Adapt, move or die—how biodiversity reacted to past climate change

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Will species be able to adjust quickly enough to survive changing temperatures, precipitation and seasons? Many alpine plants, like the Comastoma falcatum growing in high altitudes, are under risk because of climate change. Credit: Egle Kudirkiene

In the past, plants and animals reacted to environmental changes by adapting, migrating or going extinct. New findings point to radical changes in biodiversity due to climate change in the future, in a paper now published in *Trends in Ecology and Evolution* by an international group of scientists led by the Center for Macroecology, Evolution and Climate, University of Copenhagen.

Nature is reacting to climate change. Researchers have observed altered behaviour and movement among plants and animals; flowering periods are changing, owls are developing darker body colour due to warmer winters. So what does the future for biodiversity look like? Will plants and animals be able to adjust quickly enough to survive changing temperatures, precipitation and seasons?

Lead author Professor David Bravo-Nogues from Center for Macroecology, Evolution and Climate, University of Copenhagen, says, "We compiled an enormous number of studies of events that we know influenced biodiversity during the past million years. It turns out species have been able to survive new conditions in their habitats by changing either their behaviour or body shape. However, the current magnitude and unseen speed of change in nature may push species beyond their ability to adapt."

Fast changes reduce chances for species

Until now, scientists thought species' main reaction to climatic changes

was to migrate. However, the new study shows that local adaptation to new conditions seems to have played a key role in the way species survive. Species adapt when the whole population changes, e.g. when all owls develop darker body colour. This happens slowly over a long period of time.

Co-author Stephen Jackson, director of the U.S. Geological Survey's Southwest Climate Adaptation Science Center, says, "From fossils and other biological archives, we have access to a nearly limitless number of case studies throughout Earth's history. This provide us with valuable knowledge of how climate changes of various rates, magnitudes, and types can affect biodiversity."

Past extinctions help to protect future biodiversity

The new study might provide the answer to determine how biodiversity changes under climate change. This knowledge can inform policymakers in order to implement effective conservation schemes in the future. Some species that fail to adapt or migrate quickly enough, like the orange-spotted filefish, have already gone extinct due to climate change.

Co-author Francisco Rodriguez-Sanchez from the Spanish Research Council (CSIC), says, "We know animals and plants have prevented extinction by adapting or migrating in the past. However, the models we use today to predict future climate change foresee magnitudes and rates of change that have been exceptionally rare in the last million years. Thus, we need to expand our knowledge and improve our prediction models. Also, we must recognise the limitations of the models, because they are used to inform politicians and decision-makers about effects of climate change on biodiversity."

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