

to challenge yourself...

SAVING OUR WORLD BUTTERFLY Expansion

Explore more about conservation
with these case studies

Section I: CASE STUDY



THE LARGE BLUE BUTTERFLY

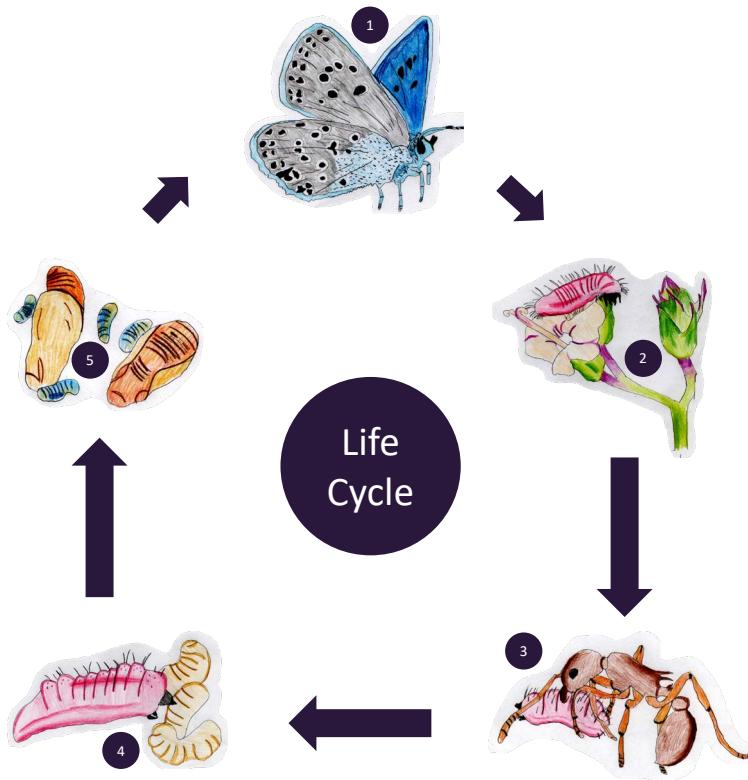
The large blue butterfly

Out of the seven species of blue butterfly that live in the UK, the large blue butterfly (*Phengaris arion*) is the largest and the rarest. Healthy populations now live in the south of the country around Somerset, but it has not always been this way.

- For as long as people have been recording their numbers, the large blue butterfly has been in decline.
- By the 1970s only a few small populations were left in the country and despite conservation efforts the species could not be saved in the UK.
- The large blue butterfly went extinct in the UK in 1979.
- In 1983 the species was reintroduced using butterfly populations from Sweden and new research led to better conservation plans being put in place.
- Since then the new UK populations of the large blue butterfly have been thriving.

The conservation story of the large blue butterfly in the UK is an excellent illustration of how important it is to research and properly understand the causes of species' declines.

Only then can conservationists put the correct management in place to help them.



Life cycle & relationship with ants...

Caterpillars of the large blue butterfly have a complex life cycle, which makes it difficult to manage the habitat they live in and conserve the species.

1 The adult large blue butterflies emerge in late June/July and fly for a few weeks. During this time, they lay their eggs on specific food plants (wild thyme), which their caterpillars feed on.

2 The caterpillars eat their food plant but don't grow much.

Here's where things get tricky

3 After a few weeks the caterpillars fall to the ground and wait to be discovered by worker ants. The caterpillars mimic the ants' chemical 'odour' and the call of an ant larvae. This tricks the worker ants into thinking they have come across some of their own larvae. The worker ants then 'adopt' the caterpillars and carry them back to their nest.



4 The caterpillars are protected by the ants and within the safety of the nest start to eat the real ant larvae. Ant larvae contain more nutrients and calories than leaves and so the caterpillars grow rapidly. They can become 20x larger than when they were first 'adopted' and reach sizes much bigger than the ants that tend to them.

5 The adult ants continue to protect the caterpillars, even as their real young get eaten. In May the caterpillars pupate and emerge a few weeks later as adult butterflies to repeat the cycle.

Section II:



INSECT COMMUNICATION

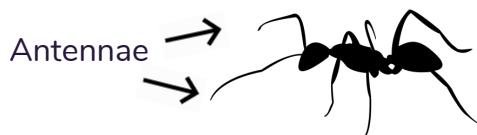
Insect communication

Insects like bees and ants often live in large groups, with hundreds or even thousands of individuals in a single colony. With so many individuals living together it can be difficult to send messages to one another, so insects have evolved some amazing ways to communicate.

