

GLOBAL CHANGE **LOCAL IMPACT**

OSU Climate Change Webinar Series



Investigating the Impacts of Climate Change on Ohio Agriculture and Forests

by Christina Dierkes

Agriculture is Ohio's number one industry, encompassing more than 14 million acres of farmland and providing more than \$5 billion worth of crops every year. But if predictions come true and climate change continues, the associated rising temperatures could seriously affect all aspects of agriculture: the types of crops farmers plant, when and where crops are planted, and the policies that will be needed to manage agriculture in harmony with environmental protection needs.

For the last 15 years, writing those environmental policies and helping the farming community understand and adjust to them has been the focus of Dr. Brent Sohngen, Professor at Ohio State University's Department of Agricultural, Environmental, and Development Economics.

"From my perspective, I'm just trying to help farmers understand different kinds

of policies they hear about," Sohngen explains. "We try to educate land owners on the potential implications of different policies, such as water quality and climate change legislation."



If climate change continues as predicted, corn and soybean yields in Great Lake states like Ohio and Indiana could decrease 20-30% by 2049 and 40-80% by 2090.

As part of OSU's continuing Climate Change Webinar Series, Sohngen presented *Potential Impacts of Climate Change on Great Lakes Farms and Forests*, which

focused on how climate change could affect the Great Lakes region, and how agriculture and forestry, some of the area's largest industries, may be impacted by changing environmental conditions, changes in demands made on land by a changing population, and the policies accompanying these changes.

"There are lots of scary stories about what impact climate change may have; we looked at what the science really says," Sohngen says, summarizing the goal of his webinar. "We looked at some of the questions people had about how climate change could alter what crops work in the area over the next 30 to 40 years, and how they could make different cropping decisions to allow for crops that work better here."

For farmers some of the potential effects of climate change may include increased average temperatures that lengthen growing seasons, changes in rainfall that can lead

to flooding or droughts, and an increase in extreme weather events that can adversely affect crops. These changing conditions not only require adaptation when growing Ohio's traditional crops, like corn and soybeans, but could also lead to other crops becoming a more economic choice for farmers.

In addition to facing changes in crop selection, farmers could also be affected by policies that encourage reforestation—the conversion of agriculture and other lands back into forests. More forests would mean an increase in the rate of carbon sequestration, the process by which plants take up carbon dioxide (a key greenhouse gas) from the atmosphere and use it to grow, locking carbon into the living plant.

Researchers like Sohngen promote the use of biomass like forests to help offset and mitigate the rising carbon dioxide levels that cause climate change. Because trees live for a long time and lock away a lot of carbon due to their size, forests are an ideal location for carbon sequestration, and some policies that try to regulate carbon dioxide emissions focus on reforestation for this reason.

Agriculture is especially affected because policies often aim to revert farmlands back into natural forests, reducing the amount of product and income farmers can generate. While this shift is unlikely to lead to food shortages, reduced agriculture production would raise prices for both food and animal feed—economic effects that have to be considered.

“Carbon sequestration policies would impact land use in the Midwest, and some estimates of land use change are pretty dramatic,” Sohngen says. “We could potentially shift 30–60 million acres of land from crops into forests across the US, and Ohio would see its fair share of that, as we have about 5–7 percent of that crop land,” he adds. But why is reforestation such an important part of mitigating the impacts of climate change?

Forests are a large part of the global carbon cycle because lots of carbon is stored in the woody biomass of trees, and trees can contain as much carbon dioxide (CO₂) as is currently present in the Earth's atmosphere—about 4 trillion tons in total. A hectare of trees can sequester or store

up to 10 tons of carbon dioxide per year, and 1 million hectares (2.5 million acres) converted into forest can remove 10 million tons of CO₂ from the atmosphere every year. “All CO₂ that we can put into trees isn't going into the atmosphere, so forestry has the potential to help us avoid the climate change problem,” Sohngen summarizes.

In addition to the direct impacts of a changing climate on forestry and agriculture, changes in the population can have an impact on how agricultural lands are used. In many countries including the United States, rising incomes lead to a shift in priorities on land use: from agricultural land growing grains and other basic food products to land used for raising cattle, land used to grow corn and other plants for ethanol production as part of a trend toward cleaner energy, and land converted into environmental services space such as national parks and nature preserves.

However, research has already shown a trend toward reduced crop yields in the United States, and if this trend continues as projected, more lands would be needed to produce the crops necessary to feed people, raise cattle for meat production, and convert plants into ethanol for energy production. At the same time, demand for forestry space increases, both for timber production to build the larger homes that come with rising incomes, and as environmental services spaces for recreation.

Balancing these conflicting demands on a limited resource like land is going to continue to be a difficult feat, and researchers like Sohngen are trying their best to advise policy makers on the potential effects of new regulations. To educate not only fellow academics, but also governmental agencies and the public on the challenges of climate change, Sohngen is part of Ohio State University Extension and has served as a member of a number of research networks, including Ohio State's own Climate Water Carbon Program and



Increased precipitation and temperature could change what types of trees grow in the Great Lakes region, potentially causing great losses to these states' timber industries.

Purdue University's Global Trade Analysis Project. As part of the Intergovernmental Panel on Climate Change (IPCC), Sohngen was the co-recipient of the 2007 Nobel Peace Prize.

More information about Sohngen and his colleagues on OSU's Climate Change Team, as well as the upcoming webinars on climate change impacts in the Great Lakes region, is available at ChangingClimate.osu.edu. The Global Change, Local Impact Webinar Series is a multi-departmental effort within Ohio State University, led by OSU Extension, Ohio Sea Grant, and Byrd Polar Research Center, to help localize the climate change issue for Ohioans and Great Lakes residents. TL



Brent Sohngen is a Professor of environmental economics at Ohio State University. He conducts research on land use and climate change, carbon trading, and water quality trading. He co-authored sections of the 2001 and 2007 Intergovernmental Panel on Climate Change reports on the impacts of climate change on forests and agriculture, and on the potential for carbon sequestration in forests.