

# A butterfly that lives underground? An evidence case story

**A butterfly that spends most of its life underground? Why? What is it doing? What does it eat? Professor Jeremy Thomas solved the puzzle for the large blue butterfly *Maculinea arion* in the 1970s just before it became extinct in the UK. Fortunately his findings were used to successfully re-introduce the enigmatic species into England. Now, with the help of partners, David Simcox and Sarah Meredith are continuing to discover more about this iconic butterfly and they are using their knowledge to help it to thrive and to survive threats such as habitat loss and climate change.**

## Dedication and evidence

David Simcox and Sarah Meredith are the project officers for the Joint Committee for the Conservation of the Large Blue and are dedicated to helping large blue butterflies. In a good year, such as 2016, they rent a cottage near a strong population and spend the summer counting eggs, nurturing young caterpillars and rushing them to suitable locations the moment they are ready to be released, which will be between 4 and 6pm in the evening. Their work includes looking after thyme and marjoram so that it's just right for the larvae. They keep moving, misting and monitoring the plants all day so that the conditions are perfect for the eggs and larvae.

The plants and the larvae from different sites need to be kept separate because the work involves studying the changes in populations and variations in DNA that are developing at the different locations - and because the caterpillars eat each other! With every season being a new generation, David and Sarah are watching evolution in action.



A newly emerged male large blue © David Simcox

## Background

For many years the large blue life-cycle was an enigma, naturalists would try to rear its caterpillars in captivity, but the caterpillars always lost interest in feeding in the 4th instar (developmental stage) and subsequently died.

In the early part of the 20th Century, Purefoy, Chapman and Frohawk made a breakthrough when they discovered large blue pupae in the nests of red ants. They subsequently showed that the larvae had been carried there by the ants and

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then spent most of the year underground feeding on ant grubs. However, this seismic discovery failed to halt the decline of the large blue in the UK.

## The last piece in the puzzle

By the early 1970s when Jeremy Thomas began to study the ecology of the butterfly there were only two remaining populations in England and things had become critical. Jeremy carried out extensive research and discovered that five different species of red ant lived on the sites and all would pick up the caterpillars. However, the butterfly only emerged from the nest of one species, *Myrmica sabuleti*.

He showed that the butterfly had evolved to perfectly mimic the grubs of *Myrmica sabuleti* whereas the other species of red ant quickly realised that it was an impostor and killed it. Furthermore, he discovered that each species of red ant thrived under different conditions and that *Myrmica sabuleti* is a heat-loving ant. In England short turf that was closely grazed in the spring and autumn enabled the ground to warm up to the temperature that allowed *Myrmica sabuleti* to dominate.

Without Jeremy's evidence we would not have known that under-grazing, caused by changing agricultural practices and myxomatosis, had caused the decline of *Myrmica sabuleti*, which was replaced by another red ant that looked similar, *Myrmica scabrinodis*, but killed large blue caterpillars.

Unfortunately, the findings were just too late to save the last populations of large blue, but they did provide the knowledge that underpinned the re-introduction programme.

## The re-introduction

When the large blue became extinct in 1979, work began to find a donor population. At first this proved to be difficult because the species

had also declined across Europe. In 1983, David followed up a lead that large blue caterpillars had been seen on Oland, an island off the East coast of Sweden. When David arrived he found some ideal limestone grassland habitat for the butterfly and to his amazement one landed at his feet!

The traditional grazing management had allowed big colonies to flourish on Oland and David brought 200 eggs and caterpillars back to the UK and put them on a site in Dartmoor close to red ants' nests and then on to Green Down (SSSI), a Somerset Wildlife Trust site. Green Down is now the biggest known population of large blue in Northern Europe and every re-introduced colony in the UK originates from this population.

## The keys to success

Careful consideration goes into deciding where the butterfly should be re-introduced. Each re-introduction is expensive, particularly in regards Project Officer time. Proposals are put forward to the Joint Committee for the Conservation of the Large Blue for consideration based on:

- historical records of the species;
- rigorous surveying for suitable colonies of *Myrmica sabuleti* ants; and
- suitable plants for the females to lay their eggs on.

These are all necessary, but the most important factor of all for new relocations is the assurance that appropriate site management will be undertaken.

There were initially four re-introductions in Somerset. The last one was in 2000. These populations have started to naturally colonise other sites and there are now between 25 and 30 populations. This fantastic achievement has been the result of collaborative working at a landscape scale. Multiple owners and

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partnership working across the Polden Hills have ensured ideal conditions for colonisation.

