The Large Blue © David Simcox

POLICY BRIEF

Conservation of Threatened Insects in Europe:

Managing habitats for land use and climate change adaptation

Insects react rapidly to changes in land use and climate because of their generally short life cycles and, in many cases, their dependency on other species. For species which directly depend on one another, a change in one species can have a severe impact on the other. A recent report by the European Environment Agency has revealed dramatic declines in some grassland butterfly populations in Europe since 1990.

Based on research results of the BiodivERsA-funded CLIMIT project, conservation schemes could be improved to help halt the extinction of the threatened insects studied in the project. Specific conservation measures could help improve the status of these species by allowing them time to adapt to environmental changes, and to maintain or progress towards favourable conservation status. Such adaptive management measures can contribute significantly to reaching the targets of the EU Biodiversity Strategy to 2020 and to fulfil the obligations in the EU Habitats Directive.

- Some highly-specialized insects, such as the Large Blue butterfly (*Maculinea arion*), are **highly vulnerable to environmental changes**
- The use of **appropriate adaptive management measures, in particular integrating ecological knowledge and promoting habitat patches and heterogeneity** have been demonstrated to be beneficial to insect conservation
- A **spectacular increase** in the Large Blue population in the United Kingdom was possible through specific conservation measures

➢ **Adequate monitoring and management of Natura 2000** sites and integration of ecological knowledge into management practices are essential for species adaptation

➢ **Creating and restoring grassland patches** enhances insect conservation, as supported by the **EU Biodiversity Strategy** and recent policy on **Green Infrastructure**

➢ National Rural Development Programmes under the **Common Agricultural Policy** could better contribute to **enhancing grassland conservation**

➢ EU Member States should build on the advice given in the new **European Commission Guidelines on Climate Change and Natura 2000** in their site management planning

The context

Research has shown that in recent decades regional extinction rates of butterflies have substantially exceeded those of birds and plants. Butterfly species which strongly depend on other species are most vulnerable to change as their survival depends on the persistence of others. The greatest recorded declines among butterflies in Europe were of species that associate with ants (myrmecophiles).

In order to understand species vulnerability to land use and climate change, the BiodivERsA-funded CLIMIT project (CLimate change impacts on Insects and their MITigation) has assessed the impacts of human-induced changes in climate and habitat on some of Europe's most specialized and threatened, ant-dependent grassland butterflies. The study species included three butterflies – Large Blue (*Maculinea arion*), Dusky Large Blue (*Maculinea nausithous*), Scarce Large Blue (*Maculinea teleius*) – all listed in the Annexes of the EU Habitats Directive), as well as the main food plants, ants and parasitoids with which each directly interacts for their own survival. Possible options for adaptation to environmental changes for the study species were tested, with the objective of conserving both the species and the associations between them and the organisms they depend on.

Key research results

Through a combination of field experiments and theoretical modelling, CLIMIT has compared the fates of a number of species under several scenarios of climate and land use change, and has studied their potential to adapt to new environments and conditions, inside and outside of protected areas. The local adaptations, changing ecological niches and different needs of these species were studied across a range of local climates – from the Mediterranean to the North and Baltic seas.

Research has helped identify conservation schemes that can be used to improve the adaptive capacity of the studied species and thus contribute to their conservation in Europe.

Integrating ecological knowledge into management

CLIMIT, and previous work carried out by some of its scientists, have demonstrated examples where the ecological needs of a threatened insect have been integrated with great success into the management of protected areas, and incorporated with equal success into a nation's agri-environmental or forestry schemes, with the Large Blue as an outstanding example in Sweden and the UK, respectively. In particular CLIMIT has demonstrated that when protected area management applies "ecological knowledge – taking into consideration the adaptive needs of species – sites can support between 10 and 100 times larger sized populations of species than elsewhere, thus reducing the extinction risk of these species. Protected areas, including Natura 2000 sites, are recognized as important tools for species and landscape conservation.

