

HOW CAN AFRICAN AGRICULTURE ADAPT TO CLIMATE CHANGE? INSIGHTS FROM ETHIOPIA AND SOUTH AFRICA

Analysis of the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia

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Ethiopia's agricultural sector, which is dominated by small-scale, mixed-crop, and livestock farming, is the mainstay of the country's economy. It constitutes more than half of the country's gross domestic product, generates more than 85 percent of foreign exchange earnings, and employs about 80 percent of the population. Unfortunately, Ethiopia's dependence on agriculture makes the country particularly vulnerable to the adverse impacts of climate change on crop and livestock production. Thus, a deeper understanding of the complex interdependence between changing climatic conditions and Ethiopia's agricultural sector—together with adaptation options—is crucial.

Additional information about farmers' awareness of climate change and current adaptation approaches would assist policymakers in their efforts to decrease the country's vulnerability to the adverse impacts of climate change. This brief is based on a study that endeavors to guide policymakers on ways to promote greater adaptation by identifying the household characteristics that increase farmers' awareness of climate change and influence farmers' decision to adapt.

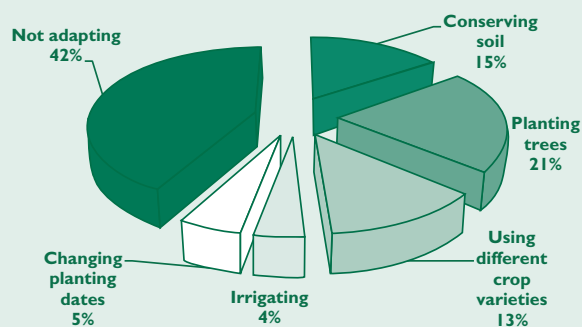
ADAPTATION METHODS

The study uses a cross-sectional household survey of farmers conducted during the 2004/05 production year in the Nile Basin of Ethiopia. The survey asked farmers how they respond to the negative impacts of climate change. Use of different crop varieties was the most common response, whereas use of irrigation was the least cited among the five adaptation methods identified. About 42 percent of those surveyed reported that they did not employ any adaptation methods (Figure 1).

Farmers reported that the primary reasons for choosing not to adapt were lack of information on climate change impacts and adaptation options, lack of financial resources, labor constraints, and land shortages. Adaptation to climate change is both costly and labor intensive. Lack of financial resources keeps farmers from acquiring the necessary technologies to allow them to adapt. For instance, while the Nile Basin in Ethiopia is rich in water resources, farmers generally cannot afford to invest in irrigation technology that would allow them to adapt to climate change or

sustain their livelihoods during climatic extremes, such as drought. Additionally, farmers are often unable to mobilize sufficient family labor or afford hired labor to make the necessary changes. Moreover, high population pressures force farmers to intensively farm small plots of land, making it difficult to adopt adaptation practices, such as planting trees, which require more land.

Figure 1 Farmers' methods of adapting to climate change



SOURCE: Deressa, T. T., R. M. Hassan, C. Ringler, T. Alemu, and M. Yesuf, *Analysis of the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia*, IFPRI Discussion Paper (Washington, DC: International Food Policy Research Institute, 2008 forthcoming).

CLIMATE CHANGE AWARENESS AND ADAPTATION

The study uses two separate models to examine the factors influencing farmers' decision to adapt to perceived climate changes. The models confirm that household wealth, represented by farm and nonfarm income and livestock ownership, increases the likelihood of climate change awareness and adaptation. Farmers are more likely to engage in soil conservation, use different crop varieties, and change planting dates as farm income

increases. Nonfarm income increases the likelihood of planting trees, changing planting dates, and using irrigation as adaptation options. Additionally, ownership of livestock significantly increases the probability of adapting to climate change.