The aim now is to establish a core population in the Cotswolds that will naturally colonise other sites. Unfortunately the early re-introductions were not a great success.



Paul Hackman (left) and David Simcox discussing habitat management on Painswick Beacon, a potential site for re-introduction in the future © Sarah Meredith

Paul Hackman, Natural England's Advisor in the Cotswolds explains: "*The original large blue stock re-introduced in the 1990s emerged too late to feed on the flowering thyme food plant because the Cotswold Hills are that bit cooler. However, after 18 successful generations in Somerset the butterfly had evolved to emerge slightly earlier and it was possible to use these populations, which were better acclimatised to the UK climate, to successfully re-establish them in the Cotswolds*".

In 2016 large blue butterflies flew at five sites in the Cotswolds, something that has not happened since the 1950s.

## Climate change opportunities

Long-term monitoring is helping us to fully understand the butterfly and how its requirements are changing.

When large blue caterpillars first hatch they feed on the flowers of thyme or marjoram.

Historically, in the UK the large blue only laid its eggs on wild thyme, whereas in southern Europe it feeds on marjoram. This is because in the hotter climate *Myrmica sabuleti* occupies the same temperature niche in a taller sward, which would restrict access to low growing thyme plants but not the taller marjoram plants. In 2005, large blues in Somerset naturally spread to a sheltered railway cutting which didn't have thyme, but did have well distributed stands of marjoram and high densities of *Myrmica sabuleti*.

In the Cotswolds there are now three populations that are using both thyme and marjoram plants. They are a model for mitigating against the impacts of climate change and evidence is suggesting that to maintain the butterfly we may need to graze sites less intensively in the future and encourage the spread of marjoram. See page 5 for an illustration of the relationships between sward height and species.

## The importance of partnership

Understanding the ecology of the large blue has been vital to the success of its conservation and the conservation of a range of other priority species that require a similar habitat. However it couldn't have been done without the Project partners who have provided the sites and their highly skilled staff who ensure they are carefully managed 12 months every year.

Natural England plays a critical role in the success of the Partnership. It provides National Nature Reserves for re-introductions, guidance through national experts and advisors with local knowledge, support through licensing and SSSI consenting and funding contributions through agri-environment schemes and the Species Recovery Programme.

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Back in the early 1960s it was Natural England's predecessor, the Nature Conservancy, that set up the Joint Committee for the Conservation of the Large Blue. The Committee still exists to help co-ordinate the partnership work with Professor Jeremy Thomas as its Chair and David Simcox as Project Officer. Members include:

- Butterfly Conservation;
- Clark Trust
- Gloucestershire and Somerset Wildlife Trusts
- National Trust
- Natural England
- University of Oxford

David works with all the partners and with landowners to identify potential new sites for re-introductions. He applies for licences, advises on site management, coordinates monitoring of the species, training of volunteers and reports back to the Committee every year.

## Network Rail

Work being done jointly with Network Rail is an example of a successful partnership. There are currently 8 large blue populations on Network Rail land, but some locations are unstable because the geology is failing. On one site where work needed to be carried out to make the area safe the partnership produced an outcome that was beneficial for both the butterflies and Network Rail.

David advised them to spread a subsoil of only 3 inches and then to sow a wild flower mix which included marjoram. This is less soil than would normally be used and it created ideal conditions for both the ant and butterfly populations. After four years there were large blue butterflies flying and laying eggs on the site while Network Rail made £40,000 in savings.

David says that Network Rail have been incredibly good partners to work with and they have worked together on several projects since

to save existing populations. He is now hoping to start further discussions to plan ahead to mitigate against future possible loss of colonies and to create the ideal landscape for compensatory populations.

## The future

There is still plenty of work to be done to ensure the recovery of the large blue butterfly and establish sustainable populations. This includes the re-introduction of more core populations and the appropriate management of further sites to encourage natural colonisations of whole landscapes. However, the key to this will be continued monitoring and evidence gathering.

When asked what has been the most important lesson he has learnt on this project, David Simcox said:

*From the very beginning Jeremy taught me that it is vital to monitor, manage and then monitor the effects of the management, this has been crucial to the success of this project and surely all ecologically based conservation projects.*

## Further information

Natural England Evidence Information Notes are available to download from the Natural England Access to Evidence Catalogue <http://publications.naturalengland.org.uk/> For information on Natural England contact the Natural England Enquiry Service on 0845 600 3078 or e-mail [enquiries@naturalengland.org.uk](mailto:enquiries@naturalengland.org.uk).