One very important method uses chemical signals called pheromones.

As humans we smell through our noses. We breath in air, which has little bits of dust and chemicals within it and receptors in our nose can detect these as different smells.

Insects don't really detect smells in the same way but instead have antennae. They are much more sensitive than our noses and detect the chemicals (pheromones) left behind by other insects.



Insects use pheromones to communicate many different things.

For example, after visiting a flower, worker bees can leave behind a pheromone that repels other members of the colony. It lets them know that the flower has already been visited and that they should stay away as the nectar, the sugary food provided by the flower, has already been taken.



Ants

Ants are another group that are well known for using pheromones to communicate. We see this in action when we witness ants walking in a line. They are using the pheromones to mark the route between food and their nest, allowing other ants from the colony to easily find and collect more food by following the pheromone 'odour' trail.



Insects also use chemical signalling to tell each other apart. Different species, and different colonies of the same species, produce different chemical 'odours'.

Insects like ants can detect how similar their own 'odour' is to the 'odour' of another individual. If they are quite similar, then the two ants are probably from the same colony. However, if the 'odours' are different the two ants are probably from different colonies. An excellent way to detect intruders.

Mimicing 'odour'

In the UK, caterpillars of the large blue butterfly mimic the 'odour' of a specific species of red ant (*Myrmica sabuleti*). This tricks the ant into 'adopting' the caterpillars, but it is a risky strategy. The caterpillars have to match the ant's chemical 'odours' very carefully. If they get it wrong, they risk being detected, attacked and eaten!

TASK: 'Talk' like a bee...

You'll need:

- Flowers: Five or more paper plates or squares of cardboard
- Pheromones: A mixture of 50% lemon juice and 50% water in a spray bottle
- A decoy: A spray bottle with 100% water

Spray all plates with the 100% water. This is so that your 'bees' will not see which 'flower' has been sprayed and which haven't. Spray one plate with the lemon juice and water mixture. This is you behaving like a bee and 'marking' the flower that you have visited.

- Be careful not to get this mixture in your eyes -

Now test the smelling power of your family or friends by asking them to behave like a foraging bee:

- They must find a 'flower' (plate) that does not smell like lemons.
- Each time they select a 'flower', spray it with the lemon juice and water mixture.
- Eventually there will be one 'flower' left without any 'pheromones' on it. The final 'bee' will have the hardest job finding the remaining 'flower'.



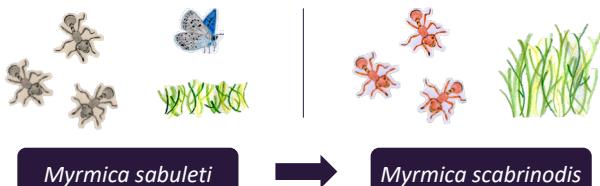
Section III:

BETTER CONSERVATION

Environmental changes and extinction
in the UK

Environmental changes and Extinction in the UK

In the UK nearly all large blue butterfly caterpillars are adopted by one species of red ant (*Myrmica sabuleti*). This species needs warm conditions and so is restricted to warm south facing slopes, with very short vegetation and minimal shading. The extinction of the large blue butterfly in the UK is thought to have been caused by the loss of the short grassland habitats of their host species.



M. sabuleti ants being replaced by another ant species, *M. scabrinodis*, that can tolerate long-grass cooler conditions, but do not support large blue butterfly caterpillars.

Grasses were kept short by grazing livestock and rabbits. However, there has been a reduction in the grazing of grasslands by cattle since the 1950s, and a decline in the rabbit population due to the spread of the disease Myxomatosis.

This has allowed vegetation to grow taller, reducing the amount of suitable habitat for the host ant of the large blue butterfly (*M. sabuleti*). As a result, other ant species have been able to outcompete and replace it. It is thought that without its host ant, the large blue butterfly gradually declined to extinction.

Reasons for failed conservation attempts

As the large blue butterfly neared extinction in the 1970s, researchers began to look closer at its ecology and life cycle.

The large blue butterfly's interactions with ants had been known for a long while. What was not known was how reliant it was on one specific ant species.

Original conservation attempts aimed to support any species of red ant alongside the large blue butterfly, instead of the specific ant species (*Myrmica sabuleti*) that the butterfly needed.



Unfortunately, despite the push to research this unique relationship, the findings came a little too late for the original UK population.

