PRIORITIZING CLIMATE CHANGE ADAPTATION NEEDS FOR FOOD SECURITY TO 2030

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The potential impact of climate change on the world's poor is a topic with wide and growing interest, but there remains much uncertainty about how specifically to adapt to a changing climate. Food security impacts are a particular concern, as hundreds of millions of people who struggle to get by in the current climate may be faced with more frequent droughts, flooding, and heat waves that can devastate crop harvests. The humanitarian, environmental, and security implications of these impacts could be enormous.

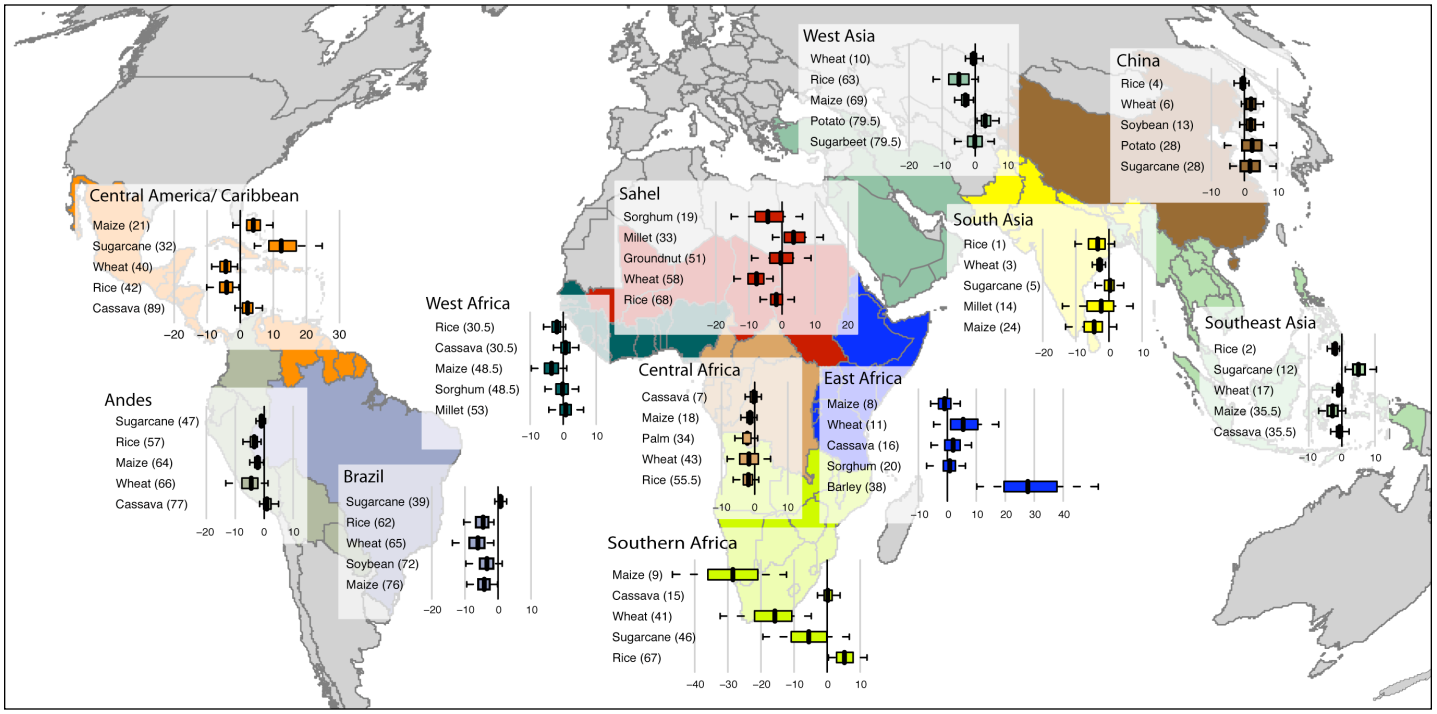
At the same time, there is limited money and time available to invest in these communities, and in the face of much uncertainty, identifying specific investments that make most sense is a difficult task. To inform these investment decisions, an analysis was conducted to summarize and compare the impacts of climate change across a broad suite of crops in all of the major food insecure regions. The analysis was based on a synthesis of what poor people eat, observed relationships between historical harvests and climate variability in poor regions, and various projections of future climate change by 2030 in these regions. A total of 94 crop-region combinations were evaluated, ranging from the most important crop for food security – rice in South Asia– to groundnuts (peanuts) in East Africa. The results for the top crops in each study region are summarized in Figure 1.

From this analysis, we draw some general conclusions relevant to policy makers.

1) South Asia and Southern Africa are two "hunger hotspots" in need of adaptation. The crop with the single largest projected impacts is maize in Southern Africa, currently the most important source of calories for the poor in this region. Losses by 2030 are expected to be a remarkable 30% by 2030, relative to production in 1990. In South Asia, which currently has 30% of the roughly 800 million global malnourished, many crops have more than a 75% chance of incurring losses from climate change. These include wheat, rapeseed, rice, millet, and maize.

2) Risk attitudes matter, because impacts on some crops are much more uncertain than others. For example, according to our models, wheat production in South Asia is very likely to experience losses by 2030 close to 5%, while

Figure 1. Projected impacts of climate change by 2030 for five major crops in each region. For each crop, the dark vertical line indicates the middle value out of 100 separate model projections, boxes extend from 25th to 75th percentiles, and horizontal lines extend from 5th to 95th percentiles. Number in parentheses is the overall rank of the crop in terms of importance to food security, calculated by multiplying the number of malnourished in the region by the percent of calories derived from that crop.



groundnut harvests in the same region may increase as much as 10% or fall as much as 20%. The difference is largely because wheat is sensitive mainly to temperature increases, while groundnuts are sensitive to rainfall – a harder variable to predict. In South Asia, investments aimed for a sure bet should focus on a crop like wheat, while those focused on avoiding the chance of major losses should focus on a crop like groundnuts. The table below lists the major crops identified for several criteria that reflect different risk priorities.

3) Crop responses to climate are poorly understood in many regions. This lack of understanding makes it difficult to know how much climate change will matter in these regions. While the difficulty of predicting climate change has become widely appreciated, the difficulty of determining crop responses to climate is often an even greater source of uncertainty. The relationships between crop production and climate remain most unclear in West, Central, and East Africa. In contrast, the relationships in Sahel, South Asia, Southern Africa, and Brazil are relatively better understood.

We are now expanding this work in several ways to (1) evaluate national level impacts in selected regions, (2) evaluate impacts on important protein sources, as this analysis was based on calories, (3) incorporate measures of endogenous adaptive capacity, for example as reflected in the number of active breeders for a crop in a given region, and (4) work with various institutions to integrate these projections into their planning activities.

Criteria	Crops, among 30 most important to food security (crop rank in parentheses)
More than 95% chance of production losses >0%	Southeast Asia rice (2) South Asia wheat (3) Southern Africa maize (9)
More than 50% chance of production losses >5%:	Southern Africa maize (9) South Asia rapeseed (26)
More than 5% chance of production losses >10%:	Southern Africa maize (9) South Asia millet (14) Sahel sorghum (19) South Asia groundnut (25) South Asia rapeseed (26)

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For more information on climate change and global hunger, and to download the full paper, please visit:

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The Program on Food Security and the Environment at Stanford University is an interdisciplinary program aimed at generating innovation solutions to the persistent problems of global hunger and environmental degradation.