Study: How will tropical mammals react to rising temperatures?

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Lydia Beaudrot. Credit: Jeff Fitlow/Rice University

How wildlife will react to climate change is an open question, but one of the first studies to compare the responses of tropical mammals to warmer habitats suggests the answer won't be as simple as "move to a

cooler place."

In a study published online this week in *Global Ecology and Biogeography*, Rice University ecologist and lead author Lydia Beaudrot and co-authors from a dozen institutions examined how 36 mammal species on three continents reacted to changing temperatures at specific places in their local habitats between 2007-15. The scientists used more than 400,000 camera-trap photos and observations, including temperature readings, from a global network of field stations operated by the Tropical Ecology Assessment and Monitoring (TEAM) Network.

"Temperatures didn't warm drastically overall during the time of our study, so we don't see huge shifts," said Beaudrot, a data scientist and assistant professor of biosciences at Rice. "But we do see changes over time in micro habitat use because of changes in the local temperature. We see that these mammals are responding to these very local temperature changes, but they're also responding to other species nearby."

TEAM helps monitor long-term trends in tropical biodiversity with near real-time data from 17 sites in Africa, Asia, Central America and South America. TEAM, which began as a partnership between Conservation International, the Smithsonian Institution and the Wildlife Conservation Society, has joined the wildlife monitoring partnership Wildlife Insights.

The species in the new study include all medium to large mammal species living mainly on the forest floor at seven TEAM sites where elevation changed by 500 meters or more.

"This is a unique study for our time," said study co-author Miguel Acevedo of the University of Florida. "Twenty years ago we did not have the data, the analytical tools or the computational power to conduct this study."

Chimpanzees, deer, duikers, wild boars, tayras, bush pigs, porcupines and mongoose were among the species studied. So was the world's largest species of rat, the giant African pouched rat, which measures up to 3 feet from nose to tail, and smallest species of deer, the lesser mouse-deer, which can weigh less than 3 pounds.

"The broad-scale pattern conservation biologists are reporting with climate change is that species are moving toward the poles and up mountains," said Beaudrot, who initiated the study four years ago during postdoctoral research at Conservation International. "By looking closely at these elevational gradients at the TEAM sites, we hope to get a snapshot of what might happen on a larger scale when species move north or south from the equator."

The animals were monitored at TEAM sites in Costa Rica, Laos, Madagascar, Malaysia, Peru, Tanzania and Uganda.

Beaudrot said temperatures did not increase dramatically at the sites over the course of the study, and one might expect that the animals would be unfazed by such minor variations.

"We were still within the range of normal temperatures at these sites," she said. "None of these temperature changes were pushing the animals outside the range of temperatures they were capable of living in.

"And despite the fact that mammals are warm-blooded and have pretty good buffering against changes in temperature, we saw really strong responses to changing local temperature over short time scales," Beaudrot said.

That said, the results were a far cry from the consistent shifts away from warmer temperatures that might be predicted by some classical ecological theories.

"We had six species with populations in multiple places, and interestingly, we saw the same species respond differently to changing temperatures at different places," she said. "We interpret that to mean that animals are not responding solely to changing temperatures. They are also reacting to the changes of other species, like predators, prey and competitors.

"That's important to know as we think about modelling how species will react to climate change," Beaudrot said. "It shows we need to account not just for temperature changes but also for the other species that are there."

"We learned that one size does not fit all when it comes to predicting the effects of environmental factors in species distributions," Acevedo said.

Wildlife Insights, which is slated to launch this year, aims to gather millions of camera trap photos from professional and citizen scientists in a globally accessible database and to provide advanced analytical tools that conservationists can use to leverage the data and influence public policy. TEAM and Wildlife Insights are supported by Conservation International, the Smithsonian Institution, the Wildlife Conservation Society, the Gordon and Betty Moore Foundation and other donors.

More information: Lydia Beaudrot et al, Local temperature and ecological similarity drive distributional dynamics of tropical mammals worldwide, *Global Ecology and Biogeography* (2019). DOI: 10.1111/geb.12908

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