European Commission

LIFE and invertebrate conservation

LIFE Nature

Environment

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Foreword

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Invertebrates are a cornerstone of our ecosystems, providing vital services such as pollination and also acting as important environmental indicators (for instance of water quality in rivers, a function of freshwater pearl mussels). Yet, despite their importance and prevalence, there is a lack of knowledge about many invertebrate species, including among the general public, resulting in a lack of care and conservation. Furthermore, the sheer number of threatened invertebrates in Europe alone makes it difficult to target them through direct conservation action.

As a result, the LIFE programme has tended to focus its funding on strengthening habitat security and conservation in order to support biodiversity richness and ecosystem health. This LIFE Focus publication offers key examples of this approach in action, ranging from projects that manage agricultural land in a way that is favourable for targeted butterfly species such as the marsh fritillary (*Euphydryas aurinia*) and violet copper (*Lycaena helle*) (see pp. 15-26); to ensuring that ancient forests contain appropriate quantities of decaying wood and associated debris for saproxylic beetles (see pp. 27-34).

LIFE projects have also benefitted other groups of invertebrates, such as bees, dragonflies, snails and various freshwater and marine species (including Europe's cold water coral reefs). It is safe to assume that other projects not featured in this publication will have had unreported benefits for invertebrate communities as a result of habitat restoration actions.

Despite these successes, it is also recognised that improvements in invertebrate conservation are both possible and necessary. Invertebrates have tended to be under-represented in LIFE Nature & Biodiversity projects in comparison with other species (see pp. 3-6). Furthermore, fewer than half of the eligible invertebrate species (those listed in Annex II and Annex IV of the Habitats Directive) have benefitted directly from LIFE funding, and much of the support for invertebrates to date has gone to a small number of charismatic species, such as the hermit beetle (*Osmoderma eremita*).

In addition, whilst the Habitats Directive is the cornerstone of EU nature conservation policy, its annexes were set more than 20 years ago, since when there has been a significant improvement in knowledge about species groups and greater awareness of particular threats (as well as an increase from 12 Member States to 27). Partly in recognition of this, since 2011 the European Commission has also been considering applications for LIFE+ projects targeting species on the IUCN Red Lists in cases where they are not included in the European Red Lists.

This evolution, together with the opportunities for a landscape-scale approach to habitat conservation afforded by LIFE Biodiversity funding, indicates that the LIFE programme will continue to champion the relevance of invertebrate conservation in new and better ways for the years ahead.

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"So important are insects and other land-dwelling arthropods that if all were to disappear, humanity probably could not last more than a few months. Arthropods are thus all around us, life-giving, and we have never taken their measure."

The Diversity of Life by E.O. Wilson (1992)

Photo: Jean Delacre /LIFE07 NAT/B/000039

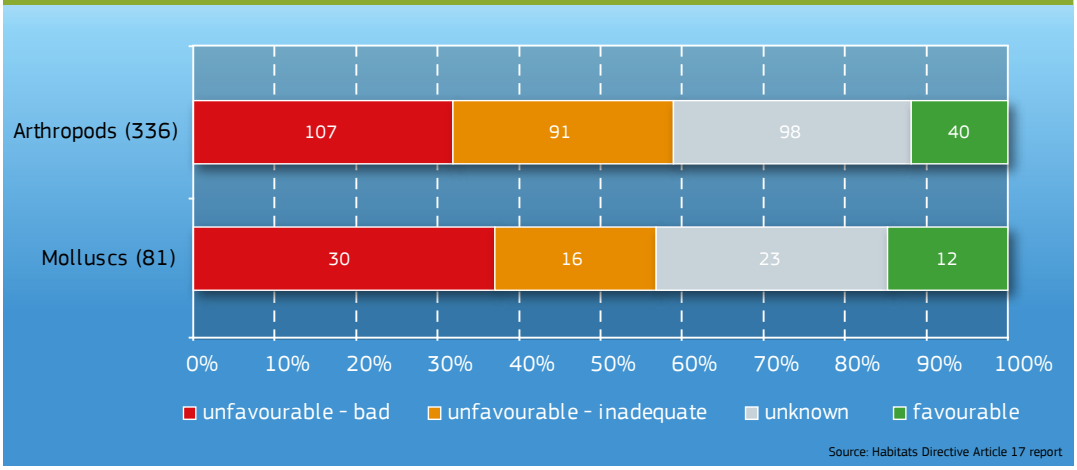
Invertebrates are a very diverse group of species that extend over all environments, ranging from mountains to seas. Moreover, at a global level, they exceed any other group in terms of species richness, biomass, and ecological functions. Indeed, some 80% of Earth's species are invertebrates, and over 95% of all animal species. Consequently, invertebrates are keystone species, underpinning life on Earth: without them the world's ecosystems could collapse. Almost every invertebrate species has a unique role in the ecosystem. They provide valuable ecosystems services, from pollination to soil formation to the control of agricultural pests.

How threatened are EU invertebrate species?

Habitat fragmentation, intense agricultural practices, climate change and many other human activities are damaging invertebrate populations.

The International Union for the Conservation of Nature (IUCN) and the European Commission have been working together on an initiative to assess some 6 000 European species according to the IUCN regional Red Listing Guidelines. In 2011, IUCN

Figure 1: **Assessment of conservation status of invertebrate species***



** The figure in brackets indicates the number of assessments in each region; the figure in the bars indicates the number of assessments.*

released European Red Lists[1] that assessed species of four invertebrate groups threatened with extinction: butterflies, dragonflies and damselflies, non-marine molluscs, and saproxylic beetles. These IUCN Red Lists conclude that:

- Nearly half of Europe's freshwater molluscs and one-fifth of selected terrestrial molluscs are threatened with extinction;
- Overall, some 9% of European butterflies are threatened in Europe, and 7% are threatened at the EU-27 level. A further 10% of butterflies are considered "near threatened";
- Some 11% of the assessed saproxylic beetles (46 species) are considered threatened in all of Europe, while at the EU-27 level, 14% (57 species) are threatened. A further 13% of saproxylic beetles are considered "near threatened" (56 species); and
- At the European level, 15% of the 137 assessed (sub)species of European dragonflies were considered threatened, of which 2% were "critically endangered", 4% "endangered" and 9% "vulnerable". A further 11% of dragonflies are considered "near threatened".

One of the problems facing invertebrate conservationists is the lack of knowledge about the exact conservation status of these species. For example, the percentage of butterflies classified as threatened (9%) is lower than for other invertebrate species (11% beetles, 15% dragonflies, and 50% freshwater molluscs), because the figure for butterflies is based on minimum estimates as population trends are little known in many countries.

1 http://ec.europa.eu/environment/nature/conservation/species/redlist/index_en.htm

EU Biodiversity Strategy to 2020

In May 2011, the European Commission adopted a new strategy that lays down the framework for EU action over the next 10 years in order to meet the 2020 biodiversity headline target set by EU leaders in March 2010[1]. The strategy is built around six mutually supportive targets which address the main drivers of biodiversity loss and aim to reduce the key pressures on nature and ecosystems services in the EU. The six targets are:

- Full implementation of EU nature legislation to protect biodiversity;
- Better protection for ecosystems, and more use of green infrastructure;
- More sustainable agriculture and forestry;
- Better management of fish stocks;
- Tighter controls on invasive alien species; and
- A bigger EU contribution to averting global biodiversity loss.

The 2020 Biodiversity Strategy follows on from the 2006 EU Biodiversity Action Plan, learning lessons from its implementation and raising the level of ambition for 2020. Consequently, in addition to halting the loss of biodiversity, the new strategy also highlights, for the first time, the immense value of ecosystems services and the urgent need to maintain and restore these for the benefit of both nature and society. Biodiversity loss is in fact very costly for society, particularly for sectors that depend heavily on ecosystems services. For example, agriculture is heavily dependent on the services provided by invertebrates species, such as insect pollination, which benefits farmers' harvests and has an estimated annual economic value of €15 billion/yr across the EU.

1 http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm COM(2011) 244 Our life insurance, our natural capital: an EU biodiversity strategy to 2020

EU biodiversity policy and invertebrates

Natura 2000 is the centre-piece of EU nature and biodiversity policy. An EU-wide network of nature protection areas established under the Habitats Directive, its aim is to ensure the long-term survival of Europe's most valuable and threatened species and habitats. The network is comprised of Special Areas of Conservation (SACs) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) which they designate under the Birds Directive.

Photo: Matjaž Bedjanič LIFE09 NAT/SI/000374

The destruction of habitats such as wetlands is the major threat to invertebrate species

The annexes (II and IV) of the Habitats Directive list 151 invertebrate species, including crustaceans, insects, and molluscs. In addition, many of the 26 000 Natura 2000 network sites in Europe play a crucial role in helping to conserve invertebrate species and their habitats.

According to the latest Habitats Directive Article 17 report on the conservation status of species, molluscs have a higher percentage of "unfavourable-bad" assessments (more than 35% of the group fall into this category) than any other Habitats Directive species groups (see Figure 1). Furthermore, around half of the assessments in the subgroups of marine and freshwater molluscs are "unfavourable-bad"; the conservation status of terrestrial snails seems to be better. The major threats to aquatic molluscs are water pollution and the destruction of habitats.

The percentage of "unfavourable-bad" assessments also exceeds 30% for species in the arthropod (crustaceans and insects) group. Many arthropods are associated with threatened grasslands and wetlands; the order Orthoptera (grasshoppers) seems to be

The missing species

Whilst the freshwater pearl mussel has been the subject of a dozen LIFE projects, other invertebrate species have never been directly targeted by LIFE. In particular, three-quarters of the beetles (*Coleoptera*), more than half of the butterflies and one-third of dragonfly species listed in Annex II of the Habitats Directive have not been targeted. Furthermore, only one of the 10 species of beetles listed in Annex II has been targeted and just one-third of the molluscs, with snails (*Gastropoda*) in particular, poorly represented to date.

Figure 2: **Proportion of invertebrates species included in Annex II of the Habitats Directive targeted by LIFE**

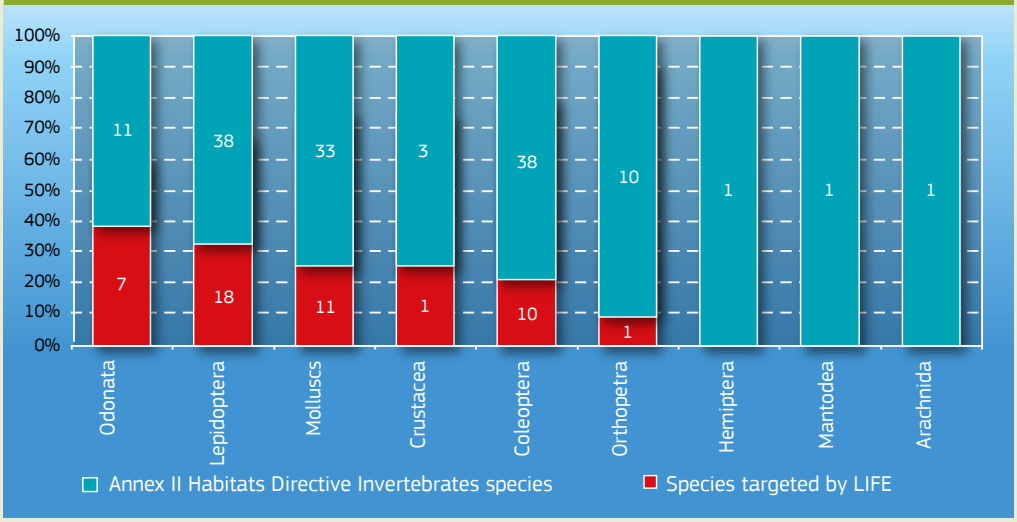


Figure 3: **Number of LIFE projects per species (1992-2010)**

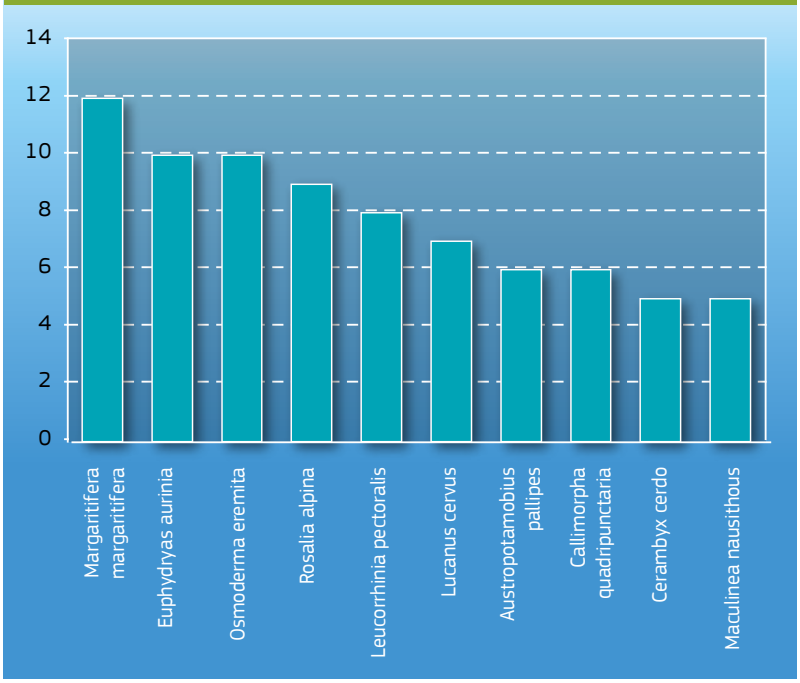
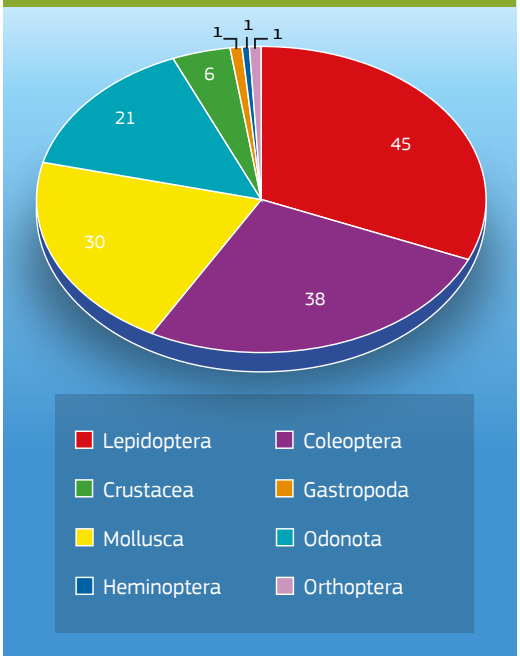


Figure 4: **Number of LIFE projects per Invertebrates species group**



doing better, with only 10% of "unfavourable-bad" assessments. Although these insects are found mostly in grassland habitats, they are in general less sensitive to successional changes than other grassland insect such as butterflies. More than 35% of the other orders of arthropod are assessed as having an "unfavourable-bad" conservation status.

LIFE a key player

Since 1992, LIFE has targeted more than 48 invertebrate species in 143 projects. Some two-thirds of these projects have dealt with butterflies and beetles (see Figure 4) and more than half have targeted just 10 species (see Figure 2). However, the most targeted species has been a mollusc: the freshwater pearl mussel (*Margaritifera margaritifera*), which has been the subject of 12 LIFE projects since 1992. The marsh fritillary butterfly (*Euphydryas aurinia*), the hermit beetle (*Osmoderma eremita*) and the Rosalia longicorn beetle (*Rosalia alpina*) are also among the invertebrate species most targeted by LIFE (see Figure 3).

LIFE projects monitor the impact of habitat restoration actions – such as counting the number of butterflies in a restored meadow in Belgium

Photo: LIFE05 NAT/B/000088

Most LIFE projects targeting invertebrates have focused actions on habitats, rather than species themselves. Habitat-related actions have ranged from restoration (e.g. rewetting wetlands) to re-establishing appropriate extensive agricultural practices (traditional grazing) on meadows.

LIFE has also co-funded the acquisition of land areas important for invertebrates in Natura 2000 network sites. Some projects have been actively working on ex-situ conservation and subsequent reintroduction to the wild of freshwater invertebrate species, such as freshwater pearl mussels and crayfish. An ongoing project in Germany is attempting to reintroduce the marsh fritillary in four Natura 2000 network sites in Germany (see pp. 16-18).

Moreover, LIFE has been supporting habitats actions throughout Europe that indirectly benefited invertebrate species. In addition, LIFE, by targeting species, has been supporting the recovery of ecosystems services provided by invertebrates, such as pollination (see pp. 47-48).

INTRODUCTION

The Terrestrial Invertebrates Platform Meeting

A two-day LIFE Nature Platform Meeting on Terrestrial Invertebrates was held in Newquay, Cornwall (UK) on 15-16 June, 2011.

Hosted by Natural England and organised by the LIFE monitoring team from Astrale, the conference provided an opportunity for members of the LIFE Nature unit, project beneficiaries and other experts in terrestrial invertebrate conservation to discuss some of the key issues regarding the conservation of these species - from butterflies to dragonflies, bees to saproxylic beetles.