Ecosystem patches

CLIMIT has demonstrated that enhancing and/or restoring certain strategically-located patches of threatened ecosystems is highly effective in conserving the studied specialised insects. While this may not necessarily contribute greatly to overall species abundance in the short term, patches can act as 'stepping stones' and facilitate the species' dispersal and, colonisation and recolonisation of extinct sites across landscapes, allowing large populations to persist on the core sites. Moreover, creating a mosaic of ecosystem patches provides habitats of differing qualities which can become temporary refuges for species during periods of extreme weather (e.g. drought or cold-wet years), again contributing to the long-term persistence of the species in a landscape.

Heterogeneity of habitats

CLIMIT research has proven that, in the northern European insect ranges, altering the intensity, timing and/or frequency of land management can help easily address the effects of modest climate warming (up to a mean of 2°C). Altering the structure and shading effect of vegetation, which can be done, for example, by decreasing or increasing grazing or mowing, or by thinning or increasing the canopy cover in woods can be a way to cope with climatic change. Changing the vegetation patterns of sites results in increased heterogeneity of habitats which has proven to be an effective tool to improve species adaptability.

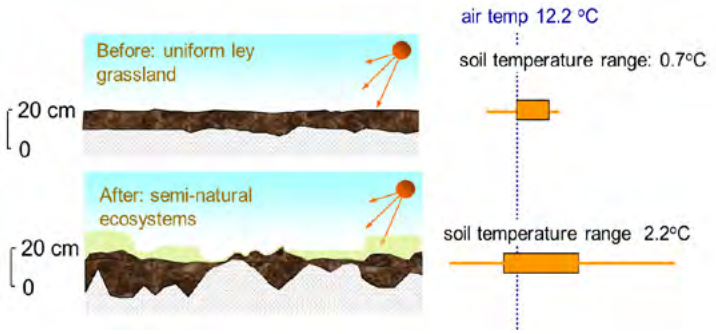

Figure 1: Changing the micro-topography and/or turf structure of formerly homogenous sites can increase the range of microclimates available to insects and plants in grasslands niches by more than 2°C, CLIMIT project.

Figure 2: Example of heterogeneity of habitat, CLIMIT project.
This new *Large Blue* site, constructed beside a UK railway line and started from bedrock, contains heterogeneous topography and swards of various heights, which together result in a wide range of soil temperatures which provide warm and cool refuges in years when the weather is, respectively, unusually cold or warm. Overall, the site is cooler than the ideal for the species under current climates, but is expected to provide optimum habitat as the climate warms.

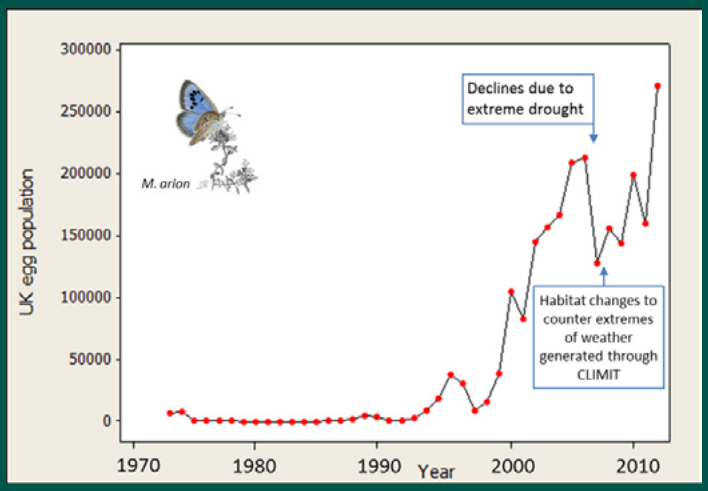

Figure 3: The abundance of the Large Blue butterfly in the United Kingdom, preceding extinction in 1978 and following its reintroduction from Sweden to carefully managed sites in the 1980s. No precise data are available for numbers prior to 1972, but anecdotal descriptions indicate a continual decline, with a similar number of butterflies to today having last occurred in the early 1950s.

