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Southern African Agriculture and Climate Change:
A COMPREHENSIVE ANALYSIS — MOZAMBIQUE

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DECEMBER 2012

CURRENT CONDITIONS

Mozambique's diverse climate is influenced by monsoons from the Indian Ocean and the hot current of the Mozambique Canal. The country's location makes it particularly vulnerability to climatic hazards such as drought, floods, and recurring tropical cyclones during the rainy season, which spans from October to April. Agriculture is the major activity of most of the population, contributing about 24 percent of the country's gross domestic product. The major crops are sugarcane, copra, sesame seeds, sugar beans, sunflower, rice, millet, and maize. Mozambique's population has doubled from independence in 1975 to the present day. The mortality rate among children under five has declined in the last 40 years thanks to improvements in the quality of health services and wider access to those services, mainly in rural areas. Life expectancy at birth increased from the 1960s through the late 1990s, but in the recent years it has decreased.

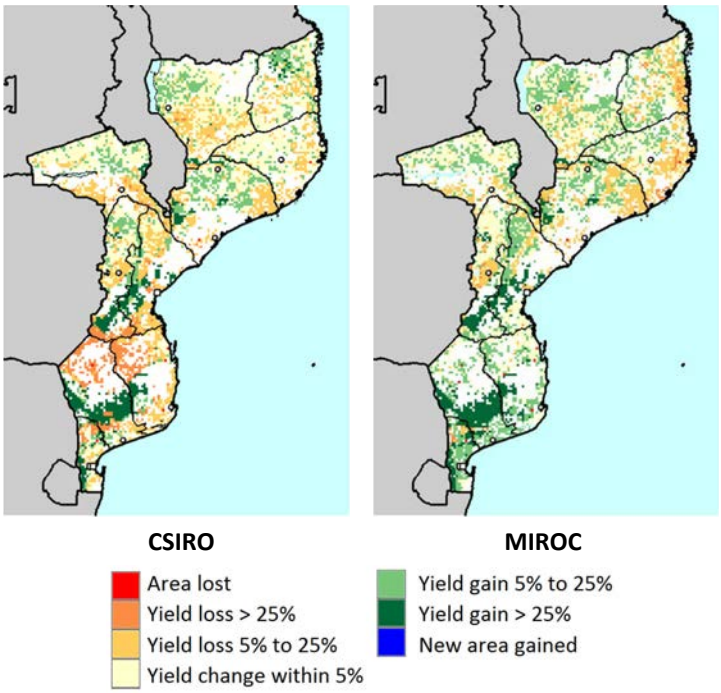
CLIMATE CHANGE SCENARIOS & THEIR POTENTIAL EFFECTS ON YIELDS

Of the four downscaled global climate models (GCMs) used in our study, all of which are from the IPCC AR4, the CSIRO model projects very little change in rainfall across the country, with a slight reduction in the eastern part of Inhambane province and an increase in part of Tete province. The MIROC model showed little change over most of the coastal area and the southern part of the country, but in the northern and northwestern parts, away from the coast, an increase in rainfall is predicted, exceeding 200 mm in a few places.

The models were also used to project annual changes in mean maximum daily temperature for the warmest month of the year through 2050. All four models predict higher temperaturea, though the degree of change differs from model to model and from region to region. CSIRO predicts the least change, with most of the country in the 1 to 1.5°C range, though changes in parts of the south go almost as high as 2°C. The MIROC model predicts slightly hotter temperatures, with increases of 2°C to 2.5°C, especially in the northeastern part of the country.

The maps above depict the results of the Decision Support System for Agrotechnology Transfer (DSSAT) crop modeling software projections for rainfed maize, comparing crop yields for

CHANGE IN YIELD WITH CLIMATE CHANGE: RAINFED MAIZE



2050 with climate change to yields with the 2000 climate. The results are geographically varied, with some areas showing gains in yield and others losses. The results also vary from one model to another. The CSIRO and MIROC models show a marked yield gain (between 5 and 25 percent) in the north. For the southern part of the country, the MIROC model shows yield increases of more than 25 percent over significant areas. On the other hand, while the CSIRO model also predicts yield gains in excess of 25 percent in some parts of the south, it also projects some yield losses of similar magnitude.

