

# Bird migration timing skewed by climate, new research finds

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A long-billed curlew in flight. Credit: Nick Saunders

Life cycles for birds, insects and trees are shifting in this current era of a

rapidly changing climate. How migration patterns, in particular, are changing and whether birds can track climate change is an open question.

Kyle Horton, assistant professor at Colorado State University, led a new study analyzing nocturnal bird migration that he hopes will lead to more answers about shifting [migration patterns](#). He and the research team used 24 years of radar data from NOAA, the National Oceanic and Atmospheric Administration, for the study.

The research team—including scientists from the Cornell Lab of Ornithology and the University of Massachusetts—found that spring migrants were likely to pass certain stops earlier now than they would have 20 years ago. Temperature and [migration timing](#) were closely aligned, with the greatest changes in migration timing occurring in regions warming most rapidly. During fall, shifts in migration timing were less apparent.

The study, one of the first to examine the impacts of [climate change](#) on migration timing at a continental scale, is published December 16 in *Nature Climate Change*.

## **Analysis using cloud computing revealed patterns of millions of birds**

Horton described the breadth of the research as "critically important," with the team observing the nocturnal migratory behaviors of hundreds of species representing billions of [birds](#).

"To see changes in timing at continental scales is truly impressive, especially considering the diversity of behaviors and strategies used by the many species the radars capture," he said. Yet while the team saw

these shifts, Horton noted that this doesn't necessarily mean that migrants are keeping pace with [climate](#) change.



This study is one of the first to examine the impacts of climate change on migration timing at a continental scale. Credit: Kyle Horton/Colorado State University

Migratory birds serve an important role in ecosystems. They eat and take

insects off the land, disperse seeds and serve other significant functions, including measuring health in these ecosystems.

Andrew Farnsworth, the study's senior author and a research associate at Cornell Lab of Ornithology, said the team's research answered, for the first time, key questions on birds and climate change.

"Bird migration evolved largely as a response to changing climate," he said. "It's a global phenomenon involving billions of birds annually. And it's not a surprise that birds' movements track changing climates. But how assemblages of bird populations respond in an era of such rapid and extreme changes in climate has been a black box. Capturing scales and magnitudes of migration in space and time has been impossible until recently."

Researchers accessed NOAA datasets through Amazon Web Services as part of the agency's Big Data Project, designed to provide access to data in a more efficient way.

Horton said that this access to the data and cloud computing greatly enhanced the team's ability to synthesize the findings.

"To process all of these data, without cloud computing, it would have taken over a year of continuous computing," he said. Instead, the team crunched the numbers in about 48 hours.

While Amazon Web Services provided access to the data, new algorithms designed by scientists at the University of Massachusetts revealed the potential of these radar data for biologists. Specifically, the scientists designed new computer vision techniques to remove weather data, a problem that had challenged biologists from decades.

"Historically, a person had to look at each radar image to determine

whether it contained rain or birds," said Dan Sheldon, associate professor of computer science at the University of Massachusetts Amherst. "We developed 'MistNet,' an artificial intelligence system to detect patterns in radar images and remove rain automatically."

### **Fall migration tends to be 'messier'**

Horton, who works in the Department of Fish, Wildlife and Conservation Biology at CSU, said that the lack of change in fall migration patterns was a little surprising, though migration also tends to be a "little bit messier" during those months.

"In the spring, we see bursts of migrants, moving at a fairly rapid pace, ultimately to reach the breeding grounds," he explained. "However, during the fall, there's not as much pressure to reach the wintering grounds, and migration tends to move at a slower, more punctuated pace."

During the fall, birds are not competing for mates, and the path to reach their destination is more relaxed. There's also a wider age range of birds migrating, as the young eventually realize they need to migrate, too. The combination of these factors makes fall migration more challenging to study.

Horton said the findings have implications for understanding future patterns of bird [migration](#), since the birds rely on food and other resources as they travel. Under climate change, the timing of blooming vegetation or emergence of insects may be out of sync with the passage of [migratory birds](#). This seemingly subtle shift could have negative consequences for the health of migratory birds.

Researchers plan to expand their data analysis to include Alaska, where climate change is having more serious impacts than in the lower 48 states

in the U.S.

**More information:** Phenology of nocturnal avian migration has shifted at the continental scale, *Nature Climate Change* (2019). [DOI: 10.1038/s41558-019-0648-9](https://doi.org/10.1038/s41558-019-0648-9) , [nature.com/articles/s41558-019-0648-9](https://www.nature.com/articles/s41558-019-0648-9)

Provided by Colorado State University

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