Butterflies and dodos hold clues to protecting biodiversity

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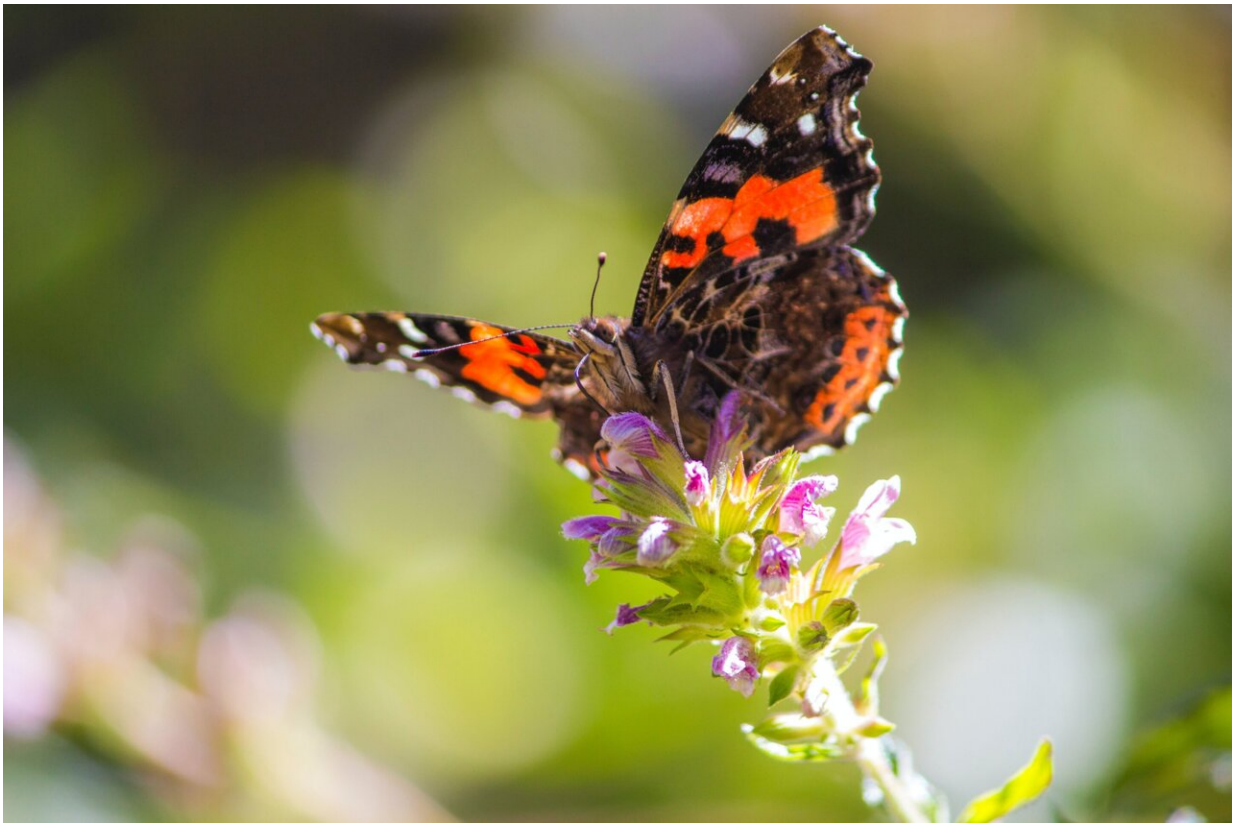

Studying how butterflies have adapted to a warming climate can be relevant for other insects too. Credit: CC0 via Unsplash

Although too late for the famed flightless bird, new scientific findings on the winged insects could help preserve animal species.

Yolanda Melero, an ecology researcher in Spain, has a bit of good news to offset some of the increasingly unsettling scenarios regarding biodiversity.

As part of an EU-funded project into butterflies, Melero said researchers found that some populations of the insect are better adapted to local extreme weather than others. What's more, the resilience seems to be linked to evolutionary relationships rather than to specific species traits.

Hopeful sign

In short, while some groups of closely related butterfly species cope well with extreme events and others don't, no common characteristic or obvious similarity links these different families. The discovery has implications for other insects.

'It means that not all populations are going to suffer as much as we thought,' said Melero, who works at Spain-based research centre CREAF and the University of Barcelona.

Drives to maintain animal biodiversity need all the support, including from science, they can get. Around the world biodiversity is declining at an alarming rate as a result of climate change, land use and other human activities.

Researchers have described this collapse in the number of animal and plant species as a "biological annihilation" and warn a sixth mass extinction is occurring that could destroy the ecosystems on which humankind relies for its own survival.

Modelling by European researchers suggests that, as more and more individual species become extinct, a chain reaction could cause entire ecosystems to collapse as important ecological interactions disappear.

They predict that ecosystems may lose 27% of vertebrate diversity by 2100.

The models highlight the importance of individual species and their population stability. But working out why some are more vulnerable to extinction than others is no easy task.

Globally heatwaves, droughts and heavy rains are increasing in frequency, length and magnitude as the climate warms.

