



Vulnerability and the Impact of Climate Change in South Africa's Limpopo River Basin

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With likely long-term changes in rainfall patterns and shifting temperature zones, climate change is expected to increase the frequency of climate-related shocks, such as floods and droughts in Sub-Saharan Africa. For farm households, an increase in the frequency of climate-related income shocks could lead not only to lower expected income, but also to higher income variance, which in turn can cause them to pursue costly risk-coping strategies and to fall below poverty trap thresholds. For this reason, it is important to understand how a changing distribution of risk will lead to increased vulnerability, not just decreased expected income.

This brief is based on a paper that uses farm households' responses to climate-related shocks in South Africa's Limpopo River Basin to gauge how farmers are likely to respond to future climate change shocks. The increased frequency and severity of droughts associated with global warming may induce farmers to change their behavior to reduce their risk of negative impacts from future climate-related shocks. While it is difficult to predict farmers' behavior and how it will affect welfare, coping strategies used in response to shocks today can be used to predict whether and how rural South Africans will cope in the future. The study examines household responses to droughts in 2005 and household vulnerability to future climate change by assessing their probability of falling below an income threshold as a result of future climate-related shocks.

Assessing household vulnerability is important because efficient social policy needs to go beyond poverty alleviation in the present to prevent poverty in the future. A poverty reduction strategy that does not distinguish between transient and structural poverty leads to inefficient use of resources, in that it focuses on those who are temporarily poor but may be able to escape poverty on their own, at the expense of those who have a high probability of becoming chronically poor.

IMPACT OF DROUGHTS ON INCOME

Using cross-sectional data from a 2005 survey of nearly 800 farmers in 20 districts in South Africa's Limpopo River Basin that was augmented with rainfall data, the study finds that droughts were the most prevalent climate-related shock reported: 41 instances of droughts were reported in 2005. No apparent relationship was found, however, between those who would have been expected to report droughts based on rainfall data and those

who did report droughts. This may be because the rainfall variable examined is an average over the entire growing season and, as a result, may not capture a run of rainless days or other important microclimate dynamics.

In order to cope with shocks, the survey asked whether or not households sold livestock, borrowed from relatives or the bank, accepted aid, migrated to another area, sought off-farm employment, or ate less. The majority of the households, however, said they did nothing in response to droughts, and a corresponding regression analysis finds the impact of droughts on income to be insignificant.

This result is puzzling because, at the very least, households must have used their available assets or reduced their consumption in response to the decrease in income caused by climate-related shocks. There are two explanations for this. First, there could be problems with the data. Income may not have been accurately measured or the reports of no response could indicate that households reported many types of droughts, not just those that were severe and required coping strategies. Treating inconsequential droughts in the same way as severe droughts would dilute the signal of severe droughts on income. The second possible explanation is that households had already adapted to living in a drought-prone environment. Droughts are common in South Africa and households may already use drought-resistant crop varieties or other coping mechanisms that lessen their impact. This does not mean the presence of droughts does not affect household wealth (that is, their asset position). The coping strategies used by farmers in the presence of drought could be very costly and a reduction in income variance could increase overall income by allowing farmers to spend less time on low-yield, low-risk activities.

ESTIMATION OF VULNERABILITY

Vulnerability is defined as the probability that a household will fall below some income threshold at some future point in time. Using median household income (16,000 Rand, equivalent to US\$2,508 in 2005) and bottom quartile income (7,800 Rand) as the two thresholds, the study assesses which households are more vulnerable to future climatic shocks. The results are plotted in four quadrants in Figures 1 and 2. Households in the upper-left quadrant are currently below the income threshold and will likely continue to be below the threshold in the future. Households in the bottom-left

quadrant are currently below the threshold but have characteristics suggesting they have less than a 50 percent chance of being below the threshold in the future. Those in the upper-right corner are above the income threshold at present but are likely to fall below it in the future, whereas those in the bottom-right quadrant are above

the income threshold and are likely to remain so in the future.

The results suggest that most households are not vulnerable to falling below the 7,800 rand threshold (Figure 1). However, when the poverty line is set at 16,000 Rand (the second income quartile), vulnerability increases significantly (Figure 2).

Further, the study finds that households that do not own farm animals are more vulnerable to falling below the poverty threshold than other households. Similarly, households with more than 10 members, and those that rely heavily on rainfed agriculture are more vulnerable to falling below the poverty threshold. Households that do not have access to credit or that have no knowledge of credit are vulnerable to falling below the poverty thresholds, but they are less vulnerable than households that succeeded in obtaining a loan.

The study also finds that in South Africa's Limpopo River Basin, residents of Gauteng province are most vulnerable to falling below the lower income threshold (7,800 Rand), whereas residents of Limpopo are the least vulnerable to falling below this threshold. Members of the siSwati and Setswana ethnic groups are the most vulnerable to falling below either poverty threshold.

IMPLICATIONS

While the impact of droughts on income was found to be statistically insignificant, and the majority of households said they "did nothing" in response to droughts, this does not necessarily mean that farming households in South Africa's Limpopo River Basin are prepared for future changes in climate patterns. Climate change is expected to bring a number of unexpected climate-related shocks requiring new adaptive behavior to mitigate their impacts. As a result, adaptation could be very costly, especially for those least able to bear that cost.

The vulnerability break-downs can help policymakers identify households that are not currently poor but are at risk of becoming poor in the future. Given that climate change will involve a redistribution and intensification of risk, attention to vulnerability is important. Given that predicting the actual effects of climate change is fraught with difficulties due to high levels of uncertainty, identifying households that are vulnerable to climate stresses will help to reduce future poverty.

FOR FURTHER READING

Shewmake, S., *Vulnerability and the Impact of Climate Change in South Africa's Limpopo River Basin*, IFPRI Discussion Paper No. 804, <http://www.ifpri.org/pubs/dp/ifridp00804.asp> (Washington, DC: International Food Policy Research Institute, 2008).

Figure 1 Vulnerability to climate-related shocks based on the probability of household income falling below 7,800 rand

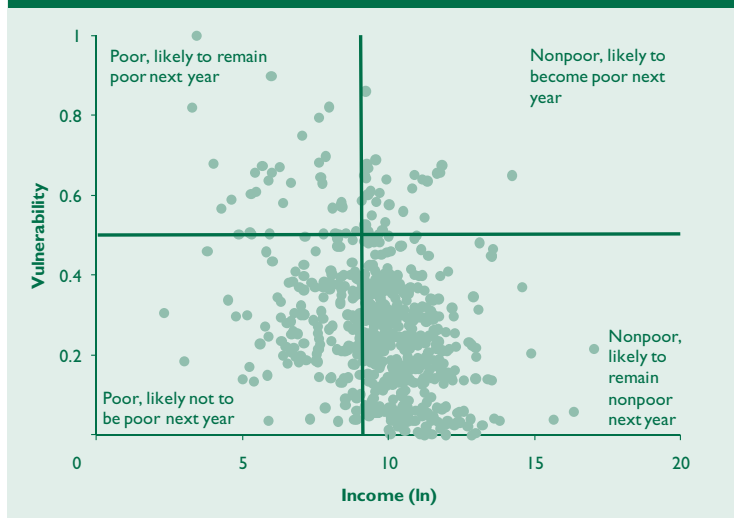


Figure 2 Vulnerability to climate-related shocks based on the probability of household income falling below 16,000 rand



SOURCE: Shewmake, S., *Vulnerability and the Impact of Climate Change in South Africa's Limpopo River Basin*, IFPRI Discussion Paper No. 804 (Washington, DC: IFPRI, 2008).

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