

Fate of turtles and tortoises affected more by habitat than temperature

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Credit: NHM, London

Habitat degradation poses a greater risk to the survival of turtles and tortoises than rising global temperatures, according to new research.

More than 60 per cent of the group are listed by the International Union for Conservation of Nature (IUCN) as vulnerable, endangered, or critically endangered, because they are being traded, collected for food



and medicine and their habitats are being degraded. Understanding the additional impact of global warming and changes in rainfall patterns on their diversity and distributions is therefore paramount to their conservation.

The team of researchers from the University of Bristol, London's Natural History Museum, and the University of California, set out to test if long-term climate change poses a threat or opportunity to <u>turtles</u> and tortoises and how they might respond to increased <u>global temperatures</u>.

As turtles live such long lives, it is impossible to conduct experiments to test for the impact of warming over several generations. The group used a novel combination of state of the art climate models and the deep time <u>fossil record</u> of turtles during warmer times.

The Late Cretaceous fossil record (66-72 million years ago), dating from the time just before the demise of the dinosaurs, was investigated as a natural experiment to quantify differences between the ecology of living turtles and tortoises and those living in an earlier, warmer greenhouse world.

The results of this study, funded by the Natural Environment Research Council (NERC) with support from The Royal Society, show that during periods with much warmer climates, turtles and tortoises were able to stand the heat in the warmer tropics – as long as there was enough water to support those species living in rivers and lakes.

Amy Waterson, PhD student and lead author from the University of Bristol, said: "Some groups of turtles have maintained similar niches over millions of years. They have withstood warmer climates in the past and their ability to adapt to the rate of environmental change happening today will be an important factor in their resilience to future climate change."



Turtles and tortoises are highly sensitive to changes in temperature and rainfall, hence concerns about the impact of climate change on their distribution. Alongside overexploitation and habitat loss, climate change is a significant threat to their conservation status with growth, abundance and geographical ranges all predicted to decline under future climate change projections.

In many species, temperature determines if the egg will develop into a male or female showing a direct impact of warming. As the group lives in ponds, rivers, on land and in the sea <u>climate change</u> can impact them via changes in temperature, rainfall, and major ocean currents.

However, Professor Daniela Schmidt, an expert in palaeobiology from the University of Bristol's School of Earth Sciences, and a member of Bristol's Cabot Institute, explained that the bigger question for the conservation of the group is not how warm it will be in the near future but how fast that warming will be: "The largest difference between the warm Cretaceous and today is that this earlier warming happened over tens of thousands of years, giving these animals a chance to adapt to these conditions, not in a century."

Professor Paul Barrett from the Natural History Museum, London added: "Other conservation threats, such as manmade <u>habitat</u> <u>degradation</u> and barriers to movement, might be as important in determining the fates of turtles in a warming world as the warming itself."

More information: Amy M. Waterson et al. Modelling the climatic niche of turtles: a deep-time perspective, *Proceedings of the Royal Society B: Biological Sciences* (2016). DOI: 10.1098/rspb.2016.1408



Provided by University of Bristol

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