Butterfly surprises

Melero has been exploring how these extreme events affect different populations of around 143 species of butterfly across Europe.

The lead researcher in the two-year EXTINCT project that ended in 2021, she expected to find that species able to cope better with extreme weather share certain characteristics.

'We were surprised because we thought that being locally adapted, or not, would be related to species traits,' said Melero.

For instance, she and colleagues from the University of Reading in the UK thought butterflies that reproduce more often would be better adapted to varying local conditions and weather extremes because they evolve faster. But this wasn't always the case.

The team also expected a link to exist between how widespread butterfly species are and their level of local adaption.

The assumption was that, for example, a butterfly species that spreads from Scotland to Spain might struggle more with a Spanish heatwave than a type that lives only in Spain.

But again, this wasn't always true.

Volunteer help

EXTINCT used historical data collected by volunteers as part of various butterfly surveying projects across Europe, some of which began in the 1970s, to analyse how different species and populations coped with extreme weather in the past.

In addition to the availability of these large datasets, Melero said there was another good reason for focusing on butterflies.

'Butterflies are species models for all insects,' she said. 'What happens in butterflies also can happen in other arthropods.'

The relationships that the EXTINCT team pinpointed to explain the resilience of some butterfly species relate to their evolutionary history.

Evolutionary relationships illustrate the association among species that have a common ancestor. This helps researchers understand when and how certain traits were developed in specific species.

Following on the results of EXTINCT, the challenge now for ecology researchers is to study these relationships to work out which branches of the various family trees of butterflies are well adapted to extreme events and which are not so that conservation efforts can be directed to the right places.

Melero says that these results can likely be extrapolated to other insects.

Flightless icon

For a stark warning about the threats posed by humans to other animal life, consider the tale of a bird known as the dodo.

Endemic to the island of Mauritius in the Indian Ocean, the dodo is an iconic example of an animal driven to extinction through human activity.

Dodos became extinct in the late 17th century through a combination of direct and indirect human factors, according to Delphine Angst, who was the lead researcher in an EU-funded project into the bird.

The NINEDOMA project, which also ran until 2021, unpicked information on the dodo's ecology such as its diet and gait to understand why some species are more prone to extinction than others.

While conventional wisdom holds that much is known about this flightless bird, the opposite is true, according to Angst.

'We don't know what its diet was, how it moved, its reproduction cycle—we have very little information about the biology and ecology of this bird,' she said.

Mixed messages

Written descriptions of dodos and their behaviour exist from sailors who stopped on Mauritius before the bird became extinct, but their accounts are inconsistent.

'It's funny because they describe things really differently,' said Angst. 'Some say the dodos are running everywhere, while some say they are walking very slowly. That is the same problem with every single thing about the ecology and the biology of the dodo—it's obvious that the people who stopped on Mauritius had no background in natural history.'

To work out how dodos actually moved, Angst took advantage of the hundreds of dodo bones in museum collections across Europe. In flightless birds, there is a relationship between the way they move and the relative sizes of their leg bones—the length, for example, of the thigh bone compared with the shin bone.

Angst's analysis suggests that, while not super-speedy runners like ostriches, dodos were able to walk or run relatively fast.

'A bit like a turkey,' she said.

To learn more about the dodo's diet, Angst used a technique known as isotopic geochemical analyses.

Chemical isotopes in samples taken from dodo bones and from other animals and plants discovered nearby were compared to provide a picture of the fruits and seeds dodos likely ate.

In giving an overall idea of the composition of their diet, this helped shed light on the fate of dodos.

Unwelcome visitors

Sailors who stopped on Mauritius hunted the birds and collected their eggs for food. Laid on the ground, the eggs were an easy target.

The ships also brought invasive animals such as cats, rats, pigs and monkeys to the island.

As well as eating dodo eggs and chicks, these new arrivals consumed many of the plants on the island, competing with the dodo for food and disrupting Mauritius's ecosystem. The dodo didn't stand a chance.

'To stop other animals facing the same fate as the dodo, you really need to understand them and how they live,' said Angst.

The story of the dodo shows that knowledge about an animal's connection with its environment—where it lives, what it eats and how and when it reproduces—is vital. Destroying crucial aspects of its surroundings means the animal can't survive.

The EU's nature restoration law

People across Europe are taking an active role in campaigning for new legislation to restore biodiversity. A European Citizens' Initiative called "Save bees and farmers!" voiced public concern about the fate of Europe's butterflies, bees and other pollinators if European farming practices continue using synthetic pesticides.

In responding to the initiative, European Commission Executive Vice-President Frans Timmermans said, 'Reducing the use of chemical pesticides is essential to help nature recover and to allow bees, butterflies and other pollinators to continue their indispensable work in Europe's fields and orchards.'

Since 2019, the European Commission has proposed numerous legislative initiatives to protect and restore biodiversity, including the Nature Restoration Law in June 2022. A key element of the EU Biodiversity Strategy, the proposal includes objectives for the long-term recovery of the EU's land and sea areas as well as binding restoration targets for specific habitats and species, including pollinating insects.

More information:

- EXTINCT
- NINEDOMA

- EU-funded biodiversity research and innovation

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