One of the main challenges identified by the meeting was the problem of knowledge gaps caused by inconsistent and insufficient data on invertebrates. Related to this is a perception that the value of taxonomy and taxonomists is frequently neglected. In addition, it was recognised that there is a strong need for more research on invertebrates, especially in Mediterranean countries.

However, the LIFE programme has not been designed to address these types of issues, and, of necessity, its focus must remain on concrete conservation actions. One possible way of bridging the knowledge gap could be to promote financing for large-scale surveys under the DG Research Framework Programme (FP7 or FP8).

It was also recognised at the meeting that volunteers play a crucial role in tasks such as butterfly monitoring. Delegates suggested that ways to reward the input of LIFE project volunteers should be found.

The new requirement for projects to network was widely welcomed as it should encourage coordination between projects and help develop common methodologies. The platform meeting concluded that best practice established through LIFE projects should be promoted and beneficiaries should be encouraged to disseminate techniques of wider value.

Photo: Justin Toland

Attendees at the LIFE Terrestrial Invertebrates Platform Meeting visit Goss Moor, one of the LIFE 'Cornwall Moors' project sites

New impetus

LIFE can target invertebrate interests through two types of project: those aimed at particular species; and those that take action to protect relevant habitats.

The Commission's decision to invite LIFE (Biodiversity) project proposals based on species listed in the IUCN European Red Lists was welcomed as giving a new impetus to invertebrate conservation. Many participants pointed to the limitations of the Habitats Directive annexes. They claimed that this is both because many species that should be there are not, but also because several species that are listed should not be. The clearest example was that of odonata with 16 species listed in the European Red List, only two of which appear in Annex II or Annex IV of the directive.

Another conclusion was that when the species, location and actions needed are well-known, the Commission might consider being more focused in the LIFE application guidelines to stimulate projects where they are really necessary (e.g. to prevent the extinction of endemic dragonflies in Greece, the Balkans and Spain). Many invertebrates require very specific and targeted actions. The generic conservation work done on certain habitat types is seldom sufficient to address these needs.

It was suggested at the meeting that for projects working to conserve or restore habitats, a more productive approach and better measure of habitat quality and biodiversity may be found through a focus on invertebrate assemblages. However, the Habitats Directive itself does not address the concept of 'assemblages of species'. It was therefore proposed that the LIFE application guidelines could be amended to welcome more information on such assemblages.

It was also suggested that the Commission could encourage key actions for 'invertebrate proofing' projects to ensure that invertebrates are considered in habitat management plans.

Many threats to invertebrate populations (e.g. fragmentation, loss of habitat, loss of habitat quality) can be addressed through landscape-scale conservation projects and programmes. Although these are becoming more widely promoted there are very few examples where the conservation needs of habitats and species can be met wholly through agri-environment schemes: the additional input of resources from the conservation sector, including LIFE co-financing, is usually required to make a successful project.

Working with agriculture

One of the greatest threats to habitat and species conservation in northwest Europe stems from agricultural intensification. This leads to projects where the only course of action is to purchase land, establish conservation friendly farming and intensively manage the habitats for conservation.

So much of nature conservation depends on the support of the farming sector. In many cases the habitat niches of threatened invertebrates are the marginal and disturbed parts of the landscape. Ironically, recently abandoned land can be very rich in invertebrate species but without management will gradually revert to scrub and woodland.
Several projects have shown that the continuity of traditional agricultural practices is vital to support rich invertebrate communities. In the 'Valvestino-Marogna-2' project (**LIFE03 NAT/IT/000147**) in the Italian Alps, for example, the importance of water troughs was shown by monitoring how invertebrate species richness increased with the vegetation development in these traditional water features, but then reduced as the water trough vegetation became more established.

Achieving conservation goals by working with the farming community can be done but it takes a lot of effort, effort which is usually additional to the main agri-environment agreement. With good science, skilled advisors to build relationships and trust, well-designed agri-environment schemes and careful targeting of resources projects can build mutually beneficial partnerships with farmers.

Ecosystems services

Finally, the meeting concluded that there is a general need for LIFE projects to make more of a statement about the wider 'ecosystems services' offered by nature projects. The wider public need to appreciate that conservation is not just about saving particular species, but that it has an impact on the welfare and well-being of society. Bees, for instance, provide an essential ecosystems service through pollination yet are threatened by changes to the countryside. There is some evidence that cities can provide the range of habitat niches that are often now lacking in the countryside, an idea being explored by the LIFE 'UrbanBees' project – **LIFE08 NAT/F/000478** (see pp. 47-48).

Bees provide an essential ecosystems service through pollination

Photo: HMOURET/ LIFE08 NAT/F/000478

Dragonflies

Some 15% of European dragonflies are classified as ‘threatened’ and a total of 16 dragonfly species are included in Annex II and Annex IV of the Habitats Directive. Since 1992, more than 30 LIFE projects have targeted directly seven of those species of dragonfly. The LIFE programme has also co-funded actions that have enhanced dragonflies’ habitats across the EU.

DRAGONFLIES

Improving the habitats of the yellow-spotted whiteface dragonfly

The impact of intensive agriculture has severely affected the habitat of the large white-faced darter or yellow-spotted whiteface (*Leucorrhinia pectoralis*) dragonfly, and as a result, it is listed in Annex II of the Habitats Directive. However, a series of LIFE projects have aimed to improve the conservation status of this threatened species.

Restored pond in Estonia – now a breeding area for Annex II amphibians Pelobates fuscus and Leucorrhinia pectoralis

The yellow-spotted whiteface is typically found in the secondary stagnant bodies of water associated with fens and transition mires (peat excavation etc.). It is 32-39 mm long and is easily identified by the large yellow seventh segment of its abdomen.

The species needs to be able to deposit its eggs on very specific vegetation along the water's edge. This type of habitat, however, is becoming scarce, either because of current methods of maintaining ditches and brooks – intensive agriculture often reaches right to the edge of the water – or because of their abandonment.

Another major problem for the yellow-spotted whiteface is that its habitats predominantly occur in areas that do not usually benefit from legal protection as nature protection areas. Despite its severe decline, large-scale habitat restoration for the yellow-spotted whiteface was not widely carried out in Europe before the LIFE programme. Moreover, conservation attempts have often failed to increase reproductive and colonisation rates, underlining the need for species-specific conservation actions.

Photo: Riinu Rannap LIFE08/NAT/EE/000257

Effective actions

A major part of the yellow-spotted whiteface population in Finland and of the entire Natura 2000 network is found in the areas of the 'Gulf of Finland – Management of wetlands along the Gulf of Finland migratory flyway' project (**LIFE03 NAT/FIN/000039**). However, overgrowth of meadows, lack of open water areas, small predators, uncontrolled visitor access and low public awareness in some places were a major threat to these sites.

These threats were successful tackled by the project: water vegetation was removed and dredged and the mosaic structure of wetlands was increased by 163 ha. Moreover, the project redirected and branched ditches and created canals to improve the condition of 76 ha of wetlands. Of particular benefit for the dragonfly was the creation of 40 small ponds.

Many of these effective measures were also implemented by an earlier project in the German state of Baden-Württemberg. The project 'Libellenarten – Protection program for endangered dragonfly species in the Southwest of Germany' (**LIFE96 NAT/D/003036**) carried out actions on 13 sub-sites of the species – several inventories were made, resulting in comprehensive management plans, buffer strips of land were purchased at six of the sites, and several voluntary agreements were made with farmers for habitat improvements.

Among the actions taken to improve the aquatic habitats were: the removal of trees shading the water; the removal of eutrophic topsoil on the banks of ditches (followed by sowing of grasses); the dredging of ponds; the removal of quaking bog vegetation, which had been choking former peat excavations; the excavation of new ponds; and the elimination of predatory fish.

For the long-term continuation of the project results a change of ditch management was necessary and talks were held with the responsible bodies to discuss different techniques and options. The LIFE project covered some of the additional costs or compensations for implementing these management measures.

Europe-wide application

An ongoing LIFE Nature project is aiming to draw up conservation measures for the successful management of this dragonfly species, with the goal of applying them on a national and European scale, thereby ensuring its long-term viability.

The 'Securing *Leucorrhinia pectoralis* and *Pelobates fuscus* in the northern distribution area in Estonia and Denmark' project (**LIFE08 NAT/EE/000257**) is aiming to protect small and isolated populations of yellow-spotted whiteface in the northern part of their distribution range in Estonia and Denmark (the project also targets the common spadefoot toad). In this area, the dragonfly species is facing extinction, and a main goal of the project is to preserve its total gene pool and avoid further reduction in its range.

The beneficiary is also seeking to establish an international cooperation network of experts and nature managers, in order to share knowledge, practical experiences and the results of the project.

Mowed area and restored ponds for dragonflies in Finland

Photo: LIFE03 NAT/FIN/000039

Photo: Matjaž Bedjanič LIFE09/NAT/SI/000374

Yellow-spotted whiteface (Leucorrhinia pectoralis)

Several projects in Belgium have been working to improve habitats for the yellow-spotted whiteface. 'LIFE Kleine Nete - Large scale habitat restoration in the valley of the Kleine Nete' (**LIFE09 NAT/BE/000411**) is focusing on the Nete, a lowland river situated in the Flemish Campine region, which is the site of an endangered population of the species. Actions to restore natural hydrology and freshwater habitats will benefit the dragonfly.

The 'LIFE Turnhouts Vennengebied - Large-scale Habitat Restoration in "Turnhouts Vennengebied"' project (**LIFE06 NAT/B/000084**) has taken steps to secure the yellow-spotted whiteface population in the northern part of the Campine region through habitat improvement and enlargement. Another recently completed Belgian project targeted 'De Zoom – Kalmthoutse Heide', a 3 750 ha heathland site that extends over the country's northern border into The Netherlands. The 'HELA - Cross-border restoration of heathland on continental dunes' project (**LIFE06 NAT/B/000085**) has carried out measures such as tree felling and turf-cutting to create a varied heathland habitat that will encourage populations of invertebrates such as the yellow-spotted whiteface.

Finally, a wetland restoration project in Slovenia is also safeguarding and creating habitats suitable for the dragonfly. The ongoing 'WETMAN - Conservation and management of freshwater wetlands in Slovenia' project (**LIFE09 NAT/SI/000374**) is providing another example of how habitat management – the River Mura is being revitalised and oxbow lakes are being restored – can benefit this species.

DRAGONFLIES

Targeted studies and **protection measures** in Spain

Water pollution, changes in land use and poor river bank and forest management have had an adverse affect on habitats favourable to invertebrate populations in the Extremadura region of Spain. A LIFE project was set up to protect key species through habitat restoration, research and awareness-raising.

Photo: Aixa Sopeña

Project signpost with Lucanus cervus

The 'Artrópodos Extremadura' project (**LIFE03 NAT/E/000057**) targeted several species of Community importance: two beetles (*Cerambyx cerdo* and *Lucanus cervus*), four dragonflies (*Coenagrion mercuriale, Macromia splendens, Oxygastra curtisii* and *Gomphus graslini*) and a butterfly (*Graellsia isabelae*). It was carried out on a network of seven Natura 2000 network sites covering some 35 500 ha in northern Extremadura.

Lack of knowledge has hampered conservation efforts for many of the species targeted by the project, and for this reason, scientific studies were conducted. These yielded precise data on the current distribution of species (on average 10 times larger than initially estimated) and their biological characteristics. Analysis enabled the proposal of suitable measures and the drawing up of a set of management guidelines, which were distributed to relevant stakeholders.

Dragonfly database

The distribution survey (the largest conducted in the Extremadura region) has ensured that sufficient management tools are now available to protect and monitor the target species. In particular, the project beneficiary – the regional government of Extremadura – drafted and approved management, conservation or recovery plans for the four species of odonates (dragonflies, including the sub-group, damselflies). The survey has also led to the publication of

Photo: Alberto Gil

Southern damselfly (Coenagrion mercuriale), a priority species for conservation

an 'Atlas' of odonates in Extremadura and the revision of taxonomy for some of the species.

Compiled information was also added to a Geographical Information System (GIS) that is now used as a reference tool when assessing projects that may affect any of the targeted species. Dragonflies were not previously included in such management calculations, says Angel Sánchez García, Extremadura's Director of Conservation Programmes, who explains the benefit: "We can say that you will have this reaction if you take this action."

The project has also made it possible to enlarge the Sites of Community Importance and revise the degree of threats listed in the regional catalogue. To this end it purchased plots covering a total of 5.85 ha of land rich in biodiversity.

Southern damselfly

For the conservation of the Southern damselfly (*Coenagrion mercuriale*), it was necessary to protect or re-establish the meadows on which they thrive. Consequently, ditches were restored or dug in the Jerte valley to ensure adequate irrigation of the land. (The ditches are re-dug every year and link different meadows – a sluice allows water to be controlled during the rainy season.) The meadows also provide feed for animals, namely cows, and it was necessary to get farmers and landowners to agree not to allow their cattle to graze on certain areas that are important for the damselfly's conservation during the spring and summer months. Grants to landowners were an effective way of promoting this action.

A total of 5 km of ditches were dug in this valley, with 2 km being inlaid with stone at the top end of the drainage stream system. Boulders were moved to make space for the meadows in the upper valley. The maintenance of ditches, according to the beneficiary, has being dying out over the past 20 years, and conservation is thus helping keep alive the traditional way of life. On one farm in the valley, Samuel Sanchez is pleased to maintain a meadow habitat suitable for the damselfly. His and other small landowners' cooperation was vital to the success of this aspect of the project.

The monitoring programme for this species went beyond the project site and involved the local population (volunteers, enthusiasts, unemployed people and so on.). "The main problem with the conservation of this species was the lack of knowledge," says Javier Pérez Gordillo, a regional government expert. Local people were also employed to protect hot spots – mainly for dragonflies because their habitats are delicate. This work is now carried out by rangers.

The public was also encouraged to report damage to rivers and streams in the region – such surveillance activity was a good way of spreading the

Restored habitat area for several dragonfly species

Restored traditional irrigation creeks are important for invertebrates species

results of the project, particularly to landowners and tourists. In fact, at the tourist centre in the Jerte valley, a nature trail featuring information panels about the conservation of target species was established. The trail uses the motif of a stag beetle, whose presence in the forested areas is a sign of the health of the habitat, the project organisers say.

A specific aim of the project was to return riverside habitats to a more natural state. This aim was difficult to achieve because of the recurring swelling of the river and the effectiveness of the measures taken can only be assessed in the long term. The eradication of invasive alien species, however, was successfully carried out.

In the La Garganta valley, the project sought to establish agreements with landowners to prevent cattle grazing during critical months. The area is home to some 70 lepidoptera species. Key actions also included safeguarding areas of peatland, which is important for several species of moth.

Spreading the results

As well as farmers and landowners, awareness-raising activities targeted universities, research institutes, local residents and tourists through educational materials, talks, games, interpretative panels and TV and press coverage. A website was created, and some of the project materials are downloadable. The project also produced an interactive CD-ROM for teachers – around 75 schools in the region were reached. Much dissemination work focused on schoolchildren and a comic book was published to raise awareness of the importance of the conservation activities in the area.

A well-attended scientific conference was held in June 2007, featuring more than 30 lectures and 100 participants. This led to the publication of a book and the organisation of a follow-up event.

The project was effectively coordinated, establishing an outstanding system of collaboration with environmental agents who participated in the project. Project results have been incorporated into relevant policies.

Oxygastra curtisii

Project number: LIFE03 NAT/E/000057

Title: Artrópodos Extremadura – Conservation of endangered arthropods of Extremadura

Beneficiary: Consejería de Industria, Energía y Medio Ambiente, Junta de Extremadura

Contact: Guillermo Crespo Parra

Email: dgmn.iema@juntaextremadura.net

Website: http://extremambiente.es/artropodos

Period: 01-Jan-2004 to 31-Dec-2007

Total budget: €1 063 000

LIFE contribution: €532 000

Butterflies

Some 9% of European butterflies face the threat of extinction and the majority of the butterfly species included in the annexes of the Habitats Directive are in need of conservation actions. Since 1992, almost 50 LIFE projects have directly targeted conservation actions at butterfly species. In addition, more than 100 LIFE projects have taken steps to manage and restore important habitats for butterflies.

BUTTERFLIES

Managing land in favour of the **marsh fritillary**

LIFE co-funded projects across the EU are helping restore habitats to a favourable status for the endangered marsh fritillary butterfly. Lessons from LIFE are being fed into new actions that take a landscape-scale approach to conservation with a view to developing meta-populations of the species.

The marsh fritillary (*Euphydryas aurinia*) is one of Europe's endangered butterflies, listed in Annex II of the EU Habitats Directive. The species, which has very specific demands in terms of habitat and food source (see box), has suffered a decline of between 20% and 50% in some areas of Europe since the late 1970s.

