

Global warming may hurt some poor populations, benefit others

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Global warming could cause crop shortages and increase food prices by 2030, say climate experts. That scenario could benefit self-employed farmers in developing countries and drive urban residents deeper into poverty. Credit: Marshall Burke

The impact of global warming on food prices and hunger could be large over the next 20 years, according to a new Stanford University study. Researchers say that higher temperatures could significantly reduce yields of wheat, rice and maize - dietary staples for tens of millions of poor people who subsist on less than \$1 a day. The resulting crop shortages would likely cause food prices to rise and drive many into poverty.

But even as some people are hurt, others would be helped out of [poverty](#), says Stanford agricultural scientist David Lobell.

"Poverty impacts depend not only on food prices but also on the earnings of the poor," said Lobell, a center fellow at Stanford's Program on Food Security and the Environment (FSE). "Most projections assume that if prices go up, the amount of poverty in the world also will go up, because poor people spend a lot of their money on food. But poor people are pretty diverse. There are those who farm their own land and would actually benefit from higher crop prices, and there are rural wage laborers and people that live in cities who definitely will be hurt."

Lobell and his colleagues recently conducted the first in-depth study showing how different climate change scenarios could affect incomes of farmers and laborers in developing countries. He will present the results today at the annual meeting of the American Association for the Advancement of Science in San Diego.

Household incomes

In the study, Lobell, former FSE researcher Marshall Burke and Purdue University agricultural economist Thomas Hertel focused on 15 developing countries in Asia, Africa and Latin America. Hertel has developed a global trade model that closely tracks the consumption and production of rice, wheat and maize on a country-by-country basis. The model was used to project the effects of climate change on agriculture within 20 years and the resulting impact on prices and poverty.

Using a range of global warming forecasts, the researchers were able to project three different crop-yield scenarios by 2030:

- "Low-yield" - crop production is toward the low end of expectations.
- "Most likely" - projected yields are consistent with expectations.

- "High-yield" - production is higher than expected.

"One of the limitations of previous forecasts is that they don't consider the full range of uncertainties - that is, the chance that things could be better or worse than we expect," Lobell said. "We provided Tom those three scenarios of what climate change could mean for agricultural productivity. Then he used the trade model to project how each scenario would affect prices and poverty over the next 20 years.

"The impacts we're talking about are mainly driven by warmer temperatures, which dry up the soil, speed up crop development and shut down biological processes, like photosynthesis, that plants rely on," he added. "Plants in general don't like it hotter, and in many climate forecasts, the temperatures projected for 2030 would be outside the range that crops prefer."

Results

The study revealed a surprising mix of winners and losers depending on the projected global temperature. The "most likely" scenario projected by the International Panel on Climate Change is that global temperatures will rise 1.8 degrees Fahrenheit (1 degree Celsius) by 2030. In that scenario, the trade model projected relatively little change in crop yields, food prices and poverty rates.

But under the "low-yield" scenario, in which temperatures increase by 2.7 F (1.5 C), the model projects a 10 to 20 percent drop in agricultural productivity, which results in a 10 to 60 percent rise in the price of rice, wheat and maize. Because of these higher prices, the overall poverty rate in the 15 countries surveyed was expected to rise by 3 percent.

However, an analysis of individual countries revealed a far more

complicated picture. In 11 of the 15 countries, poor people who owned their own land and raised their own crops actually benefitted from higher [food prices](#), according to the model. In Thailand, for example, the poverty rate for people in the non-agricultural sector was projected to rise 5 percent, while the rate for self-employed farmers dropped more than 30 percent - in part because, as food supplies dwindled, the global demand for higher-priced crops increased.

"If prices go up and you're tied to international markets, you could be lifted out of poverty quite considerably," Lobell explained. "But there are a lot of countries, like Bangladesh, where poor people are either in urban areas or in rural areas but don't own their own land. Countries like that could be hurt quite a lot. Then there are semi-arid countries - like Zambia, Mozambique and Malawi - where even if prices go up and people own land, productivity will go down so much that it can't make up for those price increases. In the 'low-yield' scenario, those countries would see higher poverty rates across all sectors."

Under the "high-yield" scenario, in which global temperatures rise just 0.9 F (0.5 C), crop productivity increased. The resulting food surplus led to a 16 percent drop in prices, which could be detrimental to farm owners. In Thailand, the poverty rate among self-employed farmers was projected to rise 60 percent, while those in the non-agriculture sector saw a slight drop in poverty. In Zambia, Mozambique, Malawi and Uganda, poverty in the non-farming sector was projected to decline as much as 5 percent.

Risk management

Lobell said that, although the likelihood of the "low-yield" or "high-yield" scenario occurring is only 5 percent, it is important for policymakers to consider the full range of possibilities if they want to help countries adapt to [climate change](#) and ultimately prevent an increase

in poverty and hunger.

"It's like any sort of risk management or insurance program," he said.
"You have to have some idea of the probability of events that have a big consequence. It's also important to keep in mind that any change, no matter how extreme, will benefit some households and hurt others."

Provided by Stanford University

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