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Plants Previously Thought to be ‘Stable' Found to be Responding to Climate Change

Many wild plant species thought to be "stable" in the face of climate change are actually responding to global warming, say researchers at UC Santa Barbara's National Center for Ecological Analysis and Synthesis (NCEAS). Their findings, in a study titled, "Divergent responses to spring and winter warming drive community level flowering trends," are published in the Proceedings of the National Academy of Sciences.

According to the study, a number of wild plant species previously thought to be unresponsive to the trend of warmer and earlier springs, because they did not bloom earlier, are actually responding to climate temperature change in a manner that is not as easily seen as in plants that exhibit earlier flowering in response to an advanced spring.

"For a large subset of species that were not shifting their flowering earlier, the lack of response was not due to any insensitivity to climate change," said Benjamin Cook, who led the research by a working group at NCEAS. Rather, he said, these plants were actually responding to the trend of warmer winters by delaying flowering, and then to the advanced spring by speeding up flowering.

"The two effects for the most part canceled each other out, leading to very little overall change in the timing of flowering for these species," said Cook, a climate modeler at the NASA Goddard Institute for Space Studies and Columbia University's Lamont-Doherty Earth Observatory.

Using two data sets covering 490 species of temperate plants in the United Kingdom and Washington, D.C., the scientists, who include Elizabeth Wolkovich of the University of British Columbia, and Camille Parmesan of the Marine Institute at Plymouth University, found that for about 10 to 18 percent of the wild plant species studied, a chilling requirement, known as vernalization, played a crucial role. Many of these plant species require a drop in temperature in the fall and winter seasons that serves as a cue to become dormant until the spring flowering season arrives. With the phenomenon of warmer winters, the plants were found to have delayed their blooming cycles, an effect that compensates for the advanced flowering brought on by an earlier spring.

"We didn't necessarily go into the analysis with any preconceived ideas," said Cook. "We were, however, surprised at how sensitive these divergent species were to the warming in fall/winter and spring, despite the lack of any trend over time."

The study not only shows that some species thought to be insensitive to climate change are actually responding to the phenomenon, but also demonstrates the need to include fall/winter temperature cues in the ongoing study of plant responses to climate change.

"This work is most relevant for conservationists and managers interested in understanding how climate change will affect their species and ecosystems of interest," said Cook. "Being able to explain why some species are responding or not responding is critical for developing accurate predictions from which conservation policies and protocols can be developed."

For the scientists, future research includes gathering and analyzing more long-term data sets to find just how many of these "divergent responders" exist in other ecosystems, and how these species will respond as winters continue to get warmer and springs come sooner.

"Right now, these species appear to have not changed much over time," said Wolkovich, who co-authored the study as a postdoctoral fellow at UC San Diego, "but all of our understanding of basic plant physiology suggests they will shift their

flowering dramatically in the future."

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† Top image: Due to progressively warmer winters and earlier springs, the spring-only responder Claytonia virginica blooms earlier by about 16 days.

Credit: Kaldari

†† Bottom image: The divergent responder Dicentra cucullaria has been found to flower earlier by about 2 days, due to delays in the blooming cycle that compensate for the advanced spring.

Credit: Mason Brock

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