Better conservation

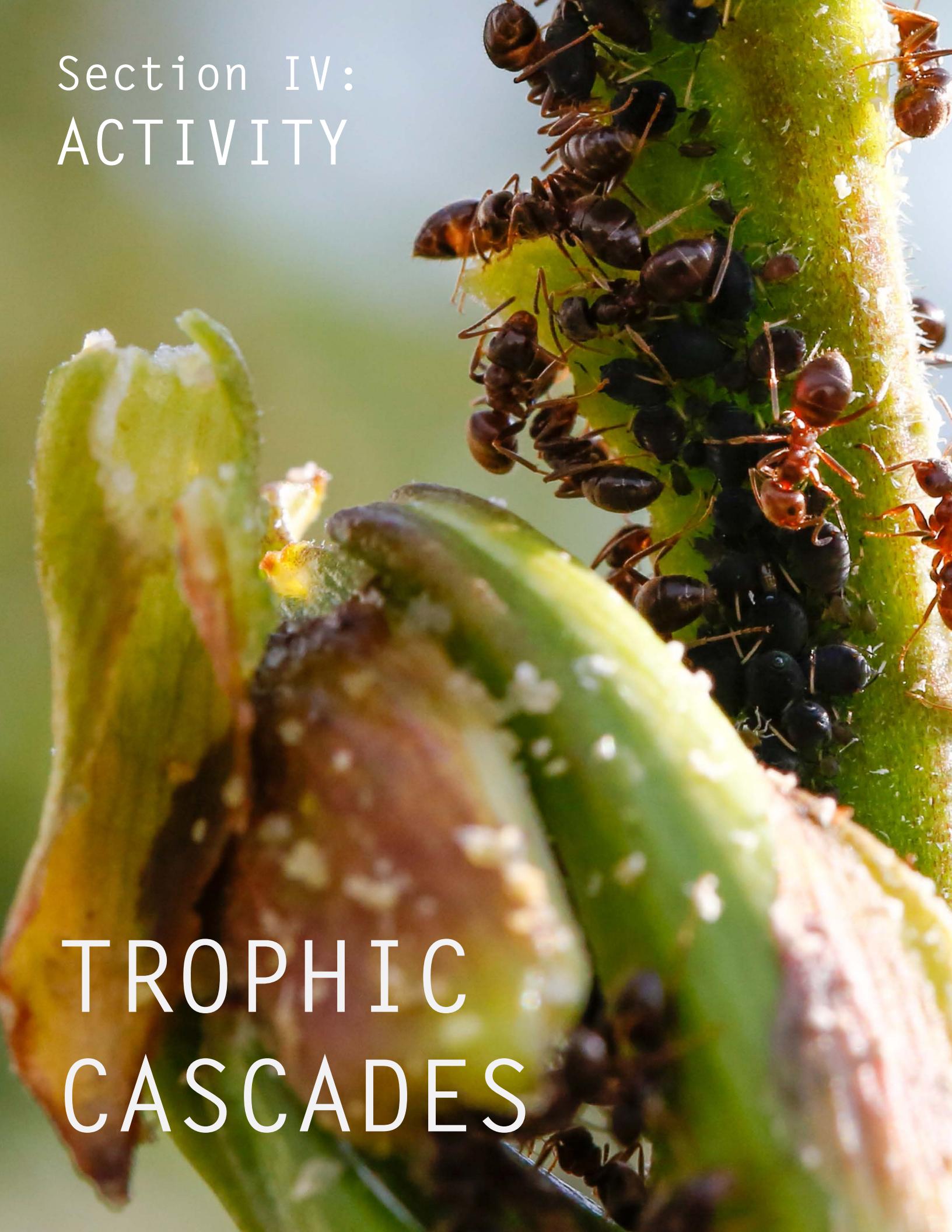
Conservationists now have a better understanding of the habitat requirements of this amazing butterfly and its specific host ant. Today, successful habitat management includes maintaining grassland sites with short vegetation. This prevents the ground being shaded and allows for the sun to warm the soil, meaning that the host ant (*Myrmica sabuleti*) can thrive. This in turn supports the large blue butterfly.

Question: To save the large blue butterfly, why do we also have to conserve ants and plants? Why can't we just conserve the butterfly? (100 words)



Section IV: ACTIVITY

TROPHIC CASCADES



Cascades

A 'cascade' is a chain or series of dominos in a row. If you change the status of just one link or domino piece, it can affect all of them.

The case of the large blue butterfly provides a good example of a cascade and the knock-on effects that one change can have on many different species.

These cascades are easy to see within a food chain and are called 'trophic cascades' (the word 'trophic' is often used to indicate 'food'). Removing just one level of a food chain can have large effects that impact other organisms within the same chain, but also entire ecosystems.

