

# Big picture look at climate change impact on US agriculture: Midwest at risk

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A new Cornell University-led study shows that Midwest agriculture is increasingly vulnerable to climate change because of the region's reliance on growing rain-fed crops.

Ariel Ortiz-Bobea, assistant professor of applied economics and management, set out to assess the impact [extreme weather](#) is having on [agricultural productivity](#) in the United States. While previous studies have looked at the vulnerability of individual field [crops](#), which make up one-third of the country's [agricultural output](#), researchers haven't addressed the whole scope of agricultural production, including livestock, at the national level.

"We're trying to get a big picture idea of what is going on," said Ortiz-Bobea. "The data captures every state's agriculture over the past 50 years. If you see in the aggregate data that something big is happening, this really captures massive processes that are affecting many people at the same time."

The resulting paper, "Growing Climatic Sensitivity of U.S. Agriculture Linked to Technological Change and Regional Specialization" published in *Science Advances*, pinpoints the specific regions in the U.S. that are growing more sensitive to extreme [climate](#) shocks. The area of greatest concern is the Midwest, where rain-fed field crops like corn and soybeans have become increasingly vulnerable to warmer summers.

To get this panoramic snapshot, Ortiz-Bobea and his team used state-level measures of agricultural productivity that capture how inputs—such as seeds, feed, fertilizer, equipment and herbicides—are converted into economic outputs. The researchers mapped that information against nearly 50 years' worth of climate data from 1960 through 2004, essentially seeing what would happen if weather was treated as an additional input.

The results show a clear escalation in climate sensitivity in the Midwest between two distinct time periods. In the 1960s and '70s, a 2-degree Celsius rise in temperature during the summer resulted in an 11 percent drop in productivity. After the 1983, however, the same rise in

temperature caused productivity to drop 29 percent.

While these damaging summer conditions usually only occur six percent of the time, the researchers indicate that an additional 1-degree Celsius warming would more than quadruple their frequency to roughly one of every four years.

"Losing almost half your profit every four years? That's a big loss," said Ortiz-Bobea, a fellow at Cornell's Atkinson Center for a Sustainable Future.

One of the reasons the Midwest is growing more vulnerable to drastic climate variations is because its agriculture industry is increasingly specialized in crop production, like nonirrigated cereal and oilseed crops.

"Specialization in crop production is a compounding factor," said Ortiz-Bobea, who collaborated on the paper with Erwin Knippenberg, a Cornell doctoral student in applied economics and management, and Robert G. Chambers of the University of Maryland.

"Most of the agriculture in the Midwest is corn and soybeans. And that's even more true today than it was 40 years ago," Ortiz-Bobea said. "That has implications for the resilience to climate of that region, because they're basically putting all their eggs in one basket, and that basket is getting more sensitive."

**More information:** "Growing climatic sensitivity of U.S. agriculture linked to technological change and regional specialization" *Science Advances* (2018). [DOI: 10.1126/sciadv.aat4343](https://doi.org/10.1126/sciadv.aat4343) , [advances.sciencemag.org/content/4/12/eaat4343](https://advances.sciencemag.org/content/4/12/eaat4343)

Provided by Cornell University

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