

# Study shows humans contribute to early arrival of spring activity in wild species

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A study in the *Proceedings of the National Academy of Sciences (PNAS)* has found that humans, through increased emissions of atmospheric greenhouse gases and aerosols, are causing regional climate change, which in turn is linked to changes seen in the springtime activity of numerous animals and plants.

"Our analyses examine a type of data not previously used for climatic change attribution studies: shifting traits in the natural history of plants and animals," writes Terry Root, senior fellow with the Center for Environmental Science and Policy (CESP) and lead author of the May 24 PNAS study. "These data provide an independent proxy of the change in global temperature over time that is not plagued with disputes (regardless of the merits of the claims) over the reliability and validity of the instrumental record of temperature."

In their study, Root and her co-authors cite evidence from the International Panel of Climate Change (IPCC) that the Earth has warmed an average of 1 degree Fahrenheit over the past 100 years. They also point to numerous studies, including a 2003 paper in the journal *Nature* co-authored by Root, showing that the spring activities of hundreds of species in the Northern Hemisphere have been occurring earlier in the year as the global temperature has risen. For example, plants are blooming an average of nearly 10 days earlier than they did 30 years ago, while many animal species are arriving earlier on migration.

"IPCC has shown that warming on a global scale is in large part due to

emissions by humans of greenhouse gases and aerosols," Root says. "Two papers in the Jan. 3, 2003, edition of Nature showed that species are responding to regional temperature changes, but neither paper determined if those temperature changes were due to natural causes, human emissions or a combination of both. The PNAS paper does just that."

## **Human-induced changes**

In the PNAS study, the authors used a computer model to calculate regional temperatures in three different ways: assuming only natural causes, such as volcanoes or sun spots; assuming only human-caused changes created by emissions of greenhouse gases and aerosols; and a combination of both. They found that changes in wild species track regional temperature changes most closely when both natural and human causes are used, and that in the vast majority of these cases, the human causes significantly overshadow the natural causes.

"Therefore, humans are indeed causing important changes in the timing of spring events of wild plants and animals," Root concludes.

More than 80 percent of the 145 species under study exhibited shifting in a manner expected with increasing temperature in the Northern Hemisphere. European species experienced the greatest change, blooming or migrating more than 15 days sooner. For species north of the 45 parallel (from Maine to Washington state), spring events came almost two weeks sooner, while North American species shifted spring activities about one week earlier on average.

Not all plants and animals are showing the same amount of change, Root says. Therefore, the connectedness among species could easily be disrupted and possibly lead to numerous extinctions. "The problem will be the differential response of species," she notes. "I call it the tearing

apart of communities. In numerous cases, the slow evolutionary process of species adaptation is not fast enough to keep up with the changing environment."

## **Statistical evidence**

What has been lacking thus far in climate change research, and what the PNAS study suggests, according to Root, is statistical evidence showing that a significant portion of the temperature increases at a regional scale are directly caused by human activities.

"Plants and animals seem to be responding to global warming," says co-author Stephen Schneider, a professor of biological sciences and a senior fellow at the Stanford Institute for International Studies. "Contrarians, those who claim that thermometers are biased and that satellite readings are poor indicators of global warming, are going to have to come up with another story to dispute our theories."

Adds Root: "Someday soon a tipping point will be reached and the norm of thinkingâ€”even in the West Wing of the White Houseâ€”will be that we can indeed affect the atmosphere and we have already changed it significantly."

The study also was co-authored by CESP postdoctoral scholars Dena MacMynowski and Michael Mastrandrea. Research was supported by grants from the Winslow Foundation, the U.S. Department of Energy Global Change Education Program and the U.K. Department of the Environment.

Source: Stanford University

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