# CPWF POLICY BRIEF

## Food and Water Security under Global Change

*This project 'Food and Water Security under Global Change: Developing Adaptive Capacity with a Focus on Rural Africa', is supported by Germany's Federal Ministry for Economic Cooperation and Development, associated with the CGIAR Challenge Program on Water and Food and involves close collaboration with researchers at the Center for Environmental Economics and Policy in Africa, the Ethiopian Development Research Institute, the Ethiopian Economics Association, and the University of Hamburg.*

### THE BIG PICTURE

Over the coming decades, global change will have an impact on food and water security in highly significant and yet uncertain ways. There are strong indications that developing countries will bear the brunt of any adverse conditions, particularly those steeming from climate change.

This is largely because poverty levels are high, and developing-country capacity to adapt to global change is weak. Furthermore, the rural populations of developing countries—for whom agricultural production is the primary source of direct and indirect employment and income—will be most affected due agriculture's vulnerability to global change processes.

The agricultural sector is the largest consumer of water resources, and variability in water supply has a major influence on health and welfare in poor areas. With water scarcity and extreme weather events expected to increase under climate change, water security could decline significantly in rural areas and in agriculture.

Consequently, it is important to understand the impacts of global change (in terms of climate, demography, technology, and so on), on agriculture and natural resources in developing countries and to develop adaptive capacity to respond to these impacts. Moreover, there is a need to develop informed and effective adaptation measures and investment options that can be taken now to alleviate adverse impacts of global change in the future.

### A RESEARCH OUTCOME THAT YOU CAN USE

At the local level, this project implemented farm household surveys in the Nile River Basin of Ethiopia and the Limpopo River Basin of South Africa to examine communities':

- vulnerability to shocks
- perceptions of long-term changes in climate (precipitation and temperature), and
- the determinants of adaptation to long-term climate change.

***Vulnerability to Climate Change and Risk***

Levels of vulnerability to climate change vary by region. In the Nile Basin of Ethiopia, vulnerability is higher in those regions with lower levels of development (Afar and Somali) and less access to technology and infrastructure, weaker institutions, and a stronger climate signal (Oromia and Tigray). Additional research has shown that in Ethiopia, a better understanding of risk behavior is essential for identifying appropriate farm-level strategies for adaptation to climate change by low-income farmers, as low-income farmers are extremely risk-averse and thus less receptive to technologies that would help them adapt to climate change.

In the Limpopo Basin of South Africa, Gauteng is the least vulnerable province, followed by Limpopo Province. Moreover, in South Africa vulnerability depends on households' access to credit and ethnicity, and increases for larger households and for those relying on rainfed agriculture. Given regional differences in exposure, sensitivity and adaptive capacity, it is important for governments to target policy responses to individual regions.

***Adaptation to Climate Change***

Common adaptation strategies include use of different crops or crop varieties, planting trees, soil conservation, changing planting dates, and irrigation in Ethiopia; and planting different crops or crop varieties, irrigation, changing planting dates, changing the amount of land under cultivation, and supplementing animal feeds in South Africa.

While the majority of farm households claimed to have perceived long-term changes in temperature or rainfall, 62% of households in South Africa and 38% of households in Ethiopia did not adapt to these changes.

Econometric analyses identified access to extension services and information on climate and adaptation options, recent experience with extreme climate events, the socio-economic position of the household, and the level of government support (food aid, farm inputs, *etc.*) as influencing households' decision to adapt to perceived climate change.

Farmers themselves cited lack of access to credit in South Africa and lack of access to land, information, and credit in Ethiopia as key constraints to adaptation.

***Alternative Adaptation Scenarios***

The impact of global change on poverty and water and food security was assessed for Sub-Saharan Africa. A 25% crop productivity increase scenario for the region yields better outcomes than a doubling of irrigated area due to the low initial irrigated areas in the region.

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Outcomes from enhanced crop productivity include increased food production, slightly lower world food prices, increased overall regional incomes, lower malnutrition levels, and lower poverty levels.

However, increase in water control will also be crucial for Sub-Saharan African agriculture as a result of projected declines in runoff and increased uncertainty regarding future rainfall patterns under climate change.

## TARGETED RESEARCH TOOLS

Policymakers are generally more interested in the development of adaptation measures following political, rather than hydrologic, boundaries. As a consequence, this project developed vulnerability and adaptation measures at province- or state-levels for these two countries.

In parallel, stakeholder forums were held in Ethiopia and South Africa to discuss measures of vulnerability, adaptation options and constraints, and the role of information and various actors—that is, the State, private sector, and civil society—in shaping adaptation to climate change.

Finally, the impact of climate change on crop production in the survey sites was simulated based on crop yield and production function models to assess the implications of climate change for local food security.

At the basin level, the impact of climate change on water availability, water demands, and irrigation was simulated to identify basin-level adaptation strategies. Moreover, alternative investment strategies at the basin level were identified for Ethiopia taking into account climate variability and change, and broader impacts on the economy.

A different but similar approach was used to study the impact of climate change and adaptation strategies on river basin units in South Africa. To capture the interactions of climate change and adaptation at the national and regional (Sub-Saharan Africa) levels, a model of water and food projections was updated to take into account the impacts of climate change in addition to other drivers of global change.

Using the integrated analysis tool, the impact of global change on poverty and water and food security was assessed for case study countries and Sub-Saharan Africa. Alternative adaptation strategies developed at workshops were assessed using the modeling framework, taking into account the local-level constraints and basin-level challenges identified.

The outcomes of these analyses were used to guide appropriate response options to reduce rural vulnerability to global change.

## FOR MORE INFORMATION

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The CPWF website:
www.waterandfood.org

The 2nd International Forum on Water and Food web portal:
www.ifwf2.org

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