# Which animals can best withstand climate change?

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Extreme weather such as prolonged drought and heavy rainfall is becoming more and more common as the global average temperature rises—and it will only get worse in the coming decades. How will the planet's ecosystems respond?

"That is the big question and the background for our study," said biologist John Jackson, who, together with his biologist colleagues Christie Le Coeur from the University of Oslo and Owen Jones from University of Southern Denmark, authored a new study, published in *eLife*.

John Jackson is now at Oxford University but was at the University of Southern Denmark when the study was made. Owen Jones is associate professor at the Department of Biology, University of Southern Denmark.

## A clear pattern

In the study, the authors analyzed data on population fluctuations from 157 mammal species from around the world and compared them with weather and climate data from the time the animal data were collected. For each species there are 10 or more years of data.

Their analysis has given them an insight into how populations of animal species have coped at times of extreme weather: Did they become more, or less, numerous? Did they have more or fewer offspring?

"We can see a clear pattern: Animals that live a long time and have few offspring are less vulnerable when extreme weather hits than animals that live for a short time and have many offspring. Examples are llamas, long-lived bats and elephants versus mice, possums and rare marsupials such as the woylie," said Jones.

## Less affected by extreme weather:

- African elephant
- Siberian tiger

- chimpanzee
- greater horseshoe bat
- llama
- vicuña
- white rhinoceros
- grizzly bear
- American bison
- klipspringer
- Schreibers's bat

## More affected by extreme weather:

- Azara's grass mouse
- olive grass mouse
- elegant fat-tailed mouse opossum
- Canadian lemming
- Tundra vole
- Arctic fox
- stoat
- common shrew
- woylie
- Arctic ground squirrel

## Quick drop—but also quick boom

Large, long-lived animals are better able to cope with conditions like prolonged drought; their ability to survive, to reproduce and to raise their offspring is not affected to the same extent as small, short lived animals. They can, for example, invest their energy into one offspring, or simply wait for better times when conditions become challenging.

On the other hand, small short-lived rodents have more extreme

population changes in the short term. In the event of a prolonged drought, for example, large parts of their food base may disappear more rapidly: insects, flowers, fruits, and they are left to starve because they have limited fat reserves.

The populations of these small mammals may also boom to take advantage when conditions improve because, in contrast to large mammals, they can produce many offspring.

"These small mammals react quickly to extreme weather, and it goes both ways. Their vulnerability to extreme weather should therefore not be equated with a risk of extinction," said Jackson.

He also reminds us that the ability of an animal species to withstand climate change must not stand alone when assessing the species' vulnerability to extinction:

"Habitat destruction, poaching, pollution and invasive species are factors that threaten many animal species—in many cases even more than climate change," he emphasized.

The researchers' study not only gives an insight into how these specific 157 mammal species react to climate changes here and now. The study can also contribute to a better general understanding of how the planet's animals will respond to ongoing climate change.

"We expect climate change to bring more extreme weather in the future. Animals will need to cope with this extreme weather as they always have. So, our analysis helps predict how different animal species might respond to future climate change based on their general characteristics—even if we have limited data on their populations," said Jones.

An example is the woylie, a rare Australian marsupial. Biologists do not know very much about this species, but because it shares a similar life style with mice—that is, it is small, lives for a short time and reproduces quickly—it can be predicted that it will respond to extreme weather in a similar way to mice.

"In the same way, there are lots of animal species that we don't know very much about, but whose reaction we can now predict," explained Jackson.

In this way, the researchers expect that the ability of different animal species to adapt to climate change is related to their life strategy, and this can help us predict ecological changes:

As habitat suitability changes due to climate change, species may be forced to move to new areas as old areas become inhospitable. These shifts depend on species' life strategies and can have big impacts on ecosystem function.

**More information:** John Jackson et al, Life history predicts global population responses to the weather in terrestrial mammals, *eLife* (2022). DOI: 10.7554/eLife.74161

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