CLIMIT has reported that application of the conservation measures presented above has made it possible to spectacularly increase the population of the Large Blue in the United Kingdom. Whereas some progress on restoring the population of the Large Blue was achieved by other scientific projects prior to CLIMIT (e.g. EU FP5 project MacMan), the conservation measures required to mitigate against climatic shifts and more extreme events were discovered and successfully applied nationwide through CLIMIT between 2009 and 2012. Thanks to this work, in 2012 more individuals were recorded in the country than at any point in the last 60 years. CLIMIT demonstrated that the status of the red ant *Myrmica sabuleti*, the Wild Thyme (*Thymus* species) and the Marjoram (*Origanum majorana*), which are associated with the Large Blue, was also improved as a result of these conservation measures. Furthermore the study revealed that adaptive measures targeted on the Large Blue benefited also other endangered species which are characteristic of these grassland ecosystems.

Policy recommendations

CLIMIT has demonstrated the importance of well-managed habitats for species conservation. It has underlined the importance of adequate monitoring and management of the Natura 2000 sites (in accordance with e.g. EU Habitats Directive's Articles 6 and 11) and of ecosystem patches also outside of protected areas which serve as stepping stones for the species' spread and interchange between sites in a landscape (EU Habitat Directive's Article 10). Although no specific studies were conducted by CLIMIT or during the production of this brief on the effectiveness and cohesion of current policies, the knowledge produced highlights measures which can enhance insect conservation.

The use of appropriate adaptive management measures, such as those presented in this brief, has been shown to be effective in conserving insect species in changing environmental conditions. It is suggested that support and guidance on adaptive management (i.e. monitoring, adapted intervention, remonitoring and evaluation) is provided to the relevant authorities as they develop and implement Natura 2000 management plans **(action 1.c of the EU Biodiversity Strategy)**. EU Member States should build on the advice given in the new **European Commission Guidelines on Climate Change and Natura 2000** in their site management planning.

Specific conservation measures, as highlighted by CLIMIT, can help species to adapt to changing environmental conditions. It is suggested that the European Commission promotes knowledge exchange on appropriate conservation measures, for example, through the **Natura 2000 Biogeographic Seminars** and follow-up activities (**action 1.d in the EU Biodiversity Strategy**).

CLIMIT identified some insect species which are most vulnerable to climatic changes and which closely interact with, and have strong impacts on, other species. For the most vulnerable insect species listed in the **EU Habitats Directive**, it is important to support the development and implementation of Species Action Plans, which could be funded through LIFE+.

The research underlined the benefits of restoring patches of grassland habitat that can act as 'stepping stones' for insect species between protected areas (see the EU Habitats Directive's Article 10). This type of landscape approach can be strengthened through the **EU Strategy on Green Infrastructure** and the 15% ecological restoration target, but suitable incentives, based on ecological knowledge, will be required to achieve them. Restoration of biodiverse grassland habitats can be highlighted as a priority under the strategic framework for ecosystem restoration (**action 6.a of the EU Biodiversity Strategy**).

Considering the EU Habitats Directive's Articles 6 and 10 and the EU Biodiversity Strategy, it is also important for the **Common Agricultural Policy** to enhance conservation management of non-intensively managed grasslands. Grassland habitats that benefit insect communities should form part of the quantified biodiversity targets to be integrated within national **Rural Development Programmes**, (**action 9.a of the EU Biodiversity Strategy**).

Further research and intervention evaluation for adaptive management are recommended to gain knowledge on the ecological requirements of insect species (e.g. EU Habitats Directive's Article 18). Evaluation is also needed to identify whether the species most vulnerable to climate change are prioritized in conservation actions.

Links to sources

CLIMIT project website
www.climit-project.net
Scientific papers by CLIMIT
www.climit-project.net/page.php?P=6

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About this Policy Brief

This Policy Brief is part of a series aiming to inform policy-makers on the key results of the biodiversity research projects funded by BiodivERsA and provide recommendations to policy-makers based on research results.

The series of BiodivERsA Policy Briefs can be found at www.biodiversa.org/policybriefs.

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The key research results presented here were validated by adj. Prof. Dr. Josef Settele, Helmholtz Centre for Environmental Research - UFZ, Halle (Germany), leader of the CLIMIT project, Prof. Dr. Jeremy Thomas, University of Oxford, UK, co-leader of the CLIMIT project and other project colleagues. Input was provided by IUCN Global Species Programme and environmental policy experts.

The policy recommendations made do not necessarily reflect the views of all BiodivERsA partners, nor of IUCN.

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