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

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CURRENT CONDITIONS

Malawi's tropical continental climate is moderated by the effects of Lake Malawi and by the country's high altitudes and proximity to the influence of westerly frontal systems that move eastward around the South African coast. There are two distinct seasons—rainy (October–April) and dry (May–October). The mean annual rainfall ranges from 500 mm in the hot, dry Rift Valley areas, where temperatures reach 35°C, to 3,000 mm in the highlands, where temperatures are moderate. Agriculture is the backbone of Malawi's economy contributing about 30 percent of the country's gross domestic product (GDP). The major food crops are maize, sorghum, millet, cassava, sweet potatoes, bananas, rice, beans, groundnuts and various pulses, which are produced throughout Malawi. Life expectancy at birth marginally improved from 37 years in 1960 to about 50 years in 1992, before dropping back to 45 years in 2002.This drop has been attributed to the HIV/AIDS pandemic. The situation improved to about 48 years in 2005 and is rising.

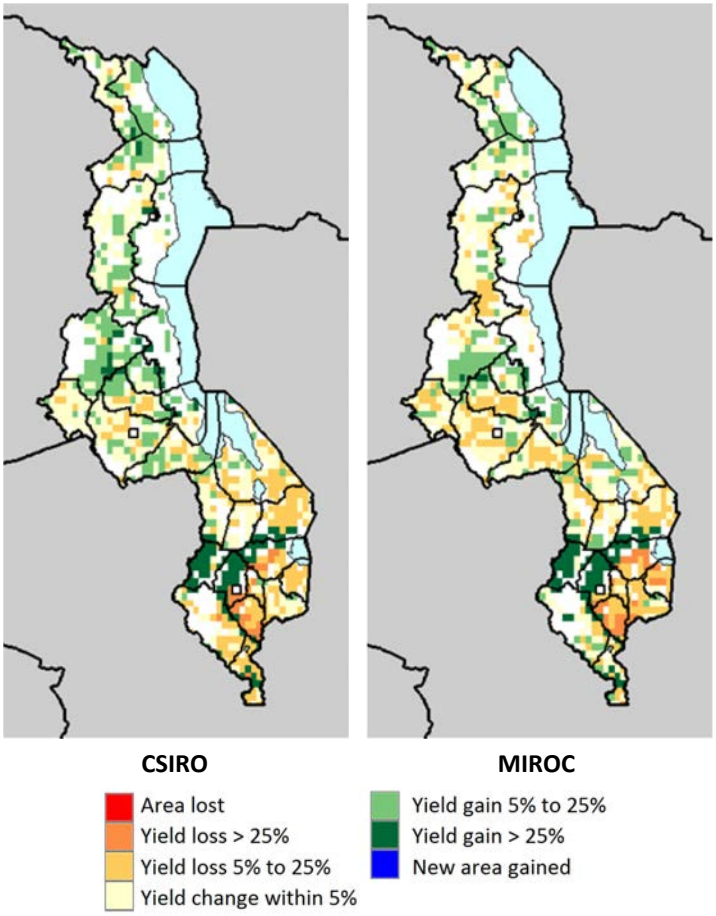
CLIMATE CHANGE SCENARIOS & THEIR POTENTIAL EFFECTS ON YIELDS

As a basis for our analysis, we used four downscaled global climate models (GCMs) from the IPCC AR4. The CSIRO model projects that mean annual precipitation for Malawi will remain unchanged between 2000 and 2050. The MIROC model, by contrast, foresees increases in mean annual precipitation ranging from 200 mm to 400 mm for the northern and central regions of the country, and 50 mm to 200 mm over most of the southern region. The differences between the models highlight the uncertainties associated with modeling precipitation using GCMs.

The models were also used to project changes over time in the mean maximum daily temperature for the warmest month. The CSIRO model projects a relatively modest increase of between 1 to 1.5°C between 2000 and 2050. The MIROC model suggests a similar rise for the northernmost part of the country only; in the rest of Malawi, it foresees an increase of 1.5 to 2