Before the 1950s, when the original UK population of the large blue butterfly still flew in Britain, the behaviour of several different species helped to maintain its survival. This chain of interactions can be summarised like this:

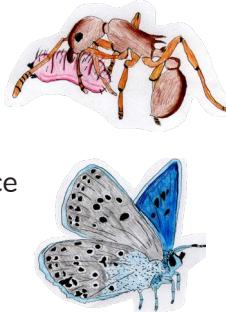
1 Rabbits and grazing animals maintained short vegetation



2 The short vegetation in turn provided warm ground (as it allowed the sunlight to warm the soil) that supported the host ant of the large blue butterfly (*Myrmica sabuleti*)



3 Finally, the host ant then supported the large blue butterfly by adopting its caterpillars and providing them with a safe space to feed and grow



TASK:

Have a look through the following two papers and see if you can draw your own chains of interactions for the species they discuss:

[Killer whale predation on sea otters linking oceanic and nearshore ecosystems, Science](#)

Look for figure 1 page 2

(Killer Whales, Sea Otters, Sea Urchins, Kelp)

Discuss: why are killer whales thought to have shifted prey species to feed on Sea Otters?
What impact has this had on Kelp?

A change in the cascade

It is thought that change to just one of the levels in the diagram triggered knock-on effects (a cascade) that led to the extinction of the large blue butterfly:

1 Traditional grazing was reduced by farmers, and the disease (Myxomatosis) dramatically reduced rabbit populations in the UK



2 As a result, vegetation grew longer



3 This vegetation shaded and cooled the ground causing the host ant species (*Myrmica sabuleti*) to be outcompeted by other ant species that can tolerate cooler temperatures



4 Without its host ant, the caterpillars of the large blue butterfly ran out of food and the butterfly became extinct



These cascades remind us that nature is full of complex interactions and that we must strive to protect as much of it as possible, as it is never clear when losing one species will result in the loss of many more.

[Trophic cascades in Yellowstone, Biological Conservation](#)

Look within the abstract

(Wolves, Elk, Woody Plants)

Discuss: what impact has the reintroduction of wolves to Yellowstone National Park had on woody plants?
What were the impacts for beavers and bison?

GLOSSARY OF TERMS

Glossary of terms

Crop: A plant grown on a large scale for human use, such as for food.

Ecosystem: A community of interacting organisms (plants and animals) and their physical environment (soil, temperature, humidity etc.).

Ecosystem services: the benefits provided by healthy ecosystems that contribute to improving human life. These include resources humans use for food and shelter, natural processes such as insects pollinating crops and improved wellbeing from spending time in nature.

Habitat: The area or environment in which a species normally lives.

Impact: a noticeable effect, influence or change. For example, if someone describes the 'impact' of humans on the natural world they would be describing how humans have changed it.

Loss: The reduction or extinction of species. A reduction could mean a reduced population size or reduced size of the area lived in by the species.

Natural process: A process existing in or produced by nature, rather than by the action of human beings. For example, pollination of flowers by insects.

Organism: An individual living thing. For example: a single plant, animal or fungus.

Pest species: A species that has a negative impact on humans, for example by destroying their crops and reducing available food.

Population: A group of organisms of one species that live in the same place at the same time.

Species: A group of organisms sharing common characteristics and that are capable of mating with one another to produce fertile offspring.

From Butterfly Expansion pack

Cascade: A knock-on effect where one change triggers lots more changes.

Ecology: The study of how living organisms interact with each other and their environment.

Extinction: Usually means the death of the last individual of a species. However, local extinction means the death of the last individual of a species within a specific area. In this case it may still survive somewhere else.

Food chain: A chain of organisms, where each organism relies on the next link in the chain as a source of food.

Host species: A species that supports another species, usually by supplying food and shelter, often at a cost to itself.

Mimic: To copy or appear like something else.

Myxomatosis: A highly infectious, usually fatal disease of rabbits, which broke out in the UK for the first time in the 1950s.

Odour: A smell.

Pheromone: A signalling chemical produced by an animal and released into the environment. The chemical can then be sensed by another animal, which can change its behaviour as a result.

Trophic cascade: A knock-on effect within a food chain, where a change to one level indirectly triggers changes to other levels.

Trophic level: A level in a food chain. Each organism in a food chain is a different trophic level. Therefore, if a food chain has five organisms it has five trophic levels.

Vegetation: A group of plants covering an area of ground.

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