

Global Warming and American Agriculture

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Scientists seem to have reached a consensus that global warming is a reality. For instance, the latest report from the Intergovernmental Panel on Climate Change, issued in February, stated: “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” But how climate change will affect the economy remains a matter of debate.

In a new paper, economists Olivier Deschênes of the University of California at Santa Barbara and Michael Greenstone of the Massachusetts Institute of Technology attempt to measure how the U.S. agricultural sector will fare. Their conclusion: Not as bad as you might expect. “If anything, climate change appears to be slightly beneficial for profits and yields,” they write.

Previous research has typically employed methods that are likely to produce inaccurate estimates of the economic effect of climate change. The most common method, the hedonic approach, is unable to capture important characteristics, such as soil quality and the option value to convert land to a new purpose, that play a key role in determining agricultural output and land values. Meanwhile, the production function approach does not account for adaptive behavior by farmers in response to climate change. For instance, as temperatures rise, farmers may change their mix of crops or use different fertilizers.

Deschênes and Greenstone propose a new strategy: “Estimate the impacts of temperature and precipitation on agricultural profits and then multiply them by the predicted change in climate to infer the economic impact of climate change in this sector.”

The authors use county-level data from the quinquennial Census of Agriculture from 1987 through 2002. The census data are a measure of the revenue produced with the land and do not include income from federal farm programs or earnings from off the farm. The data are used to estimate the effect of weather on agricultural profits and yields for given geographic area while accounting for both average weather conditions and unexpected shocks.

The authors also use two standard sets of predictions about climate change. The first doubles concentrations of greenhouse gases by the end of the 21st century, while the second assumes a 250 percent increase. The authors

incorporate medium- and long-term climate predictions and temperature and precipitation averages across 2020-2049 and 2070-2099.

Long-run climate change predictions from these agriculture census data and weather models indicate that climate change will add to annual agricultural sector profits by 4 percent or \$1.3 billion (in 2002 dollars). “Additionally, the analysis indicates that the predicted increases in temperature and precipitation will have virtually no effect on yields among the most important crops,” the authors write. This suggests that effects on profits aren’t because of short-run price increases.

Although the results indicate that the overall effect on U.S. agriculture is likely to be positive, some areas will be hurt by climate change. California, in particular, will be adversely affected. In the Fifth District, North Carolina is also expected to take a big hit.

Climate change will not affect the United States alone. As the Earth’s temperature rises, agricultural production around the globe will be altered. That could cause changes in relative prices, thus affecting markets both internationally and domestically. The authors are unable to account for that possibility.

Similarly, their model does not deal with the potential for catastrophic weather events, which some climatologists argue will result from global warming. If severe droughts or floods occur, their estimates could be significantly off the mark.

Finally, if climate change were to produce significant changes in the agricultural sector, it is not unreasonable to believe that the complex system of federal farm subsidies would also change. This would alter farmers’ incentives and the nation’s agricultural production.

Despite the paper’s limitations, the authors have taken an important and often contentious topic and provided a sober analysis. But more remains to be done, as the authors note. If global warming is, in fact, upon us, the job of economists is to help us understand what it will mean to human welfare. Agriculture is just one piece of the puzzle. The likely impact of climate change on human health, particularly mortality rates in developing countries, is an especially important issue — and one where economists, perhaps in collaboration with their colleagues from the physical and natural sciences, could make an important contribution. **RF**

“The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather” by Olivier Deschênes and Michael Greenstone. *American Economic Review*, March 2007, vol. 97, no.1, pp. 354-385.