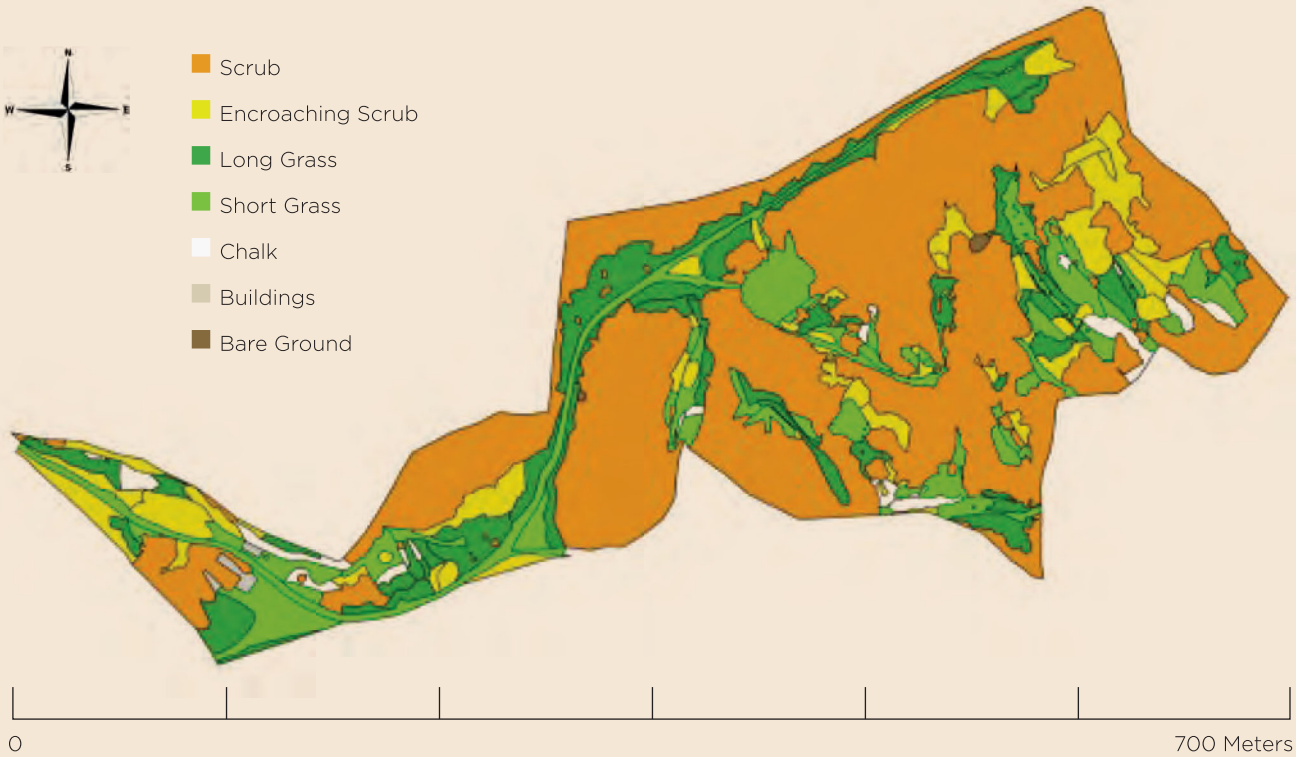
Mitigating the Effects of Climate Change – Butterflies at Totternhoe

Introduction

Climate change is already having profound effects on species in Britain, with the climatic niches of species (the area in which the climate is suitable for them to live) shifting northwards in many cases, including for butterflies (Parmesan et al., 1999). For some mobile and generalist species, this may not pose too much of a problem, as long as we have the interconnected habitats they require. However, we have many fragile specialist species that will struggle to find suitable habitats further north (Warren et al., 1999), or which disperse too slowly to be able to follow their preferred climate (Hayes et al., 2019).

Therefore, we need to look at how we can continue to support species on our sites under climate change. Small-scale variability is of vital importance on a site, especially with regards to temperature. As humans, we need relatively large changes in the landscape to see a noticeable temperature change, but other organisms operate at much smaller scales. This means that a small difference in grassland structure, vegetation height, scrub density and small-scale topographical variation can be important for species (Suggitt et al., 2018). Butterflies can often act as a 'canary in the mine' and can help us understand how other species may react to climate change. Butterfly research on our Totternhoe nature reserve is helping to influence how we continue to manage this site for the benefit of a wide variety of species under changing climatic conditions.

