

# Global Warming Expected to Impact European Farmers

Newswise — A new study by Stanford Ph.D. student Frances Moore and professor David Lobell finds that with the average 3.5 degrees Fahrenheit of warming expected by 2040, yields of wheat and barley across Europe are expected to be more than 20% lower than they would be without warming. For corn, the loss is roughly 10% less than without warming. Farmers of these crops have already seen yield growth slow down since 1980 as temperatures have risen, although 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 Moore, a Ph.D. student in the Emmett Interdisciplinary Program in Environment and Resources at Stanford. "This is a little surprising because the region is fairly cool, so you might think it would benefit from moderate amounts of warming. 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, from 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.

"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 to one better suited to warmer temperatures" said Lobell, associate professor of Environmental Earth System Science and 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 new analysis, corn has the highest adaptation potential. Moore and Lobell predict that corn farmers can reduce yield losses by as much as 87% through long-term adaptation.

As Moore points 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 issue is often how quickly farmers in Europe will adapt to climate change (adaptation uncertainty), and how crop yields will respond to climate change (response uncertainty).

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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,” said Moore. “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.”

The full study is available from [Nature Climate Change](#) [1].

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[1] <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2228.html>