More than 20 LIFE projects have directly and indirectly benefitted the marsh fritillary since the 'Wengermoor' project in Austria in 1999 (**LIFE99 NAT/A/005916**). Nine of those LIFE Nature projects have directly targeted actions at the conservation of the species (starting with the 'Trockenrasen Saar' project in Germany – **LIFE00 NAT/D/007058** – and 'Salisbury Plain' in the UK – **LIFE00 NAT/UK/007071**). Of these, three have focused exclusively on the species, the first of which was the 'Cornwall Moors' project in 2003 (**LIFE03 NAT/UK/000042**).

Restoring habitats on the mid-Cornwall moors

The Breney Common and Moss and Tregoss Moors SAC in Cornwall is one of last-remaining strongholds of the marsh fritillary in the UK, a country in which the rate of decline of the species has been particularly severe, mainly as a result of the loss of traditional livestock grazing.

The goal of the LIFE Nature 'Cornwall Moors' project was to increase the area, connectivity and quality of suitable breeding habitats for the marsh fritillary across the SAC and at seven satellite sites. This is because the lifestyle of the butterfly requires conservation actions at the meta-population level, with a cluster of breeding sites present over an area of at least 90 ha to allow for the vagaries of local extinctions and (re)colonisations. "Managing for a species

Typical mid-Cornwall landscape

like this is very difficult: it thrives where grazing is low or has been abandoned for a short time," explains project manager, Wesley Smyth of beneficiary Natural England (formerly English Nature).

Key to the success of the project was a partnership between Natural England, landowners, NGOs (the Cornwall Wildlife Trust and Butterfly Conservation) and three statutory bodies, most notable the UK Highways Agency. The Natura 2000 designation of the Moss and Tregoss Moors sites meant that the Highways Agency's plans to widen the A30 trunk road (the main arterial route into Cornwall) could only be realised if the road was re-routed around the SAC. This, says Mr Smyth, required "vision, willing partners and the Habitats Directive behind it."

The heterogeneous, post-industrial (former tin mining) landscapes of mid-Cornwall present particular challenges for conservation actions. "Involving the agricultural community in these sites is key to conserving their long-term management," notes Mr Smyth. "We used LIFE money to purchase cattle, which we lease to farmers."

Cattle (or pony) grazing is the last link in a habitat management chain that begins with scrub removal (through cutting or burning) and wetland restoration. Together, these actions create the conditions that should prove favourable to devil's-bit scabious (the butterfly's food plant) and the marsh fritillary itself. The LIFE project restored some 140 ha of the mid-Cornwall moors in total. However, monitoring results indicate the challenging nature of *E. aurinia* conservation: "Achieving the right condition among individual colonies is very difficult," says Mr Smyth. "Re-colonisation has been limited to one site. Sometimes conditions appear to be perfect but, for whatever reason, the butterflies have continued to decline. This might require investigation of their parasites – something could be happening at that level."

Nevertheless, Mr Smyth remains optimistic about the value of the work done by the LIFE project: "We know we can get a positive response where grazing management is right and, crucially, where there's a high enough density of *Succisa* plants... One of the lessons we have learnt is: Don't give up!"

> *"Achieving the right condition among individual colonies is very difficult. Sometimes conditions appear to be perfect but for whatever reason, the butterflies have continued to decline"*

Another positive outcome of this LIFE project is the fact that the seven satellite sites it targeted are now prospective Sites of Special Scientific Interest (SSSI), the first step towards becoming part of the Natura 2000 network. Natural England is working towards achieving an overarching "Mid-Cornwall Moors" Natura 2000 designation, incorporating all nine sites.

Danish restoration provides a model for future actions

The LIFE Nature 'ASPEA' project (**LIFE05 NAT/DK/000151**) used similar management methods and the same kind of partnership approach to arrest the decline of the marsh fritillary in Denmark, a country where at the start of the project (in January 2005) just eight small sub-populations survived.

LIFE 'ASPEA' achieved a favourable condition for more than 500 ha of existing and potential marsh fritillary habitats within three Natura 2000 sites in northern

The marsh fritillary and its host plants

One of the main reasons for the decline of the marsh fritillary butterfly and the difficulty of enabling habitats in which it can thrive is its unusual diet. In northern and central Europe, the species feeds on the colourfully-named devil's-bit scabious (*Succisa pratensis*), as well as the small scabious (*Scabiosa columbaria*). Devil's-bit scabious's preference for moist soil – marshy areas, lowland heath and damp meadows and woods – and a patchwork of short and long vegetation (8-25 cm) means that it is only found in areas of low-intensity grazing, typically with cattle, or areas not mown too short or too frequently. The small scabious occurs in calcareous dry grasslands and also prefers a mix of short and long vegetation. The butterfly lays its eggs inside a 'greenhouse-like' web on the host plants, which serves to incubate the larvae at the ideal temperature.

Jutland. Four new subpopulations were added – at Bruså, Napstjert Mose, Napstjert Enge and Strandby – and there was a doubling in the number of larval webs observed between the beginning of the project and its completion in December 2008. (Each subpopulation must have a minimum size of 500 individuals or approximately 125 observed spins).

The involvement of landowners and local graziers was again crucial to the success of the project. As well as establishing enduring partnerships that will allow the appropriate grazing management of the project sites to continue into the longer term, the beneficiary used newsletters and other awareness-raising tools to engage landowners, civil servants and the general public and to increase understanding of the ecology and dynamics of the marsh fritillary butterfly.

The substantial body of survey data and analysis generated by the project will not only be used to inform ongoing management of the project sites, it has also enabled the creation of a code of best practice that can be used by other marsh fritillary conservation projects. These guidelines have been "very useful" believes project coordinator Sören Kjaer, from the Danish Ministry of the Environment, Nature Agency Aalborg.

The challenge of butterfly reintroduction

Lessons from earlier LIFE Nature projects targeting the marsh fritillary are being incorporated into a new LIFE+ project in Northern Germany that is aiming to achieve an even more ambitious goal: not just habitat restoration, but species reintroduction too. The 'LIFE-Aurinia' project (**LIFE09 NAT/DE/000010**) aims to re-establish the butterfly in Schleswig-Holstein, a region in which it was last observed in 1991. To do this, landscape- and habitat-scale actions will once again be key. Over the eight years of the project, the beneficiary, Stiftung Naturschutz Schleswig-Holstein (SN-SH) will remove scrub, re-wet once marshy areas and restore low-intensity grazing at eight sites, including the last two known locations of the species (Nordoe and Jardelunder Moor)[1]. The species will then be re-introduced at four or more sites, depending on the success of the vegetation management, with a view to establishing eight subpopulations of 100 specimens each across the sites.

Since one project area (Lütjenholm) is bordering a military training area used by the German army, partnership means not only working closely with graziers, but also establishing links with the military in order to develop a more conservation-oriented approach to site management.

The beneficiary will only reintroduce the species on sites it owns to ensure that the long-term management of habitats remains favourable to the marsh fritillary. It is hoped that habitat restoration actions carried out by the 'LIFE-Aurinia' project will enable the butterfly to be reintroduced at the other target sites in approximately 20 years. To this end, the project will also develop a strategic reintroduction plan and carry out genetic studies of the species.

1 Specific actions will include the conversion of 16 ha of spruce plantations; the improvement of 40 ha of former agricultural areas into species-rich grasslands by hay/seed transfer and planting target plants (80 000 individuals); and the introduction of grazing across an area of 110 ha.

Restored and grazed grassland – habitat of the marsh fritillary

BUTTERFLIES

Linking **habitats** to **preserve** Belgium's **butterflies**

A LIFE co-funded project in the Walloon region of Belgium is taking urgently needed steps to reconstitute habitat networks for threatened butterfly species listed in Annexes II and IV of the EU Habitats Directive: the marsh fritillary (*Euphydryas aurinia*), violet copper (*Lycaena helle*) and large copper (*Lycaena dispar*). For the marsh fritillary in particular, this work is vital to prevent the species becoming extinct in the country.

Photo: Alexander Rauw

Violet copper (Lycaena helle)

With an overall objective of restoring the three target butterfly species to a favourable conservation status within 25 Natura 2000 network sites in Wallonia, the LIFE 'PAPILLONS' project (**LIFE07 NAT/B/000039**) is focusing on four specific objectives:

- Reducing the isolation of surviving populations by recreating interconnected habitat networks, taking into account the needs of each species and ensuring their long-term viability;
- Contributing to the restoration of favourable habitats for these species;
- Implementing long-term and appropriate regular management of the project sites; and
- Raising awareness among nature managers and the general public about the particularly critical situation of the butterflies and informing them about the territorial management principles needed to conserve them.

Work began in 2009 and is spread across five zones covering some 540 ha in total. The violet copper is present in three of the zones (see box p.21) and the marsh fritillary and large copper (see box p.22) are each present in two (separate) zones. Project assistant Olivier Kints is responsible for Zone 1 (Bois de Fagne), a forested area of some 2 000 ha of mainly publicly-owned land close to the French border that houses four small sub-populations of the marsh fritillary butterfly. The LIFE project, says Mr Kints, "was

Photo: Justin Toland

The marsh fritillary (Euphydryas aurinia) favours grassland meadows and clearings in forests, such as this one

very timely because of the decline of the *E. aurinia* population. There had been some restoration work already, but LIFE funding gave us a real impetus." Project manager Dominique Lafontaine concurs: "The scale of the project is much bigger...It's well known that the marsh fritillary is really sensitive to parasitism. We are sure it will disappear if nothing is done."

> *"At first there was plenty of discussion in the local community because it was a lot of money for "only" a few butterflies, but now it's well accepted"*

The strategy of the LIFE team has been to open and enlarge clearings in forested areas where the marsh fritillary is already present. "Restoring grasslands is more expensive and can lead to conflict with agriculture," notes Mr Lafontaine. The objective is to open 90 ha of clearings in the forest, creating a network of 100 ha of open areas across the forest, each no more than 1 km from the next (1 km is the flight range of the marsh fritillary butterfly). To date more than 55 ha have been cleared, with the remainder to follow in 2012. "In some clearings we find old apple trees," says Mr Kints. "This shows that there were meadows there before and that we are not trying to create something new, we are just trying to restore something that was here before."

Tractors helped with the process of creating clearings

Photo: Alexander Rauw

Clearance work involves a mix of techniques, including mowing with tractors and clearing by hand. Volunteers are also involved, for instance, helping the beneficiary to collect seeds of the marsh fritillary's host plant devil's-bit scabious (*Succisa* pratensis) for distribution to newly-cleared areas. "The best results are found when *Succisa* is in a variety of places: in the open, in the shade, near trees, along paths," says Mr Lafontaine. Unlike in other marsh fritillary habitat conservation projects, whilst grazing with horses will be introduced in some spots, most of the areas will continue to be maintained by cutting and clearing.

Winning partners

As in other project zones, work in Bois de Fagne began with an initial period of preparation, monitoring and knowledge-gathering. Informing and forming partnerships with public bodies, local authorities, electricity providers, special interest groups (e.g. hunters) and citizens was an important part of this initial phase. "At first there was plenty of discussion in the local community because it was a lot of money for "only" a few butterflies, but now it's well accepted in general," says Mr Kints. However, he says levels of support for the project have varied from one commune to another, with more opposition in areas where the hunting lobby is more influential.

"To convince hunters that what we are doing will not harm their interests we show examples of our restoration work and show that there is not much food for big mammals in the areas to be cleared,"

The violet copper

The violet copper butterfly (known in French as *le cuivré de la bistorte*) is a species that is a relict of cold regions, and is restricted to a few mountain ranges in Western Europe, including the Ardennes in Belgium, where it is found mainly in wet meadows along riverbanks. However, the deterioration of habitats as a result of – for example – plantation forestry, has caused a significant decline in violet copper populations. For LIFE 'PAPILLONS', work is taking place in three of the project zones – Bassin de la Lesse, Vallees de Haute Ardenne and Bassin de la Semois – and involves creating and restoring habitats along rivers to create an interconnected network of suitable areas within 1 km of each other. Through acquisitions or management agreements, areas of spruce plantation are being cleared and low intensity grazing with cattle introduced on the restored grasslands. "It's one of the most important [violet copper] populations in Western Europe: we really want to protect it," explains Mr Lafontaine.

Photo: Jean Delacre / LIFE07 NAT/B/000039

says Mr Lafontaine. "We have also tried to persuade less interested communes that they will be able to increase hunting fees as a consequence of our work." It is still not an easy sell, although, as Mr Kints notes, at one newly-cleared site in the forest that offers a particularly promising habitat for the marsh fritillary, hunters were "initially very angry" because it was less favourable to wild boar, but now realise that it has become one of the best places in the forest for red deer.

Collaborating and convincing

Partnership is considered an important part of making the project work. "We are not the only ones who want to create clearings, so collaborations are possible," notes Mr Lafontaine. The beneficiary has partnered with the electricity grid operator, Elia, to enable mowing of a maintenance area around the pylons in the Bois De Fagne to be done in a butterfly-friendly manner. "We asked them to keep the hedges near the pylons as transitional areas. When the hedge is too high only half will be cut,"

Devil's-bit scabious (Succisa pratensis), host plant of the marsh fritillary butterfly

Photo: Justin Toland

notes Mr Kints. However, the fact that the electricity company would ideally mow only once every 10 years, when, for the target butterfly species "it is important to cut regularly", means there is "ongoing negotiation" to secure the best outcome for all parties, adds Mr Lafontaine.

LIFE co-funding is proving crucial in achieving the goals of the project, in particular the indemnity it provides landowners for cutting trees before they reach maturity in order to create clearings. This is "very persuasive" says Mr Kints. Before the 'PAPILLONS' project, whilst it was possible to convince landowners of the importance of forest clearings, in practice a shortage of resources (time, money and manpower) often meant the work didn't get done. "Securing mowing agreements and high level protection was also more difficult before LIFE," he believes.

Some of the communes in the project areas have agreed to keep their network of clearings for 30 years, whilst agreements have also been struck for the regional forestry agency (DNF) and private landowners to continue mowing (this will be part-funded by the Walloon government). "The Forestry Agency has embraced the need to manage biodiversity and to have clearings as well as trees," says Mr Lafontaine.

Hope springs from warm springs

The result of three warm, dry springs since the LIFE project launched in 2009 is that "we have seen colonisation of new clearings from the beginning," says Mr Lafontaine. "This is very encouraging: we hope that this trend will continue." However, dry springs have also increased the population of marsh fritillary parasites. As a result, "2011 was

The large copper

Known locally as *le cuivré des marais*, the large copper butterfly is restricted to the southernmost extremes of Belgium (Bassin de la Semois in Belgian Lorraine), where it is threatened by the development of intensive farming, plantation forestry and urbanisation. The species favours wet meadows, marshes and open fallow areas, using various sorrel species (e.g. *Rumex hydrolapathum*) for feeding and breeding. With a 2 km flight range, the large copper is less threatened than the marsh fritillary and the violet copper. Nevertheless, the restoration measures being carried out by the LIFE 'PAPILLONS' project, designed to achieve at least 10 ha of suitable habitat (no more than 2 km apart) across a 100 ha Natura 2000 site, are vital to ensure the genetic exchange between populations necessary for the continued survival of the species in Belgium.

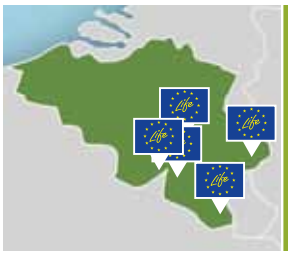
Photo: Jean Delacre / LIFE07 NAT/B/000039

very good for numbers of flying butterflies, but not good for numbers of nests," notes Mr Kints. Nevertheless, he says that even if numbers are decreasing in the four locations where the marsh fritillary was found at the start of the project, it is being found in new places: "The metapopulation level is very important." Mr Lafontaine agrees: "We hope [in 2012] these small populations can grow and compensate for the loss of existing populations."

Standing in the middle of a nature reserve in the Bois De Fagne where 63 of Wallonia's 100 or so indigenous butterfly species can be observed, Mr Kints is convinced of the value of the actions taken by the LIFE 'PAPILLONS' project. "2009 was the last chance to try and save *Euphydryas aurinia* in Belgium. Of course you never know if our actions will save the species, but, whatever the outcome, the work is good for biodiversity."

The 'PAPILLONS' project has successfully followed a strategy of restoring and enlarging a network of forest clearings in southern Belgium

Photo: Justin Toland



Project number: LIFE07 NAT/B/000039

Title: PAPILLONS - Reconstituting a habitat network for threatened butterflies (*Euphydryas aurinia, Lycaena helle, Lycaena dispar*) in the Walloon region

Beneficiary: Réserves Naturelles RNOB

Contact: Dominique Lafontaine

Email: dominique.lafontaine@natagora.be

Website: http://www.life-papillons.eu

Period: 01-Jan-2009 to 31-Dec-2013

Total budget: €7 120 000

LIFE contribution: €3 560 000

BUTTERFLIES

Boosting wet meadows butterflies in Poland

Populations of butterflies that rely on specialised habitats are decreasing across Europe. This is especially the case for butterfly species that depend on specific host plants. Habitat degradation is leading to the decline of these host plants, with a negative knock-on effect on the butterfly species that depend on them. A LIFE Nature project in Poland targeted the restoration of wet meadow habitats to help reverse this decline.