## Contact for this note

Paul Hackman (0208 0260940), Natural England Lead Advisor in the South Mercia team, has overseen the re-introduction in the Gloucestershire Cotswolds and is part of the Large Blue Committee.

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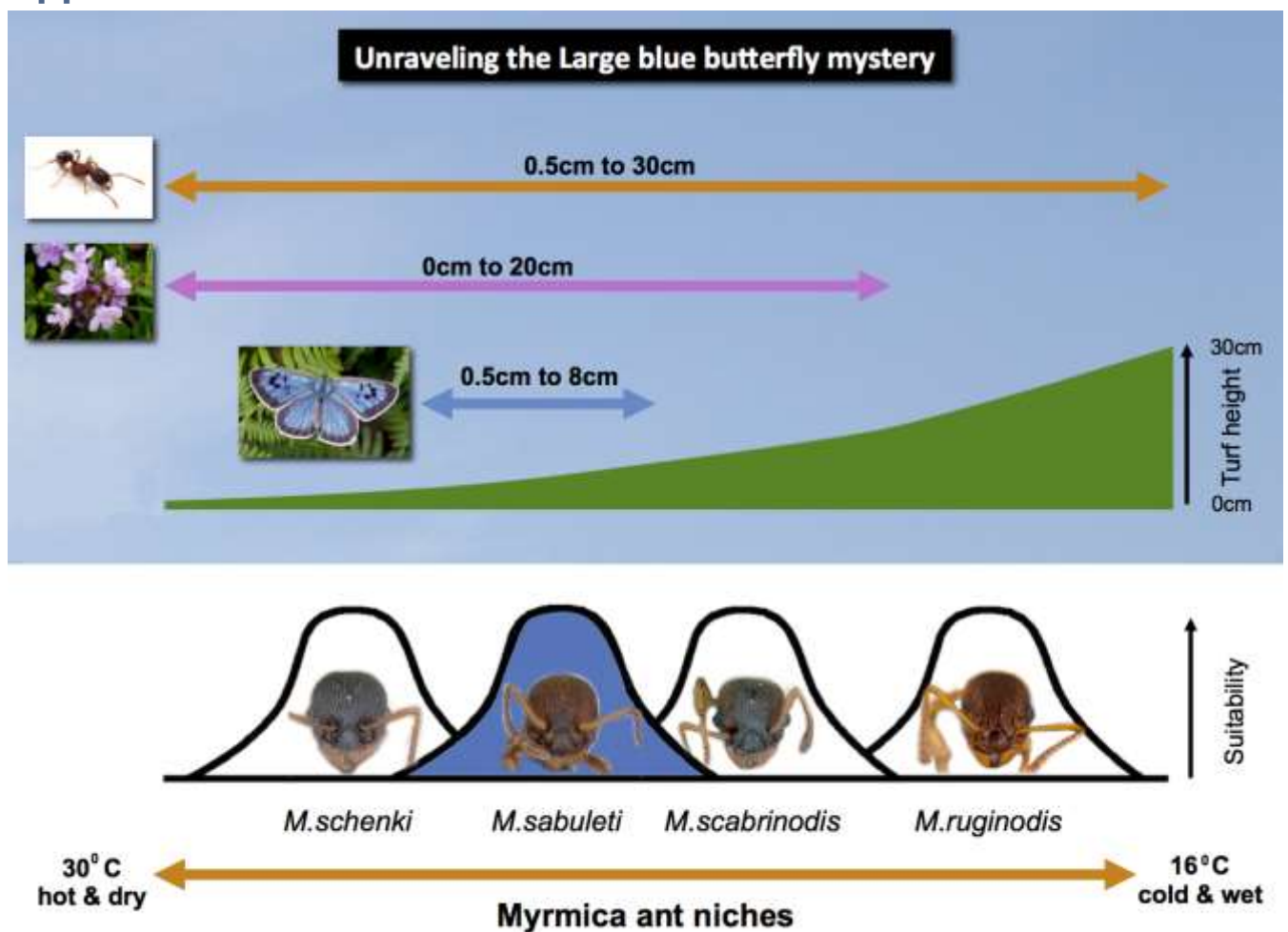
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## Appendix 1



The niches of red ants (*Myrmica*) related to turf height and ground temperature. (Thomas and Simcox unpublished)

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