A map of the main vegetation type at Totternhoe nature reserve (Hayes et al., 2018)



There is a diverse array of habitats on the site supporting a wide variety of specialised species. However, constant management by Wildlife Trust staff and volunteers is required to maintain the diverse successional habitat (grassland with areas of encroaching scrub) preferred by many species.

Totternhoe's butterflies

Totternhoe nature reserve in Bedfordshire is a large area of calcareous grassland. The site is home to a wide variety of butterfly species, including the small blue *Cupido minimus* and Duke of Burgundy *Hamearis lucina.* Research carried out by the University of Cambridge at Totternhoe showed that the Duke of Burgundy butterfly has extremely specific habitat requirements and was found using the same small areas of the reserve year after year (Hayes et al., 2018; Hayes et al., 2019). These locations were warm, sheltered valleys surrounding old mine entrances. The species has suffered large declines over the last 50 years, however, numbers appear to be rising again at Totternhoe and other sites (Hayes et al., 2018).

"Our research suggests that this spring-flying species needs these locations to warm up and power energetically demanding flights involved with territorial defence and acquiring mates. Therefore, these warm, sheltered habitats need to be maintained to ensure that healthy populations of Duke of Burgundy can be supported"

Matthew Hayes, University of Cambridge

Totternhoe Nature Reserve is home to a wide variety of butterfly species including the small blue *Cupido minimus* (pictured here) and Duke of Burgundy *Hamearis lucina* (above) butterflies. Both are dependent on warm sheltered areas. Small blue photo © Andrew Bladon, Duke of Burgundy photo © Ryan Clark

Climate change adaption

Further research from the University of Cambridge at our Totternhoe, Pegsdon Hills and Blows Downs reserves investigated how our butterflies respond to local temperature changes (Bladon et al., 2020). Across the community of butterfly species found on our reserves, there are big differences in their ability to tolerate changing temperatures. Some species, such as the brimstone *Gonepteryx rhamni* and large white *Pieris brassicae*, can cope with quite large changes and maintain a stable body temperature. Other species, including the Duke of Burgundy, really struggle and rely more on the temperature of their environment. Species that rely heavily on their environment to maintain a suitable body temperature (including the small heath *Coenonympha pamphilus* and small copper *Lycaena phlaeas*) are more likely to be at risk as the climate changes (Bladon et al., 2020). By highlighting which butterfly species are most susceptible to climate change, this research on our reserves enables us to plan habitat management. This includes considering fine-scale temperature patterns, as well as vegetation type, to help protect the most vulnerable species.