Meadows are open country habitats that depend to a large extent on human management. These fixed and low-intensity activities (namely regular hay mowing) result in valuable open country ecosystems. These semi-natural meadows contain important bird species included in the annexes of the Habitats and Birds directives, such as white storks (*Ciconia ciconia*), marsh harriers (*Circus aeruginosus*) and corncrakes (*Crex crex*), as well as a number of target butterfly species, some of which are completely dependent on wet meadows.

According to the latest (Article 17) Habitats Directive conservation status assessment, meadows (Habitat Directive codes 6410 and 6510) are a threatened habitat with an 'unfavourable' conservation status all over the EU. Meadows are disappearing for several reasons, the most important of which are:

- The impact of land abandonment. When mowing and grazing stops, meadows become overgrown with trees and shrubs;
- The increasing use of artificial fertilisers. This causes eutrophication, leading to the disappearance of food and host plants for butterflies;
- The intensification of mowing. This reduces the species-richness of meadows (repeated or early mowing prevents butterflies from laying eggs and stops larvae growing); and
- The drainage of meadow habitats. This affects the

composition of meadow plant species, including causing the disappearance of food plants for butterflies.

In order to reverse the decline of the wet meadows and its butterflies, Poland proposed 'Wetlands Butterflies', a LIFE Nature project (**LIFE06 NAT/PL/000100**) targeting six butterfly species included in Annex II and IV of the Habitats Directive that was implemented in four Natura 2000 network sites across two regions of Poland. In Mazovia, the project area included the Puszcza Kampinoska site, which sits largely within the boundaries of the Kampinos National Park, and the Całowanie Fen site - where there are still wet meadow and wetland habitats despite fen drainage. In the Lublin region actions were targeted at the Torfowiska Chełmskie and Torfowisko Sobowice sites.

The six butterfly species targeted by the Polish project were:the scarce large blue (*Phengaris (Maculinea) teleius*), dusky large blue (*Phengaris nausithous*), violet copper (*Lycaena helle*), large copper (*Lycaena dispar*), false ringlet (*Coenonympha oedippus*) and marsh fritillary (*Euphydryas aurinia*) (see table). These butterfly species are completely dependent on plants growing exclusively in wet meadows. Many of them feed and lay their eggs on one or several meadows plant species. For example, the violet copper depends upon access to bistort, a plant species that only thrives in wet meadows, whilst the dusky

Table – Status of the six target butterfly species

Species	Habitats Directive	Conservation status (Habitats Directive Article 17)	IUCN Red list EU27 (2011)	Host plant
Scarce large blue (*Phengaris (Maculinea) teleius*)	Annex II and IV	In the Alpine and Atlantic region the overall status is 'bad'. In Belgium and the Netherlands it became extinct, although in the Netherlands it has been reintroduced. In the Pannonian region its status is 'inadequate', in the Continental region it is stated as 'unfavourable-bad' and the Boreal region is the only one wherein its status is 'favourable'.	Vulnerable	Great burnet (*Sanguisorba officinalis*)
Dusky large blue (*Phengaris nausithous = Maculinea nausithous*)	Annex II and IV	In most of the EU geographical regions (Atlantic, Continental and Mediterranean) this species's overall status is 'bad'. In the Alpine and Pannonian regions it is assessed as 'inadequate '.	Near threatened	Great burnet (*Sanguisorba officinalis*)
Violet Copper (*Lycaena helle*)	Annex II and IV	In all the geographical regions where it is found (Alpine, Boreal and Continental) this species's status was assessed as 'unfavourable-bad'.	Least concern	In Central Europe, eggs are laid on the underside of bistort leaves (*Polygonum bistorta*). In the north of its range, viviparous bistort (*Polygonum vivipara*) is the host plant.
Large copper (*Lycaena dispar*)	Annex II and IV	The conservation status for the species is 'unfavourable-inadequate' in Alpine, Continental, Pannonian and Atlantic regions.	Least concern	Eggs are laid on large sorrels (*Rumex spp.*) such as *R. crispus*, *R. obtusifolius* and water dock (*R. hydrolapathum*). They are sometimes associated with ants (*Myrmica rubra* and *Lasius niger*)
False ringlet (*Coenonympha oedippus*)	Annex II and IV	For Continental and Pannonian regions overall assessments are 'unfavourable-inadequate'. For Alpine and Atlantic regions, the conservation status is: 'unfavourable-bad'.	Least concern	The eggs are deposited one by one on the blades of grass species such as meadow-grasses (*Poa spp.*), rye-grasses (*Lolium spp.*), hair-grasses (*Deschampsia spp.*), sedges (*Carex spp.*) and purple moor-grass (*Molinea caerulea*)
Marsh fritillary (*Euphydryas aurinia*)	Annex II	The species is assessed as 'unfavourable -inadequate' in Alpine, Boreal and Pannonian egions and 'inadequate-bad' in Atlantic and Continental regions.	Least concern	The foodplants are Devil's-bit scabious (*Succisa pratense*), small scabious (*Scabiosa columbaria*), field scabious (*Knautia arvensis*) and teasels (*Dipsacus spp.*)

and scarce large blues feed on a sole plant, great burnet. The large blues also have complex life-cycles in which their larvae mimic the larvae of certain ant species and are raised till pupation inside the ants' nest. The specificities of these butterflies' feeding and breeding behaviour means that all populations of large blue species are extremely sensitive to any change in the local ecosystem.

Managed restoration of mowing

The goal of the 'Wetlands Butterflies' project was to boost numbers of host plant species of the target butterflies. This was to be achieved by removing overgrowth from abandoned wet meadows, establishing extensive farming of the meadows cleared of scrub, and raising the water level on previously drained wet meadows. Management of the meadows would also be based around the needs of the target species, in particular by timing mowing so as not to interfere with the butterflies' life-cycle.

The first task of the project prior to restarting mowing was to ensure a suitable surface for mowing. This meant the removal of clumps of small trees and shrubs and, in some cases, surface levelling. The project cleared overgrowth from 383 ha and initiated first mowing on 249 ha of land. As a demonstration of the resource efficiency of the project, the unwanted trees and shrubs were ground into chips for use in domestic heating systems. Hay collected from meadows mown as part of the LIFE project was also reused in various ways, mostly by local farmers.

For meadows that had been converted to intensively farmed arable land, restoration required the removal of the top layer of soil, thereby eliminating the seed bank and preventing the regrowth of unwanted plants. To encourage the right kinds of vegetation, the project team spread hay containing the seeds of plants that had been gathered from sites where the appropriate meadow species composition for the target butterflies could be observed.

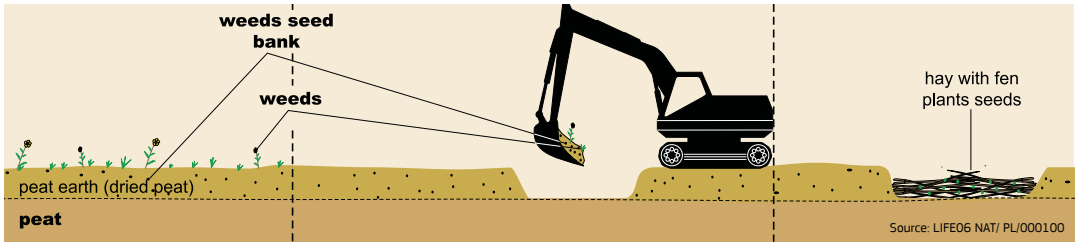
In total, the project restored more than 80 ha of meadows and established regular mowing on 430 ha across the four sites. A further 14 ha of wet meadowland was purchased with LIFE funding in the Kampinoski National Park. In addition, by installing weirs at key locations to control water drainage, the beneficiary restored 150 ha of wet meadows to the appropriate hydrological conditions.

Enabling low intensity farming for butterflies

To maintain the project areas in a way that supports the target butterfly species in the long-term, it was deemed necessary to include meadow areas within the agri-environmental schemes of the EU Polish Rural Development Programme. This would oblige farmers to follow certain rules, such as only mowing meadows once a year (in September, thus allowing the butterfly life-cycle to be completed without interruption).

The LIFE project carried out important capacity-building measures linked to this requirement, training some 50 farmers in total. The training sessions were led by experts from the Mazowiecki Landscape Park and the Agriculture Advisory Centre in Otwock and included information on the 'Wetlands Butterflies' project, agri-environmental measures

Restored meadow (left) with the host plant Great burnet (Sanguisorba officinalis) after scrub and tree removal in a meadow (right)



Project action of top soil removal by an excavator, and restoration with seeds from target meadow (hay) habitats

(e.g. traditional farming and meadow management) and actions beneficial for butterflies.

In addition, the project trained 90 agri-environmental advisers with the objective of supporting the long-term implementation of the agri-environmental programme, both in the project areas, and elsewhere in Poland. These advisers were taught by the Agricultural Consultancy Centre (CDR) and the Polish Society for the Protection of Birds (OTOP) how to identify rare species of butterflies and their host plants and about actions connected with meadows and grasslands included in agri-environmental schemes for 2007-2013.

The project team was involved in consultations with the Polish Ministry of Agriculture over its new agri-environment programme. Although it was not possible to produce a special package for butterflies, some existing packages are favourable for them. These packages were mainly implemented by farmers, for whom agri-environment plans were produced within the scope of the project. In fact, one of the notable successes of the LIFE project was its implementation of more than 30 agri-environment plans in three Natura 2000 network sites across an area covering 392 ha, three times larger than initially foreseen.

Further outreach and dissemination activities included the creation of two new education trails (in Torfowiska Chełmskiehave and Puszcza Kampinoska) and the renovation of an existing trail in Bagno Całowanie. The project published educational materials, arranged teacher-training workshops and encouraged school excursions to the trails. A total of 744 pupils and 60 teachers took part in the latter. The trails and project sites also provide a basis for nature-friendly recreation and agro-tourism, providing the local community with an economic incentive to support the butterfly habitat conservation programme in the long term.

Following the completion of the LIFE project, several of the partner organisations involved have secured funding for continued maintenance of the areas in a butterfly-friendly way. For instance, the Regional Directorate for Environmental Protection in Lublin (RDOŚ Lublin) has funds for further mowing in the Torfowiska Chełmskie project site, whilst Kampinoski National Park is continuing mowing using its own resources, whilst planning to manage the meadows through agri-environment schemes. Another project partner, the Wetland Conservation Center (Cmok) is already using agri-environment payments to farmers to continue mowing of the Bagno Całowanie area.

Scarce large blue (Phengaris teleius) on host plant great burnet (Sanguisorba officinalis)

Project number: LIFE06 NAT/PL/000100

Title: Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows

Beneficiary: Regional Environment Center for Central and Eastern Europe/Regional office in Poland

Contact: Michał Miazga

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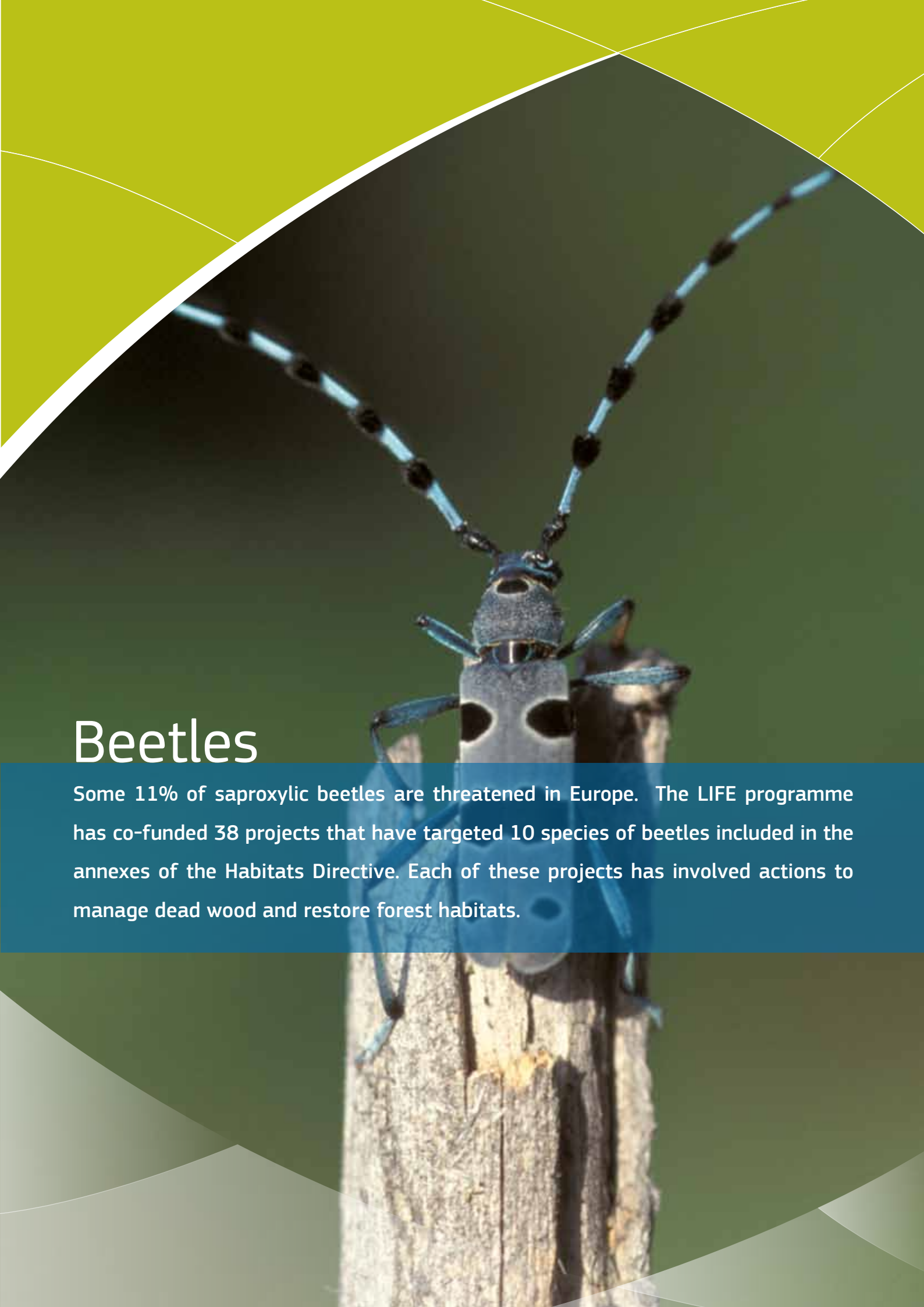
Website: www.rec.org.pl/life/

Period: 01-AUG-2006 to 31-MAR-2010

Total budget: €1 278 000

LIFE contribution: €639 000



Beetles

Some 11% of saproxylic beetles are threatened in Europe. The LIFE programme has co-funded 38 projects that have targeted 10 species of beetles included in the annexes of the Habitats Directive. Each of these projects has involved actions to manage dead wood and restore forest habitats.

BEETLES

Increasing habitats for the hermit beetle

Loss and fragmentation of habitat has led to a decrease in the population of the hermit beetle (*Osmoderma eremita*) throughout its European distribution range. LIFE Nature efforts in several countries have directly and indirectly targeted this rare and endangered saproxylic (dead wood) beetle.

The hermit beetle (*Osmoderma eremita*) is one of Europe's most threatened invertebrates. Its demise is mainly a result of its sedentary lifestyle: It lives and develops as a larva in hollow trees, particularly old oaks – but any tree species with suitable hollows – feeding off mulm, or soft rotting wood, and as an adult seldom flies more than 500-1 000 m away from its host tree. Its survival is threatened by the fragmentation of habitats, which leads to greater distances between suitable host trees, a lack of successors to the old hollow trunks, and overgrowth of open oak-wooded pastures.

A handful of LIFE Nature projects have successfully reported improvements in the conservation status of the hermit beetle in some parts of Europe. These include projects located in Sweden, Spain, and Italy. Such initiatives are important because together with other saproxylic insects, the hermit beetle performs a vital role in the decomposition of trees. Moreover, the species is an indicator of valuable forest habitats: Wherever it occurs there is also a host of other important insects, lichens, fungi etc.

Typical hermit beetle habitat – note the old trees

Photo: Raimonds Cibulskis

Several other LIFE projects, located in forested and woodland areas of old-grown trees and decaying wood (wooded meadows, virgin forests) for example in France, Germany and Latvia, have also included actions to help preserve the hermit beetle. Works have focused mainly on improving the availability and quality of ancient broad-leaved woodland habitats. And due to the beetle's poor dispersal, have also targeted improvements in habitat connectivity.

