



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

Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability

The Case of the Limpopo Basin, South Africa

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Climate change is expected to have serious environmental, economic, and social impacts on South Africa. In particular, rural farmers, whose livelihoods depend on the use of natural resources, are likely to bear the brunt of adverse impacts. The extent to which these impacts are felt depends in large part on the extent of adaptation in response to climate change. Adaptation is widely recognized as a vital component of any policy response to climate change. Without adaptation, climate change would be detrimental to the agricultural sector, but with adaptation, vulnerability can be significantly reduced.

This brief is based on a study that examines farmers' perceptions of climate change and analyzes their adaptation responses to climate change and variability using household survey data from the Limpopo River Basin in South Africa.

FARMERS' PERCEPTIONS OF CLIMATE CHANGE

Farmers' ability to perceive climate change is a key precondition for their choice to adapt. The accuracy of farmers' perceptions of climate change was assessed by comparing their perceptions of long-term changes in temperature and precipitation with climate trends recorded at nearby meteorological stations. About 91 percent of the farmers surveyed perceived an increase in temperature over the past 20 years. This perception was confirmed by the statistical record for the Limpopo River Basin between 1960 and 2003, which showed the increase occurring mostly in the summer months (October to March). An analysis of climate data at the provincial level shows the same general trend of increasing temperature with some minor variations in terms of the severity of the increase and its timing (warming occurred mostly during the winter months in Limpopo, Gauteng, and Mpumalanga). Thus, farmers' perceptions are supported by the statistical record.

In terms of precipitation, 81 percent of respondents reported a decrease in rainfall over the past 20 years. Approximately 12 percent of farmers reported a change in the timing of rains, and many of these respondents observed a delayed and shorter rainfall season (summer).

The recorded rainfall data for 1960–2003 show that about 85 percent of rainfall occurs during summer months. However, despite a majority perception that rainfall had decreased—and with the exception of the winter season where the data do show a

decreasing trend—the climate record shows no statistically significant trend over the past 40 years. Overall the climate record shows large variability in the amount of precipitation from year to year, and the same pattern was observed in each province. The high proportion of farmers noticing a decrease in precipitation could be due to the substantial decline in rainfall during 2001–03. Thus, farmer reports of a reduction in rainfall over the past 20 years may indicate that their perceptions are influenced by more recent climate trends.

A number of factors influence the likelihood that farmers will perceive climate change. Having fertile soil and access to water for irrigation decreases the likelihood that farmers will perceive climate changes, whereas education, experience, and access to extension services increase the likelihood that farmers will perceive climate changes. This suggests that perceptions are not based entirely on actual climate conditions and changes but are also influenced by other factors.

ADAPTATION TO CLIMATE CHANGE

Even though a large number of farmers interviewed noticed changes in climate, almost two-thirds chose not to undertake any remedial action. Among those farmers who did adapt, common responses included planting different crops, changing crop varieties, changing planting dates, increasing irrigation, diversifying crops, changing the amount of land grazed or under cultivation, and supplementing livestock feed. While adopting a new crop variety was the main strategy used to adapt to increasing temperature, building water-harvesting schemes was a popular strategy for coping with decreased precipitation.

Farmers cited a number of barriers to adaptation including poverty, lack of access to credit, and lack of savings. Insecure property rights and lack of markets were also cited as significant barriers to adaptation. A few farmers also reported lack of information and knowledge of appropriate adaptation measures as barriers to adaptation (Table 1).

Results from mathematical models indicate that experienced farmers are more likely to adapt to perceived climate change. In particular, the likelihood of diversifying portfolios (that is, adopting new crops or crop varieties, or using mixed farming systems), changing planting dates, and changing the amount of land under production increases with farm experience. This suggests that

Table 1 Barriers to adaptation in the Limpopo River Basin (% of the respondents)

	Lack of information about climate change	Lack of knowledge concerning appropriate adaptations	Poverty or lack of credit or savings	No access to water	Insecure property rights	Poor transport links or lack of market access	Others	No barriers
Total Basin	6	2	54	21	10	6	11	1
Limpopo	4	3	24	33	14	10	8	8
Northwest	10	0	55	3	3	1	9	22
Gauteng	0	0	32	12	0	4	20	10
Mpumalanga	9	2	48	9	6	1	13	23

farmers with greater management and technical skills are better able to cope with climate variability and change, and to spread risk by exploiting strategic complementarities among activities, such as crop–livestock integration.

Large households were more likely to adapt, indicating that additional household labor may facilitate the adoption of more labor-intensive adaptation options. Large-scale farmers were also more likely to adapt as a result of greater financial resources and access to capital, which enable them to invest in more costly technologies, such as irrigation. Likewise, wealthier households were more likely to change their planting dates in response to perceived climate change.

Access to rural services such as extension and credit also increases the likelihood of adaptation. Farmers with access to extension services—and who are therefore more likely to have knowledge of management practices to address climate changes—were more likely to diversify their portfolios in an effort to reduce risk. Access to credit also increases the likelihood that farmers will diversify their portfolios and buy feed supplements for their livestock. Given that lack of financial resources is one of the major constraints to adaptation, access to credit enables farmers with limited financial resources to purchase the necessary inputs and equipment associated with many adaptation options.

Having secure property rights also increases the probability of adaptation. With clear property rights farmers are able to make adaptation decisions involving their land, such as changing the amount of land under cultivation. Access to fertile soil also increases the likelihood that farmers will increase the amount of land under cultivation in response to climate change.

While off-farm employment could present a constraint to adaptation by reducing time spent managing farms, the results show that farmers who engage in off-farm activities are more likely to

supplement livestock feed. This suggests that expanding smallholder farmers' access to off-farm income sources increases the probability that they will be able to afford adaptation measures.

The results show important regional variation. In the Limpopo province,

which has a large rural population dependent on agriculture, farmers were more likely to adapt to climate changes compared with those in the other provinces. Similarly, households located in regions with high temperatures were more likely to adapt their farming practices, particularly by diversifying their portfolios, using irrigation, and changing planting dates.

CONCLUSIONS AND POLICY IMPLICATIONS

Given that few farmers adjusted their farming practices despite perceiving changes in climate, governments should facilitate adaptation by enabling farmers to overcome the barriers reported in this study. Specifically, policies should ensure that farmers have access to affordable credit, which would give them greater flexibility to modify their production strategies in response to climate change. Because access to water for irrigation increases farmers' resilience to climate variability, greater investments in smart irrigation are needed. Reforming pricing, clearly defining property rights, and strengthening farm-level managerial capacity should also be emphasized to promote efficient water use. More importantly, given that land reform has increased the number of less experienced and unskilled farmers, extension services need to be expanded with highly qualified personnel. Additional measures required are improving off-farm income-earning opportunities, and facilitating a smooth transition from subsistence to commercial farming.

FOR FURTHER READING

Gbetibouo, G. A., *Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa*, IFPRI Discussion Paper (Washington, DC: International Food Policy Research Institute, forthcoming 2009).

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