



Environment poses risks to future ag production

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Has the environment been good for agricultural productivity?

As part of our annual Agricultural Symposium, we dove into the real-world application of the research to be presented through stories like this. [Learn more about the Symposium.](#)

By Su Bacon

Overall, the growth in agricultural productivity has been good for the environment.

“We’re using less land and less water, and producing more,” said Keith Fuglie, economist with the U.S. Department of Agriculture.

Although the population has more than doubled since 1950, the United States now uses about 25% less farmland.

“We are feeding far more people using fewer environmental resources,” Fuglie said.

But has the environment been good for agricultural productivity?

“Despite tremendous gains in agricultural productivity, the sector remains as vulnerable to environmental factors as ever,” said Wolfram Schlenker, professor at the School of International and Public Affairs and the Earth Institute of Columbia University.

Schlenker examined the influence of environmental factors -- specifically extreme heat and ozone air pollution -- on corn yields from 1980 to 2019. His paper, “Environmental Drivers of Agricultural Productivity Growth and Socioeconomic Spillovers,” is being presented at the Federal Reserve Bank of Kansas City’s annual Agricultural Symposium.

“Extreme heat and ozone pollution have led to the largest yield reductions -- in some years, more than 20%,” he said.

For corn, temperatures above 86 degrees Fahrenheit and ozone pollution greater than 70 parts per billion (ppb) are highly detrimental to yields.

“Peak ozone pollution in the United States repeatedly exceeded 3,300 parts per billion-hours in the 1980s,” Schlenker said.

And yields fell accordingly.

Good news, bad news

The good news is that progress has been made.

Due to the success of the Clean Air Act, “almost all peak ozone pollution above 70 ppb has been eliminated over agricultural areas,” he said.

Crops are still susceptible to ozone, but it doesn’t affect year-to-year corn yields.

But warming remains.

“Temperatures in the United States have been trending mostly upward since 1980,” Schlenker said.

He found that most of the country has seen warming in the last 40 years. If the warming continues, in the worst-case scenario the hottest Dust Bowl year will become just an average year.

The projected increase in extreme heat by the end of the century is so large, in fact, that irrigation will become extremely costly and will not cool enough to offset extreme heat, he said.

Farmland in areas that already are hot may become so unproductive that it will be abandoned.

Moving growing areas north is one approach.

“The location of where crops are grown is changing,” said Philip Pardey, professor in the Department of Applied Economics at the University of Minnesota.

“Illinois and Minnesota are big corn producers now,” he said.

Feeding billions

How will climate change affect the future of food and the feeding of a projected 9 billion people by 2050?

Previously, global food supply grew faster than demand and real food prices fell significantly, alleviating hunger and poverty for hundreds of millions during the first half of the 20th century, Pardey said.

By 2050, global demand for food is expected to increase 70%.

Meeting the demand “will take larger increases in food production if at the same time, we want to reduce food insecurity from its current levels,” said Wes Peterson, professor of agricultural economics at the University of Nebraska in Lincoln.

Food insecurity is defined by the United Nations as a chronic inability to procure enough food to be adequately nourished. Currently food insecurity averages 12-15% worldwide -- more than 925 million people, he said.

“Climate change is a major problem in many parts of the world,” Peterson said.

For example, “in the Sahel region of Africa, it is not uncommon for farmers to harvest a crop only once every three or four years due to lack of rainfall,” he said.

A food shortage can occur when not enough food is produced whether due to climate change or drought, floods and fire.

Although technology can’t counteract such events, researchers are developing plant hybrids that are adapted to a variable climate.

“Technological innovation is essential, both to feed people and protect the environment,” Peterson said. “It’s going to take effort, research and awareness of the problem.”

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