Sweden is thought to hold 30-50% of the known (EU-25) hermit beetle population and so has a particular responsibility for the survival of the species. A successful pioneering LIFE co-funded project (**LIFE97 NAT/S/004240**) was jointly run by the Swedish Environmental Protection Agency (SEPA) and a number of county administrations. This ensured an overall strategy for the species, set by SEPA, was implemented and adapted according to local circumstances. Focusing on 45 sites in south and central Sweden, which altogether covered 75% of the population nationally, the project provided a strategic programme for the conservation of the species in the country. Because so little was known about the hermit beetle, the project team identified the precise management needs for its conservation and then developed individual management plans for each of the sites. It made a significant contribution to preserving and

raising awareness of the species and the long-term management of the sites was guaranteed through land purchase, national legal protection and agri-environment agreements.

The project also had considerable external influence: An important study of the hermit beetle [1] was started under the framework of the project, and completed in 2005, with the assistance of some 30 researchers all over Europe.

In 2006, the LIFE external monitoring team conducted a follow-up study of this project. This concluded that the hermit beetle had proven to be a popular choice for conservation, gaining a huge amount of public interest both during and after the project. The project and the work on the hermit beetle has developed into a national symbol for the protection of old oak trees and today forms a natural part of Sweden's preservation of old broad-leaf trees and forests.

Photo: LIFE97 NAT/S/004204

Hermit beetle (Osmoderma eremita) in Sweden

Creating wood mould

Part of the work of another Swedish project, 'MIA - Lake Mälaren Inner Archipelago' (**LIFE07 NAT/S/000902**) has also addressed the conservation requirements of the hermit beetle. Located on the archipelago of Mälaren – one of Sweden's most valuable regions for broad-leaved woodlands, with oaks and other old trees growing in a semi-open habitat – management actions have included clearing vegetation from around large oaks, planting new trees and erecting fences. The project has also created habitat boxes containing artificial mulm. The conservation focus is on bridging the time span between old and new woods.

1 Osmoderma eremita in Europe T Ranius, L O Aguado, K Antonsson, P Audisio, A Ballerio, G M Carpaneto, et al. in Animal Biodiversity and Conservation (2005)

The hermit beetle mulm of an oak tree

Photo: LIFE97 NAT/S/004204

Continuing developments

Another important project for the beetle is 'Eremita Meadows' (**LIFE09 NAT/LV/000240**), which is currently underway in Latvia. The project is targeting at least 30 Natura 2000 sites, many of which are important sites for the hermit beetle, together with the another priority saproxylic insect, the false darkling beetle (*Phryganophilus ruficollis*). Most of the project work will be carried out in Natura 2000 network sites. However, the planning and inventories will be implemented across the whole of Latvia. Key expected results are the development of an ecological network for the conservation of rare beetles and their habitats in Latvia; and an interactive GIS database for the two beetle species.

A Spanish Basque Country project (**LIFE08 NAT/E/000075**) is working specifically to improve knowledge and techniques for managing habitats for dead wood beetles, particularly the hermit and *Rosalia alpina* species (see p.34). It aims to create a European network of appropriate forestry habitats.

Meanwhile, a German project (**LIFE07 NAT/D/000225**) located in the Danube valley (between Neustadt, Baden-Württemberg and Bad Abbach, Bavaria) is also aiming to establish an ecological network for the protection of woodlands of high conservation value. The project team plans to secure the favourable conservation status of a number of associated woodland species, including the hermit beetle.

BEETLES

Spanish beetles benefit from a **pioneering approach**

Several endangered species of beetle are benefiting from the habitat restoration and pioneering monitoring techniques carried out in the Aiako Harria area of the Basque Country (Spain).

The 'Aiako Harria' SCI at the foot of the Pyrenees is home to a wide range of ecosystems of rich biodiversity. Covering nearly 7 000 ha in the west corner of Gipuzkoa province of The Basque Country, the area contains the Añarbe oak-beech forests, the Endara oak forest and the Oieleku beech forest.

However, much of the area is also covered by non-native pine trees, which together with the increasing use of the land for recreation, are putting pressure on indigenous flora and fauna, including invertebrates such as beetles – the Rosalia longicorn (*Rosalia alpina*), the stag beetle (*Lucanus cervus*), the hermit beetle (*Osmoderma eremite*) and the great Capricorn beetle (*Cerambyx cerdo*), all of which are listed in Annex II of the Habitats Directive.

Female R.alpina laying eggs on dead wood

As a result, a LIFE project (**LIFE05 NAT/E/000067**) was launched to protect, restore and expand the two natural habitats of Community interest in Aiako Harria: the Atlantic acidophilus beech forests and the Galaico-Portuguese oak woods. Conservation actions would help improve the populations of the target species that depend on these habitats..

Testing hypothesis

Dr Santi Pagola, a government biologist and president of the Basque Entomological Society, says that the first LIFE project (a follow-up project – 'BIODIVERSIDADY TRASMOCHOS', **LIFE08 NAT/E/000075** – was launched in 2010) set out to test a key hypothesis about the longhorn beetle: increasing the presence of dead wood is beneficial to population numbers. This target species of beetle is saproxilic i.e. it feeds on wood.

In order to prove this idea, the project team made incisions in trees to prevent the sap from rising up the trunk. Thus, it was able to create more dead wood in the forested areas.

This hypothesis was found to be correct, Dr Pagola says. "Drying wood is the microhabitat of the beech forest that best benefits this species." The follow-up project is testing the idea that pollarding of trees will also benefit the target species. Though this project is still ongoing, the project team says that this hypothesis is also proving to be correct.

Innovative monitoring

Prior to the initial LIFE project, information on techniques to improve the conservation status of entomofauna was lacking in Spain. The larva of the

beetles can reside in wood for two to five years before hatching in the summer. Beetles are only alive for a matter of weeks, and so the window of opportunity to carry out monitoring activities is small. A major achievement of the project was the introduction of a new monitoring method. Researchers photographed the beetles and noted the singular patterns on the arches of the individuals.

This technique has been used for monitoring of this type in Italy and has now become standard practice in Spain. "We are very proud of this development," say Dr Pagola. "Our method avoids capturing individuals and marking them, and as a result [it] is a lot less invasive."

Inventories discovered species new to science, some new to the Basque Country and others to the Iberian Peninsula. Studies also showed the diversity of the longhorn beetle: the presence of relict species with high conservation value was recorded – *Rhamnusium bicolor* and *Stictoleptura erythroptera*. "The presence of these species underlines the value of the beech forest," says Dr Pagola.

Photo: Jon Eldridge

Creating dead wood (tree incision) in forested areas for beetles

LIFE funding played an important role in helping achieve this aspect of the project. "Inventories are expensive. It was necessary to get the help of additional funds," says Inma Lizaso of the Gipuzkoa government.

Management plans

A significant achievement of the 'AIAKO HARRIA' project was the drawing up of a restoration plan for the replacement of 288 ha of land (19% more than initially expected) covered with exotic conifer masses with habitats of Community interest in the communal forestry areas, 'Añarbe', 'Usoko-Epelerreka' and 'Kausua'. The restoration of the habitats Atlantic acidophilous beech forests and Galicio-Portuguese oak woods with *Quercus pyrenaica* was also helped by the purchase of private land – a total of 54 ha were bought by the beneficiary, the local government of Gipuzkoa, a greater amount than was foreseen. See the box for a summary of the project's habitat improvement actions.

Summary of habitat improvements

***Acidophilus* beech forest (habitat 9120):**

- Increase of the area by 236 ha, starting from grown up exotic conifer plantations (38% more than the existing habitat surface in 2005) and protection of indigenous understorey in 22.5 ha of fully grown exotic broadleaved plantations;
- Improvement of the conservation status of 32 ha by means of increasing the structural complexity of the habitat. Natural regeneration started in 20 ha of the Oianleku acidophilous beech; and
- Restoration of an additional 64 ha of this habitat after the project end.

Galicia-Portuguese oak wood (habitat 9230):

- Increase of the area by 12 ha (more than 50% of the mapped area in 2006); and
- Improvement of the conservation status of 3.3 ha by means of the creation of a firebreak band.

Rivers and riparian habitat (91E0*):

- Increase of the structural complexity of the riparian habitat along 700 m of four different streams. Increase of the fish biomass, invertebrate density and dead leaves and sediment retention. Contribution to the improvement of the water resources of the Añarbe reservoir; and
- Increase of the knowledge on the habitat, its ecology, dynamic, and measures for better management.

Finally, a one hectare area, home to Killarney fern (*Trichomanes speciosum*) was conserved, along with strip of 20 m on each side of the riverbeds of the upstream tributaries of the stream 'Karrika' that is key for the hairy snowbell (*Soldanella villosa*).

Photo: Ainhoa Darquistade Fadrique

Monitoring beetle traps in an old beech tree

Spreading good practice

Many of the key outcomes of the project concerned the increasing of knowledge of habitats and species. To ensure a wide dissemination of its findings, a workshop was organised – 'International Workshop on Conservation, Restoration and Management of forest and fluvial SCIs'. Key areas included a study of the conservation status of *Galemys pyrenaicus* habitat (Pyrenean Desman); the minimum flow necessary for species in the stream Tornola (basin of the river Oiartzun); and a study of the physical habitat and retention capacity of the riverbeds flowing into the Añarbe reservoir. This study aimed to determine the simplest riverbeds in terms of structure and functionality where wood was introduced.

Moreover, a study on the diversity of forest invertebrate species of Community interest in the SCI highlighted those threatened coleopteron species typical of forest environments and dependent on the availability of dead or decrepit wood. This study, along with the drawing up of a habitat cartography in EUNIS format for the SCI, will greatly aid conservation work in the area. Another key outcome was the devising of a technical project to increase the structural complexity and the retention capacity of organic matter and sediments in the riverbeds flowing into the Añarbe reservoir.

In addition to the international workshop, bi-monthly news bulletins, an interactive CD and booklet for schoolchildren and teachers and a travelling exhibition all helped publicise the aims and results of the conservation initiative being carried out in the Aiako Harria region. Companies that were involved in the project also helped to publicise it and ensure public and private landowner support for forestry conservation and restoration.

As a result of the project, the pollarding tradition is gradually being restored in order to maximise biodiversity. Says Inma Lizaso of the Gipzukoa government: "[We were able to make] progress in three years with the project what would have taken 10 years, and the river actions probably would not have occurred without LIFE. It's only for a few years that we have been re-naturalising the landscape. It'll need 100 years, but the project is a first step."

Project number: LIFE05 NAT/E/000067

Title: LIFE AIAKO HARRIA – Conservation and restoration of "Aiako Harria" LIC (ES2120016)

Beneficiary: Direcion General de Montes y Medio Natural. Departmento para el Desarrollo del Medio Rural (The Mountains and Natural Environment General Directorate, Gipuzkoa province)

Contact: Inma Lizaso

Email: Ilizaso@gipuzkoa.net

Website: http://www.life-papillons.eu/

Period: 01-Oct-2005 to 31-Mar-2010

Total budget: €2 260 000

LIFE contribution: €1 130 000

BEETLES

Saving the distinctive *Rosalia alpina* **beetle**

A small number of LIFE Nature projects have targeted the conservation of *Rosalia alpina*, a saproxylic beetle species that is listed in Annexes II and IV of the Habitats Directive.

The Rosalia longicorn (*Rosalia alpina*), is one of the most attractive of all European insects. Despite its distinctive appearance, however, there is a lack of scientific information about its biology and habitat preferences. Widely distributed in some mountainous regions (notably in Central Europe) its populations and ranges have nevertheless suffered significant long-term declines; and in several countries its conservation status is "threatened". The main long-term threats identified are habitat loss in relation to logging and wood harvesting and the decline of old broad-leaved trees, especially of old beech forest (*Fagus silvitica*) within which it lays its eggs.

LIFE projects looking to improve the conservation status of *Rosalia alpina* have focused on preserving the species' preferred habitats and of ensuring an adequate supply of dead wood. Developing and spreading knowledge of this less well-documented saproxylic insect has been another important goal.

Leaving well alone

Few areas of truly 'natural', or old-growth, forests remain in Central Europe. Thus the 'Rothwald' project (**LIFE97 NAT/A/004117**) located in the Dürrenstein wilderness area of Lower Austria is especially important for the long-term conservation of several groups of wood-dependent beetles, including *Rosalia alpina*. LIFE co-funding was used to help create this exceptionally rare forest nature reserve, which includes one of the largest existing remains of undisturbed mixed mountain beech-spruce-fir old-growth forest in the Alpine region (c. 460 ha.) In addition, some 700 ha of formerly exploited mountain beech forests were set aside for natural succession.

A follow-up study of the project was carried out in 2006. It concluded that the conservation status of all forest habitat types in the project area would improve considerably within the next decades. In particular, dead timber is expected to occur more frequently, offering additional opportunities for all saproxylic insects. Moreover, according to the report, thanks to the already existing old-growth forest within the wilderness area, the chances for colonisation of the set-aside forests by typical forest species such as *Rosalia alpina* "are much higher" than if the area had been created elsewhere, without a well-preserved core zone.

Pollarded trees provide particular habitat features for saproxylic beetles. The main objective of an ongoing project in Gipuzkoa in the Spanish Basque Country (**LIFE08 NAT/E/000075**) is to support the conservation status of rare dead wood beetle populations found there, particularly *Rosalia alpina* and the hermit beetle. This will be achieved by improving the availability and quality of pollarded tree habitats. The project also aims to create a European network of appropriate forestry habitats for the targeted species.

Important initial research aimed at creating a more favourable environment for *Rosalia alpina* was also started under the Italian 'RECTINET.5 SCI' project (**LIFE03 NAT/IT/000139**). As part of its broader forest habitat management actions, the project targeted 2 ha of mature beech forest for works to increase the supply of available dead wood. Monitoring, however, has indicated – indicating only the "possible" presence of this attractive, but reclusive, beetle species.

Rosalia longicorn beetle (Rosalia alpina)

BEETLES

‘Cradles’ for **stag beetles**

Artificial ‘cradles’ have been trialled by an innovative Austrian-German LIFE project as a means of providing extra habitats for the threatened stag beetle (*Lucanus cervus*).

The stag beetle lives most of its life as a larva in holes in old trees and dead wood trunks in forests and groves. Forest management, in eliminating old trees and dead wood, destroys at the same time the habitat and food for this priority saproxylic beetle species. Once quite common, the population of the stag beetle – along with that of other saproxylic beetles – is in steep decline. In Europe it is listed in Annex II of the Habitats Directive, and it is a globally threatened / declining species according to the IUCN (2010) Red List.

To reproduce, the stag beetle requires sufficient decaying or dead wood, predominantly from oak trees. It takes five to eight years for the fully-developed beetles to hatch. The ‘Donauwaelder-LIFE’ project (**LIFE04 NAT/AT/00003**) – located along the Danube between Germany and Upper Austria – aimed to increase the areas of suitable habitat for the stag beetle, alongside its broader goals of conserving 440 ha of semi-natural and ‘natural-like’ forested areas of the Upper Danube Valley.

Stag beetle (Lucanus cervus)

Photo: DGVI/CNBF Verona - Bosco della Fontana

Part of the project’s works focused on land-purchase, planting of native tree species and the setting aside of some forest areas to encourage the growth of natural forests in the future. However, alongside its overall long-term conservation objectives, there was an immediate problem to address concerning the stag beetle – that is, how to increase the available supply of suitable dead wood?

Transformation

Working with technical support from a specialist from Switzerland, the team aimed to create artificial stag beetle habitats, trying out different types of woodchip beds and boxes, to supplement the lack of available dead wood in the area. As the transformation process from egg to cock chafer grub to adult stag beetle takes such a long time (up to eight years), this action needed to be started immediately, in order to be able to judge its success over the project lifetime.

In 2005, seven artificial stag breeding habitats were created– all located on the southern edges of forests (mostly oak and hornbeam) on the German side of the project area (in Bavaria). This action proved successful, and when the project ended, stag beetle grubs were found at three artificial habitat sites. Moreover, flying stag beetles were also observed in the vicinity of most of the newly-created habitats.

These initial monitoring results were promising, and the project team expects that the artificial stag breeding habitats will attract an increasing number of beetles in the future. Finally, this innovative technique may also be of value to other projects targeting the conservation of this rare species in Europe.

Other invertebrate species

In addition to dragonflies, butterflies and beetles, LIFE projects have targeted actions at many other invertebrate species: from terrestrial species such as snails, to freshwater and marine invertebrates (including pearl mussels, crayfish and the myriad invertebrates found on coral reefs). Some of these species, such as freshwater pearl mussels, play an important role in indicating the health (or otherwise) of an environment or habitat; others, such as bees, provide crucial ecosystems services and contribute greatly to biodiversity.

SNAILS

LIFE **saving snails**

Reduced habitat sizes and increased pressure from tourism and gull predation has led to many species of molluscs being considered endangered. LIFE projects, however, are increasing our knowledge of snail populations with a view to safeguarding their number and drawing up plans for their protection.

In the Portuguese region of Madeira, for example, the 'Moluscos/Porto Santo - Terrestrial Molluscs of Porto Santo and the Adjacent Islets' project (**LIFE98 NAT/P/005239**) gathered useful data on a group of snail species about which little was previously known. An exhaustive inventory was carried out in all islets where the target species, including several that are listed in Annex II of the Habitats Directive, are found..