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CLIMATE CHANGE & FOOD SECURITY SCENARIOS

The research used the IMPACT global model for food and agriculture to estimate the impact of future GDP and population scenarios on crop production and staple consumption, which can be used to derive commodity prices, agricultural trade patterns, food prices, calorie consumption, and child malnutrition. Three GDP-per-capita scenarios were used—an optimistic scenario with high per capita income growth, a pessimistic scenario with low per capita income growth, and an intermediate (or baseline) scenario.

For Mozambique, the three scenarios all show a very moderate increase in GDP until around 2025, after which the optimistic scenario shows a much more rapid increase than the others, overtaking the intermediate scenario by around 2037. This crossing pattern is due to the fact that these scenarios came from different sources. While the optimistic scenario shows a more than ten-fold increase between 2010 and 2050, even the pessimistic scenario shows GDP quadrupling over the same period.

IMPACT projects a near doubling of yield between 2010 and 2050. Harvested area will rise slightly through 2030 and then fall back to 2010 levels by 2050. The higher yields and changes in harvested area should produce a doubling of total production between 2010 and 2050.

There is very little variation of yield projections between climate models or between scenarios for maize in Mozambique, with yield increases being driven by changes in consumer demand and technological advances.

Net exports are expected to increase to a plateau in 2025, followed by a slow decrease after 2040. The world price of maize is expected to rise during the entire period.

Cassava yields are projected to increase slowly through 2025 and then to begin a gradual decline. As was true for maize, yield projections for cassava have very little difference between climate models and scenarios.

Harvested area will increase slightly from 2010 to 2050, driving a slow but steady increase in production over the same period. With rising demand from a larger population, net exports are estimated to increase only slightly up to 2015, followed by a steep reduction through 2050. The world price of cassava is projected to increase very gradually through 2040 in all scenarios. In the pessimistic scenario, cassava prices will then continue to increase. In the baseline scenario, they will hold steady from 2040 to 2050, whereas the optimistic scenario suggests a minor decline from 2040 to 2050.

The IMPACT model was also used to predict the number of malnourished children under the age of five and the number of available kilocalories per capita. All scenarios show a moderate increase in the number of malnourished children from 2010 to 2025 and reductions thereafter, with sharper reductions under the optimistic and baseline scenarios. The pessimistic scenario peaks in 2023 at around 1,040,000 children, declining to about 800,000 in 2050. The baseline scenario peaks in 2020 or so before declining to 520,000. The optimistic scenario peaks slightly later than the intermediate scenario and slightly earlier than the pessimistic scenario, and then declines sharply to fewer than 250,000 by 2050.

Under the pessimistic scenario, the IMPACT projections of available kilocalories per capita level remains more or less constant through 2030, at about 1,800 per day, and then rises to about 2,050. The baseline scenario shows a constant level of available kilocalories through 2025 and an increase thereafter. The optimistic scenario is similar to the intermediate scenario but rises more sharply, showing an increase to 2,900 kcal by 2050, well above the 2,000 kcal/day considered as the healthy intake for an active adult.

RECOMMENDATIONS

In a country where incomes are low, where a growing population exerts mounting pressure on natural systems, and where roads are poor, climate change poses a potentially severe problem for agriculture. Under these circumstances, the need to implement the Mozambican National Adaptation Plan of Action (NAPA) for agriculture is urgent. Highest priority must be given to the objective of strengthening the capacities of agricultural producers to cope with climate change.

Among the recommendations advanced in the monograph from which this brief was drawn are the following. Policymakers should:

- enhance the road network in the north of Mozambique so that the expected increase in cassava and maize production can be distributed throughout the country;
- contribute to self-sufficiency and food security by finding alternative sources of crops, such as sorghum; and
- identify alternative cassava varieties suitable to the changing climate.

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This is an excerpt from the chapter on Mozambique that will appear in the forthcoming peer-reviewed IFPRI monograph, *Southern African Agriculture and Climate Change: A Comprehensive Analysis*. For more information, contact g.nelson@ifpri.org. The authors would like to acknowledge financial support from the European Union and the Canadian International Development Agency through their support of the CGIAR Research Program on Climate Change, Agriculture, and Food Security, the German Federal Ministry for Economic Cooperation and Development, and the Bill and Melinda Gates Foundation.