Impoverished areas of Africa and Asia face severe crop losses from climate change in 20 years

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Many of the world's poorest regions could face severe crop losses in the next two decades because of climate change, according to a new study by researchers at Stanford University's Program on Food Security and the Environment (FSE). Their findings will be published in the Feb. 1 issue of the journal *Science*.

"The majority of the world's 1 billion poor depend on agriculture for their livelihoods," said lead author David Lobell, a senior research scholar at FSE, which focuses on environmentally sustainable solutions to global hunger.

"Unfortunately, agriculture is also the human enterprise most vulnerable to changes in climate," Lobell added. "Understanding where these climate threats will be greatest, for what crops and on what time scales, will be central to our efforts at fighting hunger and poverty over the coming decades."

Climate change and hunger hotspots

In the study, the researchers focused on 12 regions where a large share of the world's malnourished populations reside, according to the United Nations Food and Agriculture Organization, including much of Asia, sub-Saharan Africa, the Caribbean and Central and South America.

Temperature and rainfall are key factors affecting crop yield. To determine the impact of global warming on agriculture in these regions, the authors analyzed 20 climate change models and concluded that by 2030, the average temperature in most areas could rise 1.8 degrees Fahrenheit (1 degree Celsius), while seasonal precipitation in some places—including South Asia, South Africa, Central America and Brazil—could decrease.

“To identify which crops in which regions are most under threat by 2030, we combined projections of climate change with data on what poor people eat, as well as past relationships between crop harvests and climate variability,” Lobell explained.

Their analysis revealed two hunger hotspots where climate impacts on agriculture look particularly dire: Southern Africa and South Asia. “We were surprised by how much and how soon these regions could suffer if we don’t adapt,” said study co-author Marshall Burke, a researcher at FSE. “For example, our study suggests that Southern Africa could lose more than 30 percent of its main crop, maize, in the next two decades, with possibly devastating implications for hunger in the region.”

Potential losses in South Asia are also significant, he added, with projected losses of 10 percent or more for many regional staples, including millet, maize and rice. “For poor farmers on the margin of survival, these losses could really be crushing,” Burke said.

Prioritizing investments

With such large projected losses in many poor regions, adapting agriculture to a changing climate will be a crucial global task, the authors said.

“By looking systematically across regions and at a wide range of crops of

importance to the poor, we hope to provide a way to prioritize investments in adaptation," Lobell said. "Say you're an organization with finite resources that's interested in alleviating hunger and concerned about the effects of climate change. Our study asks, given the data we have, where would you spend your money first" And while the data are not perfect, we have to make decisions based on available data."

Although relatively inexpensive adaptations, such as planting earlier or later in the season or switching crop varieties, could moderate the effects of climate change, "the biggest benefits will likely result from more costly measures, including the development of new crop varieties and expansion of irrigation," the authors write. "These adaptations will require substantial investments by farmers, governments, scientists and development organizations, all of whom face many other demands on their resources."

In addition to specific areas, such as Southern Africa and South Asia, where urgent investment in agricultural adaptation is needed, the authors pointed to other regions where uncertainties about climate change are higher and, therefore, investment priorities might differ among institutions.

"Areas of West Africa and the Sahel stand out as regions with very high rates of food insecurity and with a very high dependence on agriculture, but also with a fair amount of uncertainty regarding climate change impacts," Burke said. "For these regions, you get half of the climate models telling you it's going to get wetter and the other half giving you the opposite. As a result, our study raises the potential for very bad impacts in these regions but with much less certainty than in other regions."

The study also pointed to a few developing regions, such as the temperate wheat-growing areas of China, that could benefit in the short

run from climate change, he added.

Investing for change

In the face of these uncertainties, where should organizations be investing money, and what kind of adaptation investments make the most sense"

“There are the sure bets, such as maize in Southern Africa and rice in Southeast Asia, where all models agree that impacts will be negative,” Lobell said. “Then there are those cases where things could get really bad, such as for sorghum in the Sahel or millets in Central Africa, but where we are less certain. In the end, if a choice has to be made, individual institutions will have to decide for themselves whether to pursue the sure bets or the riskier but potentially high-payoff investments.”

The study arrived at a particularly useful time, said co-author Rosamond Naylor, director of FSE and senior fellow at Stanford’s Woods Institute for the Environment. “The international donor community is starting to invest once again in agricultural productivity in the developing world, and our study will help show where these investments might be the most worthwhile,” she said. “We know we can’t do everything right away, but this helps us know where to start.”

Naylor and her colleagues at FSE have begun looking at other aspects of climate and agriculture, including two multi-year studies on the impact of biofuels expansion on climate change and the world’s poor.

Source: Stanford University