Photo: Dinarte Teixeira

Pseudocampylaea portosanctana: one of the five endemic snails on Madeira targeted by the project

The project was able to establish the distribution area for these species within the SCI; such information is invaluable for the regional authorities, which are responsible for the management of the land. The project drew up preliminary guidelines based on its findings, as well as a management plan that includes measures for controlling visitor access.

Another major management problem is the prevalence of open-air landfill sites and other dumping grounds, which are directly responsible for increases in the size of the gull population. These birds feed on molluscs, though their exact impact on mollusc populations is unknown. The management plan of the project will lead to a stricter application of the Environmental Impact Assessment legislation.

Community involvement

The project also took steps to involve the small local community (some 5 000 inhabitants) of Porto Santo, which knew little about the mollusc communities before the start of the LIFE project. Contacts were made through the Porto Santo Municipality and the Porto Santo Delegation of the regional government, as well as through the media. A special effort was made to involve local students in the project, keeping them up-to-date on findings with a view to raising their interest in the natural heritage around them.

An ongoing LIFE project, 'Life Ilhéus do Porto Sant - Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area' (**LIFE09 NAT/PT/000041**) is operating in the same region as the earlier one. It is targeting the Natura 2000 site of the Porto Santo Islets that is home to many endangered endemic species.

The project is aiming to remove threats to the natural ecosystems of the site, such as from invasive plants and increasing rabbit populations. Again information gathering is central to the success of this project. From the data recorded, Action Plans for the endangered species in Porto Santo islets will be drawn up. Monitoring activities will also researchers to assess the impact of the conservation actions on the target species. The project is also aiming to expand the distribution area of this endangered mollusc.

One of Porto Santo's islets- Ilhéu de Cima - the only place in the world where the snail Discula turricula is found

Photo: Carlos Freitas

SNAILS

Conserving the narrow-mouthed **whorl snail**

Habitat destruction has led to the narrow-mouthed whorl snail (*Vertigo angustior*) being listed in Annex II of the Habitats Directive as an endangered species. However, several LIFE projects that have focused on habitat conservation have specifically targeted this type of snail among other wildlife species in order to improve its conservation status.

One of these projects, 'Lowland Limestone – The Lowland Limestone Pavement Rehabilitation Project' (**LIFE99 NAT/UK/006094**), focused on a series of limestone pavements and other limestone habitats – such as English yew (*Taxus baccata*) woodlands and Tilio Acerion ravine forests – which surround the Morecambe Bay area in northern England. The site, which is home to a population of narrow-mouthed whorl snails, is under threat. Though limestone pavement stones are no longer removed for decorative use in domestic gardens (a problem in the past), concerns are growing about the impact of commercial afforestation with non-native species.

The LIFE project was able to boost habitat management activities. Of particular benefit to the snail species was the introduction of deer control measures, which reduced grazing pressure on the lower branches of yew. The culling of deer (mainly roe deer) was only necessary at some sites for the effect to be seen on other sites. Other habitat management actions, such as the re-establishment of traditional coppicing inside the yew and lime woodland and grazing management of grasslands, also helped improve the snails' habitat.

Restored river habitat for V.angustior in Obermain, Germany

Photo: LIFE08 NAT/D/000001

Vertigo angustior

Long-term management

Coppicing and scrub removal yielded particularly good results. Low, spreading branches provide the shelter needed to maintain mossy sites, which are attractive for the snail. Moreover, the project built dams to restore water levels and increase the area of natural vegetation. Controlling the water level was one of the most pressing issues that the Natura 2000 site faced, and following the construction of the dams the project partners were able to focus on the long-term management of the natural habitats.

An ongoing project, 'Obermain – Upper Main valley' (**LIFE08 NAT/D/000001**), is benefiting a population of narrow-mouthed whorl snails in Germany. The project's overall objective is to ensure that the Upper Main valley remains an important corridor for water and wetland habitats and their characteristic species. Conservation actions are helping improve and enlarge water and wetland areas and are being co-ordinated to ensure involvement and support from appropriate stakeholders, especially those from the recreation and tourism, fishing and conservation sectors. This integrated approach aims to help achieve operational efficiencies and ensure sustainable benefits for the long term.

FRESHWATER AND MARINE INVERTEBRATES

Preserving rare **freshwater mussel** species

Four endangered species of freshwater molluscs have benefited from LIFE co-funded conservation actions carried out by projects across Europe.

Since 1992, the majority of LIFE Nature projects targeting river mussels have focused on improving the conservation status of the rapidly-declining populations of the freshwater pearl mussel (*Margaritifera margaritifera*). LIFE projects have also directly or indirectly targeted the endangered Spengler's freshwater mussel (*Margaritifera auricularia*), the thick shelled river mussel (*Unio crassus*), and *Unio elongatulus*, a little-studied river mussel that occurs mainly in Mediterranean countries.

Vanishing pearl mussels

Once common, scientists estimate that more than 90% of the overall numbers of the freshwater pearl mussel (*Margaritifera margaritifera*) have disappeared from Europe's rivers and streams over the past 100 years. Listed in annexes II and V of the Habitats Directive, the mollusc is also classified as 'endangered' in the IUCN Red List. Decline of water quality, unintentional crushing and deliberate killing in search of pearls are some of the main reasons for the species' rapid decline.

The freshwater pearl mussel can live for up to 200 years and during its complex lifecycle it has planktonic stages as well as a parasitic one – it lives in the gills of host fish such as trout or salmon. Populations, and particularly the young mussels living in river beds, are vulnerable to increases in temperature and pollutants, as well as to eutrophication, siltation and sediment extraction. It represents a key indicator species of river ecosystem quality and is also an umbrella species – i.e. protecting the pearl mussel has a positive impact on the entire river ecosystem.

All the LIFE projects aimed, or are aiming (as some are ongoing) to improve the species' habitat and the riverine ecological conditions, in particular, the water

Typical freshwater pearl mussel habitat

Photo: Hervé Ronné

quality and riverbed and shore structure. These are achieved by restoring riverbanks, removing commercial forestry plantations from river valleys and planting riverine woodlands. Moreover, the projects have targeted an improvement in the habitats of the host fish that the mussels' parasitic larvae, the small glochidia, depend upon during the reproductive cycle. This is achieved by the implementation of fish passages, removal of artificial blocking structures and improvement of the fish spawning areas. All the projects include monitoring of populations, in order to assess their structure and viability.

Swedish stronghold

Sweden is one of the strongholds of the pearl mussel in the EU. Despite this, populations there are threatened as elsewhere in Europe. A Swedish project (**LIFE04 NAT/SE/000231**) aimed to secure populations in 21 Natura 2000 sites. The project implemented several actions targeting riverbeds and host fish, including brown trout and salmon. These included the creation of migration opportunities for the host fish in 10 sites by removing obstacles, fixing incorrectly placed road culverts and building bypasses around migration barriers. In order to restore more natural buffer stream zones, the project removed planted spruce along two streams so as to benefit deciduous trees.

These actions resulted in a more ecologically functional buffer stream zone, and thus reduced disturbance and silting. Moreover, the project replaced the shore's stones on the riverbed that had been removed to facilitate timber floating. This helped recreate a more natural habitat for the host fish. The project also carried out direct species actions on the riverbed, such as placing gravel and stones at appropriate locations in the watercourse, thus helping small juvenile mussels to find suitable substrate in areas where silting may have caused declines in recruitment. This action also benefited spawning grounds for brown trout. New riverbeds were created in nine of the project's watercourses.

In Belgium, there are only a few remaining populations, found in very clean watercourses in the Rulles, Sûre, Vierre and Our basins. Most of these are small, with only one population containing more than 1 000 individuals. One LIFE project (**LIFE02 NAT/B/008590**) aimed to restore these key populations through the long-term conservation of their habitats. Studies, monitoring and a mapping exercise were implemented in order to increase understanding of the pearl mussel's habitat and ecological requirements. The monitoring efforts highlighted 600 problem areas, including 180 newly-discovered concerns. Based on these findings, the LIFE team then implemented a series of management initiatives to tackle the identified problems. Works included restoring riverbanks, removing conifers from river valleys and planting deciduous, riverine woodlands. Some 20% of all identified issues were successfully resolved.

Captive breeding

In France, where scientists estimate the overall pearl mussel population has decreased by more than 60% since the beginning of the 20th Century, the 'Mulettte' project (**LIFE09 NAT/FR/000583**) is hoping to restore the pearl mussel populations of the "Massif Armoricain" (French Brittany). The ongoing project is targeting six Natura 2000 riverine sites, which are known to be important refuges for the species in western France. Although difficult, it is possible to successfully rear mussels in breeding stations, as demonstrated by a number of LIFE projects. Thus, a key goal of the project is to establish a breeding centre and to develop and implement a captive breeding methodology. The project is hoping to produce 4 000 individuals for each of the six river areas targeted.

Reintroduction of adult freshwater pear mussels in Sweden

Photo: Lennart Henriksson

The main thrust of a recently-completed LIFE project in the Luxembourg Ardennes (**LIFE05 NAT/L/000116**) was also to set up and manage a breeding station. The aim was to ensure the regular reintroductions of young pearl mussels into the River Our, where the existing, very small (1 500 individuals) and ageing, pearl mussel population is severely threatened, mainly because of poor water quality and management. Populations of host trout are also very low.

An assisted breeding programme for the freshwater pearl mussel is currently being developed by the 'Irfon Special Area of Conservation' project (**LIFE08 NAT/UK/000201**), which is adopting an ecosystems aproach to the restoration of the River Irfon in mid-Wales.

An earlier German project in the border area of Bavaria, Saxony and the Czech Republic (**LIFE02 NAT/D/008458**) successfully released young pearl mussels using the following technique: brown trout were infected with mussel larvae in a fish farm; after nine months the young mussels come off the fish gills – at this stage they were collected from the fish tanks using fine sieves and were infiltrated into the cleaned bottom of the brook via a tube. Some 342 000 individuals were released in total.

This technique was also used for the thick shelled river mussel (*Unio crassus*), with the release of 115 000 young mussels in the project sites. Since the beginning of the 20th Century, numbers of this 'near threatened' freshwater mollusc have declined throughout its European distribution, as a result of deteriorating water quality.

Photo: Aixa Sopeña /LIFE04_NAT/E/000033

Raising of Margaritifera auricularia individuals in the captive breeding centre

However, reintroductions don't always work. A Spanish LIFE project (**LIFE04 NAT/ES/000033**) was unsuccessful in its attempts to breed the Spengler's river mussel (*Magaritifera auricularia*) in captivity. The project team infected 100 fish and recovered 115 000 juveniles. Yet, despite using several different methodologies, none of the juveniles managed to grow and survive beyond 10 weeks. As a result, no infected fish or juvenile mussels were released into the wild. With no natural breeding in wild populations (the youngest specimen being over 70 years old), the future for this species looks bleak in Spain.

Margaritifera auricularia marked for reintroduction and monitoring (left) and M. margaritifera (right) individuals in their natural habitat

Photo: Aixa Sopeña (left) and Hervé Ronné (right)

FRESHWATER AND MARINE INVERTEBRATES

LIFE **targets 'vulnerable' white-clawed crayfish**

Since 1999, LIFE has co-funded nine projects that directly targeted the white-clawed crayfish – the majority of them taking place in Italy. Project actions have included improving water quality and stream habitats as well as captive breeding and reintroductions.

Photo: LIFE03 NAT/IT/000147

Female white-clawed crayfish bred in captivity

The white-clawed crayfish (*Austropotamobius pallipes*) is a freshwater species mainly associated with fast-moving waters such as small mountain streams and the springs of large rivers. The species is intolerant of any kind of water pollution and it needs water temperatures below 25°C, with quite high concentrations of oxygen. For this reason it is considered a good biological indicator of the quality of water in the rivers and streams where it is found. It is included in annexes II and V of the Habitats Directive and is classified as 'vulnerable' in the IUCN Red List.

European populations are increasingly sporadic. Reasons for this include habitat degradation, water removal, pollution – including sewage, insecticides and farm waste effluent – poaching, the spread of invasive non-native crayfish species (*Pacifastacus leniusculus, Procambarus clarkii*) and the effects of climate change. According to the 2007 'Article 17' reports on the conservation status of Europe's most endangered species, in all geographical regions where this species occurs (Alpine, Atlantic, Continental and Mediterranean) its conservation status was assessed as 'bad'. Germany is the only country where it is performing well.

As well as actions to improve water quality and appropriate habitats, all projects focused, or are focusing (as three are ongoing) significant efforts on the breeding and reintroduction of crayfish into carefully targeted areas. This involves capturing healthy specimens and breeding them in captivity before releasing the offspring into the wild to recolonise habitats and add genetic diversity to weak sub-populations. The released specimens and their habitats are carefully monitored and awareness-raising activities carried out.

Italian efforts

Although the species is still found across the entire Italian peninsula, numbers have fallen sharply and many local populations have been eliminated. This vulnerable crustacean is now confined to isolated groups in the

Photo: LIFE03 NAT/IT/000137

An expert looking for crayfish under rocks in the Sinello stream, one of the sites where they were reintroduced

least polluted watercourses that face a high risk of local extinction and loss of genetic diversity.

The *Austropot. lombardo* project (**LIFE00 NAT/IT/007159**) carried out reintroductions of the white-clawed crayfish in two SIC sites in Lombardy. More than 3 000 individuals collected from the provinces of Oltrepo and Lecco were released in two sites (the rivers Ticino and Pegorino). Genetic and sanitary studies were undertaken to choose the source populations, and the reintroduced crayfish were permanently marked in order to facilitate monitoring. The extent of the naturalisation of the reintroduced population, the presence of newborns and the overall dispersal patterns of the released specimens were observed. The population of crayfish, which was introduced to semi-natural conditions in a pool of the Ticino Park, is being used as a source for future reintroductions

Another Italian project, 'Austro Centro-LIFE' (**LIFE03 NAT/IT/000137**), prepared and adopted an action plan for the species in seven provinces in central Italy and gave technical training. This project also restored two breeding facilities in order to raise juvenile crayfish to release into the wild and to improve breeding techniques. After a preliminary study of the distribution and ecological conditions of the local crayfish populations, more than 4 400 juvenile crayfish born by captive breeding and 270 adult crayfish were released in 18 selected sites in three central Italian regions (at least 250 crayfish were released in each site). Surveillance and scientific monitoring activities also were carried out to reduce poaching.

Monitoring the weight of crayfish

Photo: LIFE03 NAT/IT/000137

Better breeding techniques

Meanwhile, a project in northern Italy, 'Valvestino-Marogna 2' (**LIFE03 NAT/IT/000147**) aimed to prevent the extinction of the white-clawed crayfish species in the SCIs, *Val Valvestino* and *Corno della Marogna*. First, a survey was conducted to assess the ecological conditions and the local crayfish population. The resulting data showed that it was possible to reinforce the existing populations with new individuals in the *Valvestino* where the species had natural reproduction, and to reintroduce the species in a selected water course in the *Corno della Marogna*, where no crayfish were found in the survey. In order to achieve this goal a crayfish breeding facility was built with 10 tanks and an artificial pond. The project improved the breeding techniques and 610 juvenile crayfish were released in the predefined locations. Juveniles were bred from reproductive crayfish that were captured in rivers and water courses within the two sites and then released after the reproduction period.

Using the experience gathered by these projects, an ongoing project (**LIFE08 NAT/IT/000352**) plans to reintroduce the crayfish in 47 Italian Natura 2000 sites by breeding 23 200 juvenile crayfish in newly established or restored breeding centres. In addition, the recently started 'RARITY' project (**LIFE10 NAT/IT/000239**) is hoping to combat the spread of the highly invasive, non-native crayfish species, the Louisiana red swamp (*Procambarus clarkii*) in Friuli-Venezia Giulia, north-east Italy. The region's stock of indigenous crayfish populations is particularly important when compared with those of other Italian regions – and includes some endemic subspecies that represent an important genetic heritage for biodiversity. These populations, however, are under serious threat, and may risk complete disappearance, from the recent and widespread appearance of the *P. clarkii*.

Elsewhere in the EU, an ongoing UK project (**LIFE08 NAT/UK/000201**) is also aiming to reintroduce the white-clawed crayfish in two Natura 2000 sites.

The crayfish breeding centre in Borrello

Photo: Iva Rossi

FRESHWATER AND MARINE INVERTEBRATES

LIFE **protects fragile reefs**

Reefs of rock and coral in European waters provide unique habitats for many species of invertebrates, but are also extremely vulnerable to disturbance. Several LIFE projects have worked to restore, protect or simply increase understanding and awareness of these important habitats.

Photo: LIFE02 TCY/TR/000061

Reef habitats are listed in Annex I of the Habitats Directive (1170). Reefs can be based on permanent bedrock, boulders and small rocks or solid mass formed from matter produced by living organisms themselves. Reefs may be permanently submerged, or exposed at low tide and are a key coastal habitat as well as being found further out to sea. Intertidal areas are only included within the Annex I habitat type where they are connected to subtidal reefs.

