

Climate change will affect farmers' bottom line

June 7 2016



Southwestern US farmland values will change with changing climate. Credit: Katelina Creative commons CC0 Public Domain

Over the next 70 to 100 years, our climate is projected to change dramatically, with major impacts on a wide variety of economic sectors. But the sector that is most likely to be affected by these changes is agriculture. A number of studies support this assertion, but relatively few look at the effect of climate change on agriculture from a comprehensive economic perspective.

An interdisciplinary team from the University of Illinois recently investigated the effects of [climate change](#) on farmland values in the Southwestern United States.

"We chose to look at farmland values because they reflect the sum of future expected profits and account for adaptation. And that's exactly what climate change is about: long-term change and adaptation," explains U of I economist Sandy Dall'Erba.

The team focused on a single climate region, the U.S. Southwest, where climate changes are expected to make farming even more difficult than in other regions. The predictions say that places like Arizona will get hotter overall, with more frequent heat waves and more sudden and extreme rainfall events that could lead to periodic flooding. But even within that one climate zone, the team expected some variation. To capture that, they separated out the effects on lowland counties versus highland counties.

What's new about the work is that the team used an economic model that allowed them to look across production systems, so they could evaluate farmland values for soybean producers and cattle ranchers alike. The model, known as the Ricardian approach, also allowed for adaptation on the part of the farmer.

"Farmers are smart; you can't assume that in 100 years they're going to still be farming corn like they are now," Dall'Erba says. "Climate is

changing, new practices and new technologies develop, so they may switch to another production system. The Ricardian approach assumes farmers will adapt."

Further, they were able to integrate what they called "spillover" effects: the influence of one farmer's practices on another. "A simple example is irrigation—the amount of water you get is very much dependent on how much the farmer upstream from you is taking away. That element has been pretty much overlooked in this framework so far," Dall'Erba notes. Another example of spillover is communication between farmers about farm practices and the availability of certain subsidies.

Finally, the team evaluated multiple climate change scenarios. In most socioeconomic research relating to climate change, a single scenario is tested. Dall'Erba's co-author, U of I atmospheric scientist Francina Dominguez, knew that it was important to provide a range of what the future climate will look like. As such, the researchers worked with seven scenarios of future climate data derived from several global and regional climate models.

Taking all of these factors into account, the team found that irrigation, population density, and farm subsidies all increased farmland value, but subsidies had an effect in highland counties only. In addition, heat waves were found to hurt productivity.

Their results also indicated that land values in one location are influenced by irrigation and climate conditions in neighboring locations due to water depletion, water run-off, and/or sudden floods that follow intense rainfall.

"Counties are open economies, so elements beyond their boundaries have an influence on them," Dall'Erba says. "Overall, and based on the set of future climate scenarios accounted for in our work, it seems that

highland counties will be more affected by climate change than lowland counties."

The next step for the research team is to apply their approach to the rest of the country. Because they found variation between highland and lowland counties within a single climate zone, they're expecting to find even more spatial variation when they look at the country as a whole. They also plan to incorporate the role of trade of agricultural products into their system.

"One element that has been overlooked in the field is that one locality may experience a sudden drought and, as a result, may import more corn or cotton from elsewhere. That kind of spillover due to unexpected weather events outside your own locality is something that deserves a lot more attention. Several articles along these lines have already appeared, but they focus on international trade. Much more needs to be done on the trade network taking place within countries," Dall'Erba says.

More information: "The impact of climate change on agriculture in the Southwestern United States: The Ricardian approach revisited," *Spatial Economic Analysis*, [DOI: 10.1080/17421772.2015.1076574](https://doi.org/10.1080/17421772.2015.1076574)

Provided by University of Illinois at Urbana-Champaign

Citation: Climate change will affect farmers' bottom line (2016, June 7) retrieved 25 April 2024 from <https://phys.org/news/2016-06-climate-affect-farmers-bottom-line.html>

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