

Study shows importance of European farmers adapting to climate change

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A newly published Stanford study indicates European wheat yields will drop more than 20 percent by 2040 due to global warming.

A new Stanford study finds that due to an average 3.5 degrees Fahrenheit of warming expected by 2040, yields of wheat and barley across Europe will drop more than 20 percent.

New Stanford research reveals that [farmers](#) in Europe will see crop

yields affected as global temperatures rise, but that adaptation can help slow the decline for some crops.

For corn, the anticipated loss is roughly 10 percent, the research shows. Farmers of these crops have already seen yield growth slow down since 1980 as temperatures have risen, though other policy and economic factors have also played a role.

"The results clearly showed that modest amounts of [climate change](#) can have a big impact on yields of several crops in Europe," said Stanford doctoral student Frances Moore, who conducted the research with David Lobell, an associate professor of environmental Earth system science.

Moore, a student in the Emmett Interdisciplinary Program in Environment and Resources, described the results as somewhat surprising because Europe is fairly cool. "So you might think it would benefit from moderate amounts of warming," she said. "Our next step was to actually measure the potential of European farmers to adapt to these impacts."

Moore and Lobell analyzed yield and profit records from thousands of farms between 1989 and 2009. These originated in the European Union's annual Farmer Accountancy Data Network survey. Combining detailed climate records with the farm data, they were able to understand how yields and profits have changed over time. By comparing yields in warmer and cooler parts of Europe, they could predict how adaptation may help European farmers in the coming decades. Their research is detailed in the latest issue of the journal *Nature Climate Change*.

"By adaptation, we mean a range of options based on existing technologies, such as switching varieties of a crop, installing irrigation or growing a different crop, one better suited to warmer temperatures," said Lobell, the associate director of the Center on Food Security and the

Environment at Stanford. "These things have been talked about for a long time, but the novelty of this study was using past data to quantify the actual potential of adaptation to reduce [climate change impacts](#). We find that in some cases adaptation could substantially reduce impacts, but in other cases the potential may be very limited with current technologies."

According to the analysis, corn has the highest adaptation potential. Moore and Lobell predict that corn farmers can reduce yield losses by as much as 87 percent through long-term adaptation.

As Moore pointed out, three key areas of uncertainty make it difficult to predict the future of crop yields in Europe. Most scientists focus on the uncertainty around future climate conditions, but the Stanford team found that the biggest issues are often how quickly farmers in Europe will adapt to climate change (adaptation uncertainty) and how [crop yields](#) will respond to climate change (response uncertainty).

In future research, Moore and Lobell hope to focus on measuring how quickly farmers are adapting to changing temperatures.

"This paper has shown that crops in Europe are sensitive to warming and that adaptation can be important in reducing that impact," Moore said.

"The next question is how quickly farmers will use the available options for adapting. Europe has already seen a lot of warming, so we should expect to already see adaptation if farmers are quick to respond to climate signals."

Provided by Stanford University

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