Reefs support a wealth of biodiversity, which can vary significantly from one reef to another based on their particular topography, substance, temperature, water flow, turbidity, depth, salinity and the extent of air exposure. However, in shallow waters they are typically characterised by communities of attached invertebrates and algae. Invertebrates that make use or depend on reefs include crabs, shrimps, snails, starfish, worms, sea anemones, mussels and scallops, as well, of course, as sponges and coral.

Reefs are widespread around the coasts of Europe, although particular types are more restricted in their distribution. Europe has important areas of cold-water coral reefs in the northeast Atlantic that feed by capturing food particles from the surrounding water. However, Europe's reefs are extremely vulnerable to damage from fishing activities, pollution, coastal disturbance and direct exploitation.

Protecting Europe's reefs

In Denmark, cavernous boulder reefs in shallow-water habitats have been extensively exploited for their easy-to-excavate large boulders. The LIFE project 'BLUEREEF' (**LIFE06 NAT/DK/000159**) is working hard to protect these endangered habitats, which rise out of the seabed and support important invertebrate species, including large sea urchins, leather corals and the European lobster (*Homarus gammarus*) that live in the crevices between the large boulders.

'BLUEREEF' has restored 60 000 m^3 of reefs by bringing boulders from quarries in Norway into the target area. It aims to stabilise 6 ha of the existing reef area and restore the structure and function of 6.5 ha of marine cavernous boulder reefs. A Site of Community Importance has been selected - at Kattegat Bay - to be a sanctuary for donor populations of reef-dependent species and to provide a corridor linking sites within the Natura 2000 network.

Two LIFE projects have worked to protect from human interference marine meadowlands of seagrasses (*Posidonia oceanica*) which act as barrier reefs providing habitat for invertebrates such as anemones, starfishes, sea urchins and crustaceans: the 'Capo Feto' project (**LIFE99 NAT/IT/006270**) in Italy; and the 'Biomares' project (**LIFE06 NAT/P/00019**) in Portugal. 'Biomares' has proposed an active management strategy for reefs and the restoration of sand banks permanently covered with sea water.

Tube anemone (Cerianthus spp.)

Photo: LIFE07 NAT/E/000732 WWF J. M. Hernandéz

Photo: LIFE07 NAT/E/000732 Alberto Serrano

Coldwater coral (Lophelia pertusa) surveyed by the Spanish 'INDEMARES' project

Project discovers new species

The Baltic Sea projects 'Baltic MPAs' (**LIFE05 NAT/LV/000100**), 'DENOFLIT' (**LIFE09 NAT/LT/000234**) and 'MARMONI' (**LIFE09 NAT/LV/000238**) have worked on marine monitoring and mapping, which increase understanding of the conservation status of reef habitats and related invertebrate species. A similar Spanish marine inventory project, 'INDEMARES' (**LIFE07 NAT/E/000732**), even made the dramatic discovery of a new species of soft coral in the Menorca Channel. The species was named *Nidalia indemares* because of the project.

Two UK projects have developed marine-management approaches covering important areas of reef habitat: the 'PISCES' project (**LIFE07 ENV/UK/000943**) explored an ecosystem approach in the Celtic Sea; and the 'UK marine SACS' project (**LIFE96 NAT/UK/003055**) developed locally-based management schemes in 12 marine SAC sites. The Spanish project '3R-FISH' (**LIFE07 ENV/E/000814**) is currently working to reduce fish industry waste that impacts negatively on reef habitats.

Finally, several projects have raised understanding and protection of reef habitats that form specifically as part of coastal habitats: the 'Rahja' project (**LIFE96 NAT/FIN/003023**) in the Finnish Rahja archipelago; 'Deserta Grande' (**LIFE95 NAT/P/000125**) in the Portuguese archipelago of Madeira; 'Juniper Dunes' **(LIFE99 NAT/IT/006189**) on the Italian island of Sardinia; and the 'SIC del Tirreno' project (**LIFE99 NAT/IT/006275**) along the Southern Tyrrhenian Sea in Italy.

INVERTEBRATE SPECIES AS ENVIRONMENTAL INDICATORS

Using invertebrates to assess the state of **habitats** and **ecosystems**

Invertebrate species can have an important role to play as environmental indicators – for instance as indicators of biodiversity or water quality. LIFE co-funding has been used on several occasions for this purpose, helping "monitor" the health of ecosystems and habitats across the EU.

One of the first LIFE projects to involve invertebrates as environmental indicators was 'SOWAP' ("Soil and surface water protection using conservation tillage in Northern and Central Europe" - **LIFE03 ENV/UK/000617**), a transnational project led by beneficiary Syngenta UK's Jealott's Hill International Research Centre. The goal of 'SOWAP' was to collect data from demonstration plots at sites in Belgium, Hungary and the UK to assess the advantages and disadvantages of using conservation agriculture techniques. This knowledge could then be used to inform land use management decisions by farmers and politicians.

Trials were established on 48 demonstration plots, covering 18 farms in the three countries, allowing direct comparison between different land management techniques including zero-till, non-inversion tillage, mould-board (or inversion tillage) and fallow. Farmer's workshops and open days were organised at all sites to promote zero-till techniques and non-inversion tillage, as well as to discuss the pros and cons of conservation agriculture.

In addition to assessing the commercial viability of the different techniques, birds, earthworms (*Oligochaeta*) and aquatic invertebrates were monitored as indicators of biodiversity.

Earthworms indicate healthy soil

Although crop yields were typically 10% lower using conservation agriculture methods, soil management costs could be reduced by up to 70%. Furthermore, the 'SOWAP' project found that although there were significant variations between sites, in terms of soil erosion, water run-off and biodiversity, the general trend was for conservation agriculture to outperform conventional methods. Results showed that conservation tillage could reduce soil erosion by up to 95% on light, sandy soils and that soil structure and function were improved with higher levels of soil carbon, nitrogen and soil moisture. Farmers visiting the sites also saw that conservation tillage could reduce water run-off by as much as 90%.

Important biodiversity benefits were recorded, with earthworm activity in particular being enhanced. This is significant since earthworms act as natural indicators of soil quality and their presence helps improve the conservation status of other species further up the food chain.

Photo: LIFE03 ENV/UK/000617

Earthworms are important indicators of soil health

Helping to assess sustainable forest management

The need to reconcile the demands of forestry and the forest products industry with the ecosystems services provided by our forests has led to the development of the concept of sustainable forest management (SFM). 'ManFor C.BD'. (**LIFE09 ENV/IT/000078**) is an ongoing LIFE+ project that seeks to provide detailed information on important environmental indicators for assessing SFM in Europe's forests. The results of the project will be used to help forest management professionals meet the objectives of production, protection and biodiversity and to make the connection between SFM indicators and landscape-scale ecology.

The project is assessing the effectiveness of alternative forest management options in a number of different test areas, from plantations to protected forests, including Natura 2000 sites and priority habitats and species. Both vertebrates and invertebrates (specifically beetle families such as *Scolytidae, Cerambycidae, Buprestidae* and *Lucanidae*) are being used to calculate the impact of those management alternatives on carbon cycling and the biodiversity of selected forest ecosystems with a view to defining a set of good practices for SFM. The first beetle surveys have been carried out as a pilot action to help optimise the monitoring process; a minimum of two sites per year will be surveyed by the project team.

Acoustic monitoring in Greece

An innovative means of measuring biodiversity is being tested by a new LIFE Nature project in Greece. 'AMIBIO' (**LIFE08 NAT/GR/000539**) is using small, solar-powered multi-sensor monitoring stations to conduct acoustic surveys within the Hymettus Natura 2000 site near Athens. (The project area includes both includes both Kaisariani forest and Lake Vouliagmeni). Information gathered by these audio collecting field units is wirelessly transmitted to a central base station for automatic statistical analysis of audio and climate data.

Results of the acoustic monitoring will be used to provide baseline information about specific groups of acoustically active biota – including bats, birds, frogs, toads, terrestrial animals and stridulating insects - and to generate an index of biodiversity based on the complexity of calls recorded within a region.

Grasshopper (Chorthippus biguttulus) sound spectra monitored in Greece

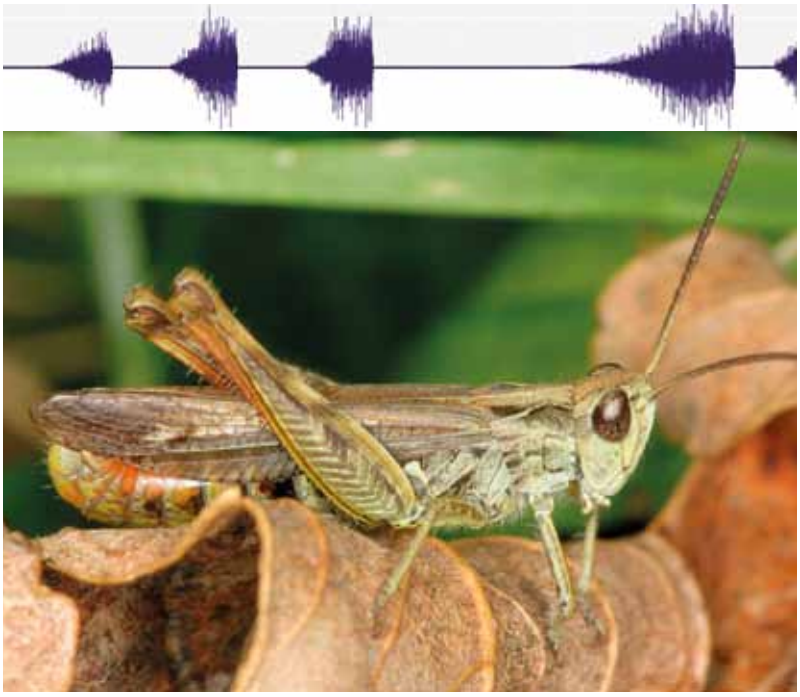


Photo: LIFE08 NAT/GR/000539

Since "singing" invertebrates such as orthoptera (grasshoppers, crickets and locusts) and cicadas are more often heard than seen or trapped, acoustic surveying could be a particularly useful tool for rapid assessment programmes (RAP), that provide a snapshot of the biodiversity of specific regions. The project, which is led by the Wire Communications Laboratory at the University of Patras (Greece), will also be able to detect atypical sound events related to potentially hazardous human activities (e.g. tree-cutting, gunfire) and natural or man-made disasters (e.g. storms and forest fires) and report them to the relevant authorities.

To date, the beneficiary has compiled a sound library of several hundred high-quality recordings of orthoptera, as well as screening existing databases to find more than 4 000 relevant audio recordings of insects, amphibians, birds and mammals. Using this information, the AMIBIO team has conducted a biodiversity assessment that saw 22 orthoptera and 3 cicada species identified (as well as amphibians, birds, bats and other mammals). Tagging and archiving of the vocalisations will enable researchers to calibrate the sound identification software that is being developed as part of the project.

Improving water quality and diversity in agricultural basins

Aquatic invertebrates such as freshwater pearl mussels (e.g. *Margaritifera margaritifera*), freshwater crayfish (e.g. A*ustropotamobius pallipes*), aquatic snails, aquatic worms, and the larvae of aquatic insects are excellent indicators of water quality. 'CREAMAgua', an ongoing LIFE project based in Spain (**LIFE09 ENV/ES/000431**) will take advantage of this fact to monitor the effects of measures to improve biodiversity in parts of the Monegros area of the Ebro river basin that have been degraded by intensive agricultural use.

In collaboration with local farmers, the beneficiary will introduce 'natural' ecosystem structures of wetlands and riverbank forests to reduce inorganic nutrients - nitrates and phosphates - and salts from agricultural runoff in the entire Monegros area. As well as improved aquatic biodiversity and water quality in the River Flumen, the project will also target the establishment of permanent populations of birds, amphibians and invertebrates in the wetlands.

ECOSYSTEMS SERVICES PROVIDED BY INVERTEBRATES

LIFE support to **bees** and other **valuable insects**

Insects contribute significantly to vital ecological functions such as pollination, pest control, decomposition and wildlife nutrition. Such ecosystems services are also important in terms of their economic value – with Europe's bee population alone estimated to be worth €14.2 billion annually (2005).

Recent studies show that the populations of many pollinating insects are in decline. This finding is particularly worrying for Europe's 2 500 species of wild bee, which together with honeybees, hoverflies and other insects, are responsible for pollinating nearly 80% of wild flora and 70% of European agricultural crop plants. The causes of this decline are multiple and several of them are closely linked to human activity. Among the main causes of bee decline are: the widespread use of pesticides; nutritional stress linked to habitat loss and climatic conditions; the disappearance of possible nesting sites (through landscape changes and urbanisation); an increase in monoculture and exaggerated road-side upkeep; and the incidence and spread of diseases and pests.

Recent work, however, has indicated that urban habitats and residential areas can harbour a large number

In a park in Lyon, 'Urban-bees' has installed "bee hotels" (background) and a spiral structure with aromatic plants designed to appeal to bees

Photo: LIFE08 NAT/F/000478 HMOURET

Photo: AMOREAU

'Urbanbees' LIFE project exhibition

of wild bee species and they might therefore play a role as temporary or permanent refuges for this most efficient of pollinators. There are a number of reasons for this including, in a chemical context, the fact that there are fewer pesticides in urban areas than in some agricultural areas; and in a bioclimatic context, that the temperature is 2 to 3 degrees Celsius hotter in cities than in the surrounding countryside. Bees are generally thermophile (heat-loving) insects, preferring to nest in warm environments.

An ongoing LIFE+ Biodiversity project (**LIFE08 NAT/F/000478**) is currently carrying out an interesting pilot study on the conservation of wild bees in the greater urban areas of Lyon, France. Running until 2014 the 'Urbanbees' project is also hoping to promote actions that will conserve and enhance the biodiversity of wild bees in urban habitats across Europe.

'Bee friendly' habitats

The goal is to first develop an action plan to conserve and enhance the diversity of bees in 10 urban and peri-urban areas of Lyon. This will include the installation of special nesting devices for bees and promoting appropriate 'bee-friendly' guidelines for the maintenance and/or development of public green spaces, farmland and home gardens. Guidance will also be provided on changing conventional gardening practices in parks and recreational areas to favour the planting of native plant and tree species and to combat the spread of non-native, invasive species.

A network of biological corridors will be developed between the 10 selected pilot sites (8 000 m^2). Here the aims are to increase favourable habitats for wild bees; and to reduce the genetic isolation of individual populations. Following testing and validation in the pilot areas around Lyon, another objective is to disseminate the action plan to 20 EU cities.

Two LIFE Environment projects have also looked at the role of insects in a societal context i.e., in terms of their contribution towards the provision of ecosystems services, or in terms of their impact on quality of life and health. The 'Spanish Ecodiptera' project (**LIFE05 ENV/E/000302**) developed an innovative method for the treatment of pig manure. Insects (mainly flies) are used to decompose the waste and transform it into high-quality fertiliser that can be applied without negative impacts on environment or health. Previously, another French LIFE project (**LIFE99 ENV/F/000489**) developed strategies for reducing the nuisance caused by mosquitos proliferating in the wetlands and coastal lakes and lagoons of Languedoc-Roussillon and Provence.

The sweat bee (Lasioglossum spp.) is an effective pollinator

Projects focusing on Invertebrates

The table below provides examples of LIFE projects focusing on invertebrates species. For more information on individual projects, visit the online database at: http://ec.europa.eu/environment/life/project/Projects/index.cfm.

