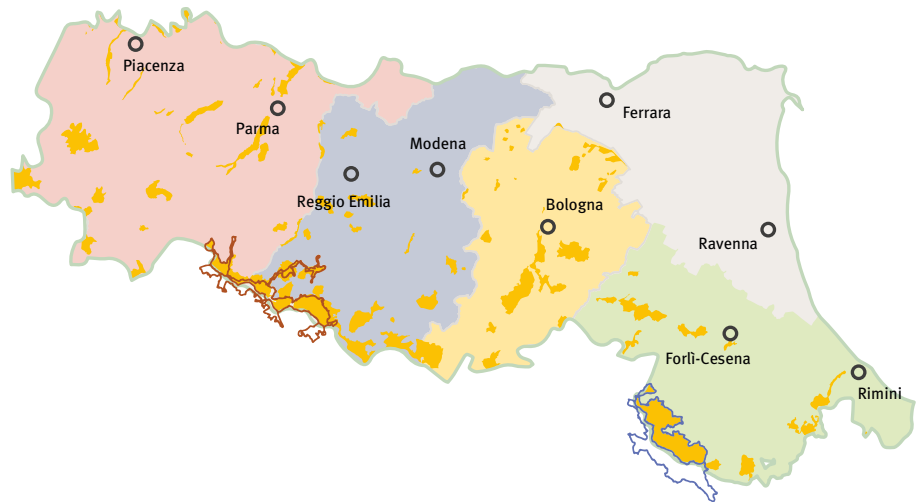
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78 sites of Natura 2000



- National Park of Casentinesi Forests
- National Park of Tuscan-Emilian Apennines
- Romagna Macro-area
- Central Emilia Macro-area
- Eastern Emilia Macro-area
- Western Emilia Macro-area
- Emilia-Romagna Region
- Sites Rete Natura 2000

The project partners



COORDINATOR
 Regione Emilia-Romagna
Settore Aree protette, foreste e sviluppo zone montane – Area Biodiversità
 Viale Aldo Moro 30 - 40127 Bologna
 tel. 051.527.6978 cell. 3314012671
 pec: segprn@postacert.regione.emilia-romagna.it

- Parchi, Aree Protette e Natura 2000
- Aree protette, Foreste e Natura 2000 in Emilia-Romagna



PARCO NAZIONALE APPENNINO TOSCO-EMILIANO
 administrative headquarters: Sassalbo (MS)
 tel. 0585 947200
 operational headquarters Ligonchio (RE)
 tel. 0522 899402
 info@parcoappennino.it
 www.parcoappennino.it



PARCO NAZIONALE FORESTE CASENTINESI, MONTE FALTERONA E CAMPIGNA
 headquarters: Pratovecchio (AR)
 tel. 0575 50301
 headquarters of park community of Santa Sofia (FC)
 tel. 0543 971375
 info@parcoforestecasentinesi.it
 www.parcoforestecasentinesi.it



ENTE DI GESTIONE PER I PARCHI E LA BIODIVERSITÀ – EMILIA OCCIDENTALE
 headquarters: Collecchio (PR)
 tel. 0521 802688
 info@parchiemiliaoccidentale.it
 www.parchidelducato.it



ENTE DI GESTIONE PER I PARCHI E LA BIODIVERSITÀ – EMILIA CENTRALE
 headquarters: Modena (MO)
 tel. 059 209311
 info@parchiemiliacentrale.it
 www.parchiemiliacentrale.it



ENTE DI GESTIONE PER I PARCHI E LA BIODIVERSITÀ – EMILIA ORIENTALE
 headquarters: Valsamoggia loc. Montevoglio (BO)
 tel. 051 6702811 / 339 7223135
 info@enteparchi.bo.it
 www.enteparchi.bo.it



ENTE DI GESTIONE PER I PARCHI E LA BIODIVERSITÀ – ROMAGNA
 headquarters: Riolo Terme (RA)
 tel. 0546 77404
 promozione@parchiromagna.it
 www.parchiromagna.it

“ The clearest way into the Universe is through a forest wilderness. ”

John Muir

To Sergio, always present in our memory and in the Universe of Nature to which he gave so much in the interval of his earthly life.

(...) Inasmuch as in large bodies or at all events the larger ones, the process of manufacture was facilitated by the yielding of the material, whereas in these minute nothings what methods, what power, what labyrinthine perfection is displayed! (...) I consequently beg my readers not to let their contempt for many of these creatures lead them to condemn to scorn what I relate about them, since in the contemplation of Nature nothing can possibly be deemed superfluous.

Pliny the Elder, I, in *Book XI, Natural History*

(...) the invention of beetles (...) consists «only» in their having changed the use of the front pair of wings. They are no longer wings but elytra: they are thickened and sturdy, and serve only as protection for the hind wings, which are membranous and fragile. (...) But the beetles' armour is an admirable structure (...). It is a masterpiece of natural engineering, and is reminiscent of the all-iron armours of medieval warriors. It is without gaps: the head, neck, thorax and abdomen, although not welded together, form a stumpy, almost invulnerable block, the tenuous antennae can be retracted into grooves, and even the joints of the legs are protected by protrusions reminiscent of the greaves of the Iliad...

Primo Levi, in *The Beetles, Frogs on the Moon and other animals*

Under the willow branches in the mud bathed
An impure people are silent, frozen in their torpor,
While we see on the water thin spiders
Fleeing towards the water lilies, veiled by a vapor.
But, hovering over this world where life at peace
Sleeps a joyless sleep and almost without waking,
Beings who are only light and dew
Alone shake their ephemeral souls in the sun.
One day I saw these slender ladies,
As we call them, pride of the calm waters,
Rejoicing the pure air with the brightness of their wings,
Fleeing and seeking each other over the reeds...

Anatole France, *The death of a dragonfly*

The quotations in italian are taken from: Mino Petazzini, *La poesia degli animali. Un'antologia di testi su cervo, chiocciola, farfalla, lucciola, lucertola, lupo, mosca, rana, volpe, zanzara e tanti altri animali selvatici*, Vol. 2, Luca Sossella editore (2022).