

Climate Change Deepens Vulnerability to Poverty

Extreme climate events can drastically reduce agricultural productivity. What are the implications for poverty levels in developing countries?

Adverse climate events, like extreme heat, droughts and floods, can devastate agricultural systems in developing countries. Increased frequency and intensity of such climate extremes will adversely affect crop production, which could in turn reduce incomes of poor farmers and exert upward pressure on food prices. Both of these will tend to increase poverty levels. There is thus a strong need to quantify the impact of climate volatility on the poor, and to answer questions such as: Does the impact vary across socioeconomic strata? How will projected increases in climate volatility affect agricultural productivity?

A new paper by Ahmed, Diffenbaugh and Hertel explores these questions. The analysis focuses on the frequency and magnitude of extremely hot, dry, and wet years—e.g. years with heat waves, droughts, and excess rainfall—and their poverty implications in two time periods: the late twentieth century and the late twenty-first century. The climate in the future is based on one of the more pessimistic emissions scenarios considered by the International Panel on Climate Change, namely the A2 scenario characterized by low trade flows, slow capital stock turnover and slow technological change. Under this scenario, technology diffuses more slowly than in the other scenario. Families and international disparities in productivity, and hence income per capita, are largely maintained or increase in absolute terms.

The authors find that the frequency of occurrence of what is now the 30-year-maximum extreme wet event increases throughout the world. For example, it triples in Southeast Asia. The absolute magnitude of these 30-year-maximum events is also

greater throughout the world in the future, with peak increases of more than 40 percent in Southeast Asia. All countries exhibit substantial increases in the frequency and magnitude of extreme hot events as well as extreme drought years, although there are a few that have less frequent or less intense drought years in the future.

In addition to describing the magnitude and spatial heterogeneity of changes in climate volatility, the study also quantifies the vulnerability of developing countries to current climate volatility by simulating the response of productivity in the grain sector to once-every-30-years climate events, for a sample of 16 developing countries. The study's key findings include:

- Bangladesh, Mexico, Mozambique, Malawi, Tanzania and Zambia were among countries with the highest shares of population entering poverty in the wake of extreme events.

- There was tremendous heterogeneity in the impact on poverty levels across different segments of the population, when differentiated by primary income source. The urban, wage-labor dependent stratum was the most vulnerable group, even though it contributed modestly to total poverty in the sample of countries. The poverty rate for this group doubled in Malawi under the extreme event. Food is a major expenditure for the urban poor. As food prices rise, this group's overall consumption falls with rising prices, which pushes it below the poverty threshold of consumption.

- Farmer households were hurt by the adverse productivity shock, but the value of their farm output rose due to higher food prices. As a result, these households were generally much less sensitive to climate extremes.

These results suggest that, given the expected decrease in the share of developing country populations living

in rural areas by more than one-third between 2010 and 2050, climate extremes of a specific magnitude may have a greater impact on poverty at the national level in the future than they do now, due to higher population concentrations in urban areas in developing countries.

Urban wage-laborers are most vulnerable due to extreme exposure to food price increases

Finally, the study suggests that adaptation responses, such as irrigation investments, could reduce the decline in agricultural productivity resulting from extreme events like drought, thereby mitigating the events'

impact on poverty. However, even when farmers are aware of the need for adaptation, they may face barriers such as information and credit constraints. Policy responses to changes in climate variability should thus aim to create an enabling institutional environment that is required in addition to investments in infrastructure in order to protect vulnerable populations against poverty.

Syud Amer Ahmed, Noah Suresh Diffenbaugh and Thomas Hertel. Forthcoming. "Climate volatility deepens poverty vulnerability in developing countries." Environmental Research Letters.