SPECIES	TITLE	PROJECT NUMBER
Bivalvia		
Margaritifera auricularia	Margarita Aragón - Conservación de Margaritifera auricularia en Aragón	LIFE04 NAT/ES/000033
	Margaritifera Cataluña - Conservation of an endangered naiad Margaritifera auricularia in Ebro river (Catalunya)	LIFE00 NAT/E/007328
	Ardmouperl - Restoration of pearl mussel populations in the Ardennes	LIFE05 NAT/L/000116
	BLACKWATER SAMOK - Restoration of the Upper River Blackwater SAC for the Freshwater Pearl Mussel, Atlantic Salmon, European Otter and Kingfisher	LIFE09 NAT/IE/000220
	Fpmswe - Freshwater Pearl Mussel and its habitats in Sweden	LIFE04 NAT/SE/000231
	ISAC 08 - Irfon Special Area of Conservation Project	LIFE08 NAT/UK/000201
	MARGAL ULLA - Recovery of populations of Margaritifera margaritifera and Galemys pyrenaicus inn the Ulla river basin (Galicia)	LIFE09 NAT/ES/000514
	Margarita Sanabria - Preservation of Margaritifera margaritifera at LIC in Zamora	LIFE03 NAT/E/000051
	MULETTE - Conservation of the freshwater pearl mussel in the Massif armoricain	LIFE09 NAT/FR/000583
	Pearl mussels - Restoration of fluvial ecosystems containing pearl mussels	LIFE97 NAT/FIN/004086
	Pearl mussels 31/8/2006 - Conservation of habitats of pearl mussels in Belgium	LIFE02 NAT/B/008590
	Vindel River LIFE - Restoration of tributaries of the Vindel river combined with monitoring and evaluation of ecological responses of species and habitats	LIFE08 NAT/S/000266
	ECOTONE – Management of riparian habitats towards the conservation of endangered invertebrates	LIFE10 NAT/PT/000073
	Large freshwater mussels Unionoidea in the border area of Bavaria, Saxonia and the Czech Republic	LIFE02 NAT/D/008458
Unio crassus	ECOTONE – Management of riparian habitats towards the conservation of endangered invertebrates	LIFE10 NAT/PT/000073
	Steigerwaldrand Iphofen - Woodlands and river valleys on the Steigerwald slopes near Iphofen	LIFE09 NAT/DE/000005
	Large freshwater mussels Unionoidea in the border area of Bavaria, Saxonia and the Czech Republic	LIFE02 NAT/D/008458
	UC4LIFE - The thick shelled river mussel (Unio crassus) brings Life+ back to rivers	LIFE10 NAT/SE/000046
Unio elongatulus	Mejora de los hábitats y especies de la red Natura 2000 en Banyoles: un proyecto demostrativo	LIFE08 NAT/E/000078
Coleoptera		
Buprestis splendens	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
Carabus variolosus	Bachtäler Arnsberger Wald - Rehabilitation of streams in the " Arnsberger Wald"	LIFE07 NAT/D/000214
Cerambyx cerdo	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	Campanarios de Azaba - Biodiversity conservation in western Iberia	LIFE07 NAT/E/000762
	LIFE AIAKO HARRIA - Conservation and restoration of "Aiako Harria" LIC (ES2120016)	LIFE05 NAT/E/000067
	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
	Bosco Fontana - Bosco Fontana : urgent conservation's actions on relict habitat	LIFE99 NAT/IT/006245
Cucujus cinnaberinus	Evo - Evo Forest - Awareness-raising and protection of Southern Finalnd forest biotopes	LIFE02 NAT/FIN/008466
	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
Lucanus cervus	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	Donauwaelder - Alluvial forests and slope forests of the Upper Danube Valley	LIFE04 NAT/AT/000003
	LIFE AIAKO HARRIA - Conservation and restoration of "Aiako Harria" LIC (ES2120016)	LIFE05 NAT/E/000067
Lucanus cervus	Steigerwaldrand Iphofen - Woodlands and river valleys on the Steigerwald slopes near Iphofen	LIFE09 NAT/DE/000005
	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
	Bosco Fontana - Bosco Fontana : urgent conservation's actions on relict habitat	LIFE99 NAT/IT/006245
	HIGRO - HIGRO – Demonstrative Actions for the Conservation of Priority Habitats in Northern Mountain Areas in Portugal	LIFE09 NAT/PT/000043

SPECIES	TITLE	PROJECT NUMBER
Morimus funereus	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
Osmoderma eremita	BIODIVERSIDADY TRASMOCHOS - Management and conservation of *Osmoderma eremita, **Rosalia alpina* and other saproxylic habitats of Community interest in Gipuzkoa	LIFE08 NAT/E/000075
	DONAUKEH - Hillsides and Floodplains in the Danube valley between Neustadt and Bad Abbach (DONAU KEH)	LIFE07 NAT/D/000225
	EREMITA MEADOWS - Management of Fennoscandian wooded meadows (6530*) and two priority beetle species : planning, public participation, innovation	LIFE09 NAT/LV/000240
	Kinnekulle - Kinnekulle plateau mountain - restoration and conservation	LIFE02 NAT/S/008484
	Meadows - Restoration of Latvian floodplains for EU priority species and habitats	LIFE04 NAT/LV/000198
	MIA - Lake Mälaren Inner Archipelago - Restoration and Management	LIFE07 NAT/S/000902
	N Gauja - Protection and management of the Northern Gauja Valley	LIFE03 NAT/LV/000082
	Osmoderma eremita - Preservation of the beetle, Osmoderma eremita in Sweden	LIFE97 NAT/S/004204
	ROSORIS - Natural meadows and pastures of Östergötland - restoration and maintenance	LIFE05 NAT/S/000108
	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
Phryganophilus ruficollis	EREMITA MEADOWS - Management of Fennoscandian wooded meadows (6530*) and two priority beetle species : planning, public participation, innovation	LIFE09 NAT/LV/000240
Rosalia alpina	BIODIVERSIDADY TRASMOCHOS - Management and conservation of *Osmoderma eremita, **Rosalia alpina* and other saproxylic habitats of Community interest in Gipuzkoa	LIFE08 NAT/E/000075
	LIFE AIAKO HARRIA - Conservation and restoration of "*Aiako Harria*" LIC (ES2120016)	LIFE05 NAT/E/000067
	Marais de Rochefort - Preservation and restoration of the Rochefort marshes biological functions	LIFE06 NAT/F/000147
	RETICNET VALCHIAVENNA - RETICNET. 5 SCI for the conservation of wetlands and main habitats	LIFE03 NAT/IT/000139
	Schütt-Dobratsch - Schütt-Dobratsch	LIFE00 NAT/A/007055
	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
	Piatra Craiului II 1/7/2007 - Natura 2000 sites in the Piatra Craiului National Park	LIFE03 NAT/RO/000032
	Tarvisiano - Integrated plan of action to protect two NATURA 2000 sites	LIFE98 NAT/IT/005112
	Dürrenstein/Niederösterreich - Wilderness area Dürrenstein - Niederösterreich (Lower Austria)	LIFE97 NAT/A/004117
Stephanopachys substriatus	Corpo Forestale - Conservation actions in NATURA 2000 sites managed by the State Forest Service	LIFE04 NAT/IT/000190
Crustacea		
Austropotamobius pallipes	AUSTROP CENTRO - Austropotamobius pallipes: protection and management in SAC sites of Central Italy	LIFE03 NAT/IT/000137
	Austropot. lombardo - Conservation of Austropotamobius pallipes in two SIC sites of Lombardy	LIFE00 NAT/IT/007159
	CRAINat - Conservation and Recovery of Austropotamobius pallipes in Italian Natura2000 Sites	LIFE08 NAT/IT/000352
	ISAC 08 - Irfon Special Area of Conservation Project	LIFE08 NAT/UK/000201
	Valvestino-Marogna 2 - Biocenosis restoration in Valvestino Corno della Marogna 2	LIFE03 NAT/IT/000147
	RARITY - Eradicate Invasive Louisiana Red Swamp and Preserve Native White Clawed Crayfish in Friuli Venezia Giulia - RARITY	LIFE10 NAT/IT/000239
Gastropoda		
Caseolus calculus	Life Ilhéus do Porto Sant - Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area.	LIFE09 NAT/PT/000041
Caseolus commixta	Life Ilhéus do Porto Sant - Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area.	LIFE09 NAT/PT/000041
	Moluscos/Porto Santo - Terrestrial Molluscs of Porto Santo and the Adjacent Islets	LIFE98 NAT/P/005239
Caseolus sphaerula	Moluscos/Porto Santo - Terrestrial Molluscs of Porto Santo and the Adjacent Islets	LIFE98 NAT/P/005239
Discula turricula	Life Ilhéus do Porto Sant - Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area.	LIFE09 NAT/PT/000041
Elona quimperiana	LIFE AIAKO HARRIA - Conservation and restoration of "Aiako Harria" LIC (ES2120016)	LIFE05 NAT/E/000067
Idiomela subplicata	Life Ilhéus do Porto Sant - Halt the loss of European Biodiversity through the recovery of habitats and species of the islets of Porto Santo and surrounding marine area.	LIFE09 NAT/PT/000041
	Moluscos/Porto Santo - Terrestrial Molluscs of Porto Santo and the Adjacent Islets	LIFE98 NAT/P/005239
Vertigo angustior	Lowland Limestone - The Lowland Limestone Pavement Rehabilitation Project	LIFE99 NAT/UK/006094
	Obermain - Upper Main valley	LIFE08 NAT/D/000001

SPECIES	TITLE	PROJECT NUMBER
Vertigo moulinsiana	Natura 2000 Rivers - Safeguarding Natura 2000 Rivers in the UK	LIFE99 NAT/UK/006088
	STREAM - River Avon cSAC: demonstrating strategic restoration and management	LIFE05 NAT/UK/000143
Heminoptera		
Bees	Urbanbees	LIFE08 NAT/F/000478
Lepidoptera		
Callimorpha quadri-punctaria	BIOMURA - Conservation of biodiversity of the Mura river in Slovenia	LIFE06 NAT/SI/000066
	Bisamberg - Bisamberg habitat management	LIFE06 NAT/A/000123
	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
	DONAUKEH - Hillsides and Floodplains in the Danube valley between Neustadt and Bad Abbach (DONAU KEH)	LIFE07 NAT/D/000225
	Lounské Středohoří Steppe - Active protection of the SCIs with thermophilous habitat types and species in Lounské Středohoří hills	LIFE09 NAT/CZ/000363
	Obere Drau - Combine of the flood plain-forests of the Upper Drau-river valley (Kärnten)	LIFE99 NAT/A/006055
Coenonympha oedippus	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
Colias myrmidone	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
Erebia christi	Alpe Veglia - Alpe Veglia and Alpe Devero: actions of conservation of mountain grasslands and peatlands	LIFE02 NAT/IT/008574
Eriogaster catax	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
	RICOPRI - Restoration and conservation of dry grasslands in southern and central Italy	LIFE09 NAT/IT/000118
	Steigerwaldrand Iphofen - Woodlands and river valleys on the Steigerwald slopes near Iphofen	LIFE09 NAT/DE/000005
Euphydryas aurinia	ASPEA - Action for sustaining the population of Euphydryas aurinia	LIFE05 NAT/DK/000151
	Campanarios de Azaba - Biodiversity conservation in western Iberia	LIFE07 NAT/E/000762
	Cornwall Moors - Restoration of the mid Cornwall Moors for the Euphydryas aurinia	LIFE03 NAT/UK/000042
	LIFE-Aurinia - Reestablishment of the Marsh Fritillary (Euphydryas aurinia)	LIFE09 NAT/DE/000010
	PAPILLONS - Reconstituting a habitat network for threatened butterflies (*Euphydryas aurinia, Lycaena helle, Lycaena dispar*) in the Walloon region (Belgium)	LIFE07 NAT/B/000039
	RestHejK - Restoration of the Wetland Area of Hejnum Kallgate	LIFE06 NAT/S/000113
	UVOR - Untersberg-Vorland	LIFE06 NAT/A/000124
	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
	HIGRO - HIGRO – Demonstrative Actions for the Conservation of Priority Habitats in Northern Mountain Areas in Portugal	LIFE09 NAT/PT/000043
	Wengermoor-Projekt - The Wengermoor Project	LIFE99 NAT/A/005916
Euphydryas maturna	Steigerwaldrand Iphofen - Woodlands and river valleys on the Steigerwald slopes near Iphofen	LIFE09 NAT/DE/000005
Graellsia isabelae	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
Hypodryas maturna	UVOR - Untersberg-Vorland	LIFE06 NAT/A/000124
Lopinga achine	UVOR - Untersberg-Vorland	LIFE06 NAT/A/000124
Lycaena dispar	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
	NATURA 2000-LUXEMBOURG - Contribution from local authorities to the implementation of NATURA 2000	LIFE07 NAT/L/000542
	PAPILLONS - Reconstituting a habitat network for threatened butterflies (Euphydryas aurinia, Lycaena helle, Lycaena dispar) in the Walloon region (Belgium)	LIFE07 NAT/B/000039
	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
Lycaena helle	PAPILLONS - Reconstituting a habitat network for threatened butterflies (Euphydryas aurinia, Lycaena helle, Lycaena dispar) in the Walloon region (Belgium)	LIFE07 NAT/B/000039
	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
Maculinea arion	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364

SPECIES	TITLE	PROJECT NUMBER
Maculinea nausithous	Obermain - Upper Main valley	LIFE08 NAT/D/000001
	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
	Rheinauen bei Rastatt - Rhine wetlands near Rastatt	LIFE09 NAT/DE/000004
	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
	Wengermoor - Projekt - The Wengermoor Project	LIFE99 NAT/A/005916
Maculinea teleius	Obermain - Upper Main valley	LIFE08 NAT/D/000001
	UVOR - Untersberg-Vorland	LIFE06 NAT/A/000124
	Wetlands Butterflies - Conservation and upgrading of habitats for rare butterflies of wet, semi-natural meadows	LIFE06 NAT/PL/000100
	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
Melanargia arge	RICOPRI - Restoration and conservation of dry grasslands in southern and central Italy	LIFE09 NAT/IT/000118
Parnassius apollo	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
Parnassius mnemosyne	Butterflies CZ-SK - Integrated protection of rare butterfly species of non-forest habitats in the Czech Republic and Slovakia	LIFE09 NAT/CZ/000364
Odonota		
Coenagrion hylas	Tiroler Lech - Wild river landscape of the Tyrolean Lech	LIFE00 NAT/A/007053
Coenagrion mercuriale	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	Libellenarten - Protection program for endangered dragonfly species in the Southwest of Germany	LIFE96 NAT/D/003036
Gomphus graslinii	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	ECOTONE – Management of riparian habitats towards the conservation of endangered invertebrates	LIFE10 NAT/PT/000073
Leucorrhinia pectoralis	Cuxhavener Küstenheiden - Large Herbivores for Maintenance and Conservation of Coastal Heaths	LIFE05 NAT/D/000051
	DRAGONLIFE - Securing Leucorrhinia pectoralis and Pelobates fuscus in the northern distribution area in Estonia and Denmark	LIFE08 NAT/EE/000257
	Gulf of Finland - Management of wetlands along the Gulf of Finland migratory flyway	LIFE03 NAT/FIN/000039
	HELA - Cross-border restoration of heathland on continental dunes	LIFE06 NAT/B/000085
	LIFE Kleine Nete - Large scale habitat restoration in the valley of the Kleine Nete	LIFE09 NAT/BE/000411
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	WETMAN - Conservation and management of freshwater wetlands in Slovenia	LIFE09 NAT/SI/000374
	Libellenarten - Protection program for endangered dragonfly species in the Southwest of Germany	LIFE96 NAT/D/003036
Macromia splendens	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	ECOTONE – Management of riparian habitats towards the conservation of endangered invertebrates	LIFE10 NAT/PT/000073
Ophiogomphus cecilia	BIOMURA - Conservation of biodiversity of the Mura river in Slovenia	LIFE06 NAT/SI/000066
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	Obermain - Upper Main valley	LIFE08 NAT/D/000001
Oxygastra curtisii	Artrópodos Extremadura - Conservation of endangered arthropods of Extremadura	LIFE03 NAT/E/000057
	ECOTONE – Management of riparian habitats towards the conservation of endangered invertebrates	LIFE10 NAT/PT/000073
	HIGRO - HIGRO – Demonstrative Actions for the Conservation of Priority Habitats in Northern Mountain Areas in Portugal	LIFE09 NAT/PT/000043
Orthoptera		
Stenobothrus eurasius	Lounské Středohoří Steppe - Active protection of the SCIs with thermophilous habitat types and species in Lounské Středohoří hills	LIFE09 NAT/CZ/000363

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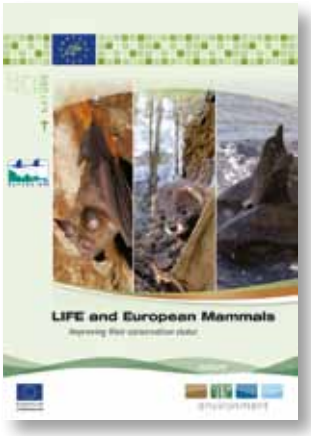

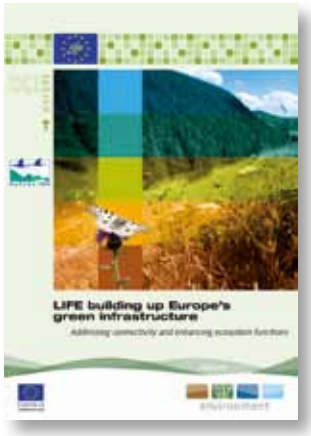

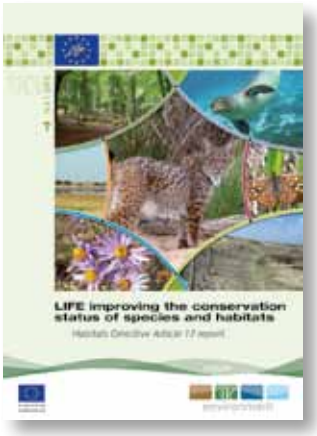

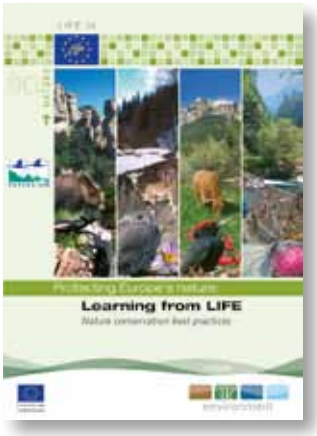

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