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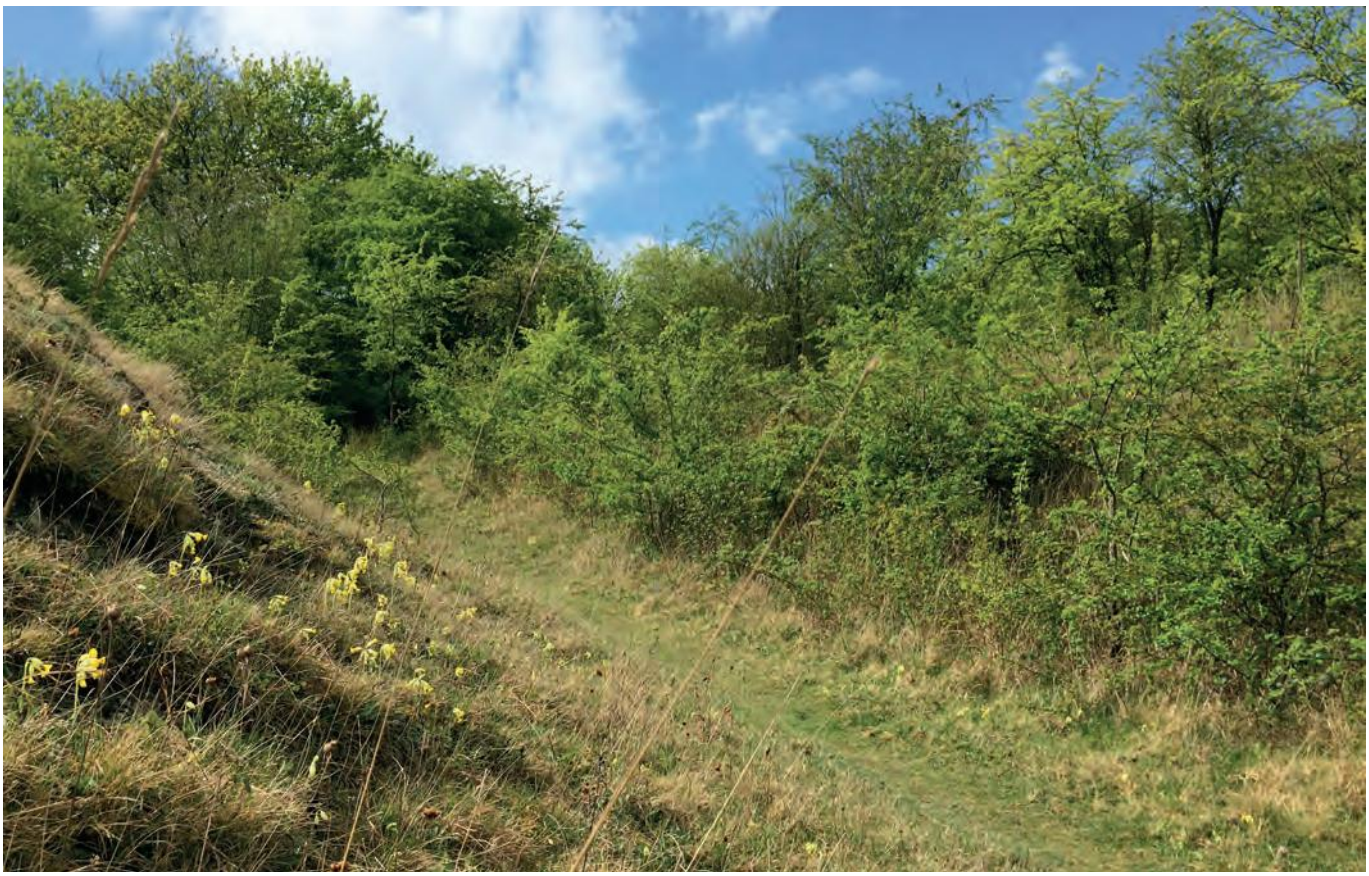
wildlifebcn.org/butterfly-climate-studies

> *"It seems that the species that are more dependent on the temperature of their environment are at the greatest risk when dealing with future climate change."*
>
> *Dr Andrew Bladon, University of Cambridge*



An example of a typical Duke of Burgundy habitat at Totternhoe nature reserve. They require warm, sheltered banks to survive. Photo © Andrew Bladon

Nature reserves in a changing climate

To ensure that species can move through the landscape, local populations on reserves need to be connected up with high-quality habitat in the wider countryside. Alongside this, nature reserves need to adjust their management to take into account the changing needs of species due to climatic change. Populations of species need to be monitored so that conservation interventions can respond to detected changes. This research has shown just how important it is to maintain diverse transitional habitats, with topographic and structural variability, to create different temperatures on our sites. This will help maximise the chances of preserving suitable conditions for many different species into the future. The diverse transitional habitats that suit the butterflies will undoubtedly suit a large variety of other species as well. By working in partnership with the Insect Ecology Group at Cambridge we are at the cutting edge of research in this area and results can inform our management of the site straight away.

Our reserve management needs to take into account the changing needs of species at the microclimatic level in order to protect these species for future generations. Photo © Andrew Bladon

> *"The combination of monitoring, research and conservation management that is carried out by the Wildlife Trust will be essential for the continued survival of species into the future."*

Dr Andrew Bladon and Matthew Hayes, University of Cambridge

Summary

The management of our nature reserves has kept them in fantastic condition and they support a wide variety of special and rare species. Climate change is likely to pose unforeseen challenges to some of the rare species that currently thrive on our sites. We need our management to take into account future climatic conditions. As a local charity, we are well placed to do this. By working with academics at the cutting-edge of research, we can secure a strong future for species in our area.

Acknowledgements

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