

Sierra Nevada birds move in response to warmer, wetter climate

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This adult male Anna's Hummingbird, *Calypte anna*, is an urban-adapted species. Unlike many other bird species in the Sierra Nevada mountains, the Anna's Hummingbird did not track its climatic niche. Instead, it moved away from it.
Credit: Morgan Tingley photo

(PhysOrg.com) -- If the climate is not quite right, birds will up and move rather than stick around and sweat it out, according to a new study led by biologists at the University of California, Berkeley.

The findings, to be published the week of Sept. 14 in an online early edition of the journal [Proceedings of the National Academy of Sciences](#), reveal that 48 out of 53 bird species studied in California's Sierra Nevada mountains have adjusted to climate change over the last century by moving to sites with the temperature and precipitation conditions they favored.

The few species, including the Anna's Hummingbird and Western Scrub-Jay, that did not pack up and leave when the climate changed were generally better able to exploit human-altered habitats, such as urban or suburban areas, the researchers said.

"In order to conserve biodiversity in the face of future climate change, we need to know how a species actually responds to a warming climate," said study lead author Morgan Tingley, a Ph.D. student in the Department of Environmental Science, Policy & Management and at the Museum of Vertebrate Zoology at UC Berkeley. "Comparing past and present ranges of species that experienced climate change is one of the best ways to gain this knowledge. Understanding how species will respond to climate change allows us to take steps now to restore key habitats and create movement corridors that will help them respond to the changes we have coming."

The study, conducted in collaboration with Audubon California, a non-profit state program of the National Audubon Society, includes data from a survey of 82 sites in the Sierra Nevada and details the changes in birds' geographic range over the course of a century. On average, those sites have seen a 1.4 degree Fahrenheit increase in temperature and nearly a quarter of an inch more rainfall during the breeding season since the early 1900s.



Here, Morgan Tingley (right) and Pascal Title (left) are conducting a point count in the field for a resurvey of wildlife in the Sierra Nevada. Credit: Allison Shultz photo

While individual species responded differently to environmental change - some birds gravitated towards warmer temperatures while others preferred cooler climes - these idiosyncratic responses were successfully predicted for the majority of species by standard models that scientists employ to forecast the impact of climate change.

The researchers focused on abundant bird species whose range was restricted to the western United States. Based upon information from the species' entire North American breeding range, the biologists determined the optimal average temperature and precipitation conditions in which the species breed. These conditions are known as the "Grinnellian niche," named after famed UC Berkeley ecologist Joseph Grinnell, who first developed the concept.

The study builds upon pioneering surveys conducted between 1911 and

1929 and led by Grinnell, who was the founding director of the Museum of Vertebrate Zoology. Grinnell and his legion of researchers methodically cataloged the birds, mammals, reptiles and amphibians they observed as they hiked throughout the Sierra Nevada, establishing an invaluable record of wildlife before mining, grazing and agriculture irreversibly altered the landscape.

Since then, global warming has emerged as another threat to Sierra Nevada habitats, presenting an additional impetus for scientists to resurvey those sites, which spanned as far north as Lassen Volcanic National Park, through Yosemite National Park, and south to Mount Whitney. To that end, Craig Moritz, UC Berkeley professor of integrative biology and director of the Museum of Vertebrate Zoology, began the Grinnell Resurvey Project in 2003 with funding from the National Science Foundation, the Yosemite Foundation and the National Park Service.

In many cases, the biologists were able to hike along the same trails that Grinnell and his colleagues walked some 90 years earlier. When comparing modern data with those earlier records, the researchers used statistical methods that minimized false absences of species when cataloging the occurrence of wildlife.



This is an adult male Western Bluebird, *Sialia mexicana*, a low elevation species, holding a large beetle. This bird species was found to have shifted its geographical range in response to both temperature and precipitation. Credit: Morgan Tingley photo

In 2008, 100 years after the founding of the Museum of Vertebrate Zoology, the UC Berkeley-led team published the first study based upon the resurvey. That study found that small mammals were moving to higher elevations or reducing their ranges in response to global warming.

"When we did the mammal work in Yosemite, we saw some species moving up in elevation, but some did not, and we didn't really know why," said Moritz, who is also co-author of this study. "This new paper is giving us a clue about whether or not a species will be forced to shift when climate change alters its niche."

Some bird species, such as the Dusky Flycatcher and the Green-tailed Towhee, were more sensitive to temperature changes, while precipitation was the motivating factor for the move of species such as the Yellow-rumped Warbler and the Lazuli Bunting. About a quarter of the species tracked were affected by both temperature and rainfall.

Modeling responses to future climate change typically assumes that species will move according to their preferred "Grinnellian" or "climatic" niche, but few studies have directly examined whether those assumptions were valid.

"This study shows the assumptions that underlie existing forecasts of how species will respond to climate change are valid, at least for most [bird species](#) in the mountains of California," said study co-author and conservation biologist Steve Beissinger, UC Berkeley professor of environmental science, policy and management. "This is alarming because forecasts suggest many species will go extinct with the climate warming that we expect to occur, but it also gives us confidence that costly conservation investments made now based on climate forecasts will have a valuable payoff in the future."

Tingley said that future studies should determine whether these findings are true for other species. "Birds are arguably more mobile than many other species, so it remains to be seen whether other animals will be able to keep pace with future [climate change](#), which is anticipated to be far greater in magnitude and faster in rate than what we have experienced thus far," he said.

Source: University of California - Berkeley ([news](#) : [web](#))

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