Household characteristics—including the level of education, sex and age of the household head, and household size—are found to increase the probability of adaptation. A higher level of education is associated with greater access to information on climate change, improved technologies, and higher productivity. The results show that education increases climate change awareness and the likelihood of soil conservation and changing planting dates as an adaptation method. Male-headed households are found to be more likely to adapt to climate change. Given that men do much of the agricultural work in Ethiopia, they are more likely to obtain information about and have access to new technologies, and to take greater risks than female-headed households. The age of the household head, which captures farming experience, also influences awareness of, and adaptation to, climate change. Similarly, larger households are more likely to adapt to perceived climate change, probably because they are often associated with a higher labor endowments.

Access to rural services, including credit, crop and livestock extension, and information about climate change, also increases the use of adaptation options. Availability of credit eases cash constraints and allows farmers to purchase inputs such as fertilizer, improved crop varieties, and irrigation facilities. The study confirms a positive relationship between the level of adoption and the availability of credit. In particular, access to credit increases the likelihood that farmers will employ soil conservation methods, change planting dates, and irrigate. Access to crop and livestock extension significantly increases the likelihood of adaptation, particularly the probability of planting trees. Information about climate change and appropriate adaptation methods also increases the likelihood of adaptation.

Social networks play distinct roles in adoption of agricultural technologies: they act as conduits for financial transfers that may ease farmers' credit constraints, provide information about new technologies, and facilitate cooperation among farmers to allow the costs and benefits of adaptation to be shared. The study confirms that social networks—measured by the number of relatives living in the area and access to farmer-to-farmer

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extension—increase awareness of climate change. In addition, the study finds that access to farmer-to-farmer extension increases the likelihood of adaptation to climate change.

Farm location, local temperature, and the amount of precipitation also influence farmers' adaptation to climate change in the Nile Basin of Ethiopia. As expected, farmers living in different agroecological settings employ different adaptation methods. For instance, lowland farmers are more likely to conserve soil but less likely to use different crop varieties, to plant trees, or to irrigate compared with midland farmers. Further, while highland farmers are more likely to perceive changes in climate than midland farmers, those in the highlands are less likely to plant trees.

Farms in areas with higher annual mean temperatures over the survey period were more likely to adapt to climate change. Higher annual mean temperature increases the likelihood of employing soil conservation methods, using different crop varieties, changing planting dates, and irrigating. Similarly, lower levels of precipitation over the survey period increased the likelihood of adopting adaptation techniques—specifically, using soil conservation methods, changing crop varieties, changing planting dates, and irrigating. These results suggest that as the temperature rises and conditions become drier, farmers employ methods to preserve soil moisture to ensure that their crops survive.

POLICY IMPLICATIONS

Findings indicate that policymakers and other stakeholders would do well to raise awareness of climate change, facilitate the availability of credit, invest in technologies, create additional opportunities for off-farm employment, invest in research on the use of new crop varieties and livestock species that are more suited to drier conditions, encourage informal social networks, and invest in irrigation. Such measures would help farmers in the Nile Basin of Ethiopia to moderate the adverse consequences of climate change, while maintaining their livelihoods and food security.

FOR FURTHER READING

Deressa, T. T., R. M. Hassan, C. Ringler, T. Alemu, and M. Yesuf, *Analysis of the Determinants of Farmers' Choice of Adaptation Methods and Perceptions of Climate Change in the Nile Basin of Ethiopia*, IFPRI Discussion Paper No. 798 (Washington, DC: International Food Policy Research Institute, 2008).

This series of IFPRI Research Briefs is based on research supported by the Federal Ministry for Economic Cooperation and Development, Germany, under the project "Food and Water Security under Global Change: Developing Adaptive Capacity with a Focus on Rural Africa," which forms part of the CGIAR Challenge Program on Water and Food. Through collaboration with the Center for Environmental Economics and Policy in Africa, the Ethiopian Development Research Institute, the Ethiopian Economics Association, and the University of Hamburg, the project aims to provide policymakers and stakeholders in Ethiopia and South Africa with tools to better understand and analyze the consequences of global change—in particular climate change—and to form policy decisions that facilitate adaptation in these countries and beyond.

Financial Contributors and Partners

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

Printed on alternative-fiber paper manufactured from agriculturally sustainable resources that are processed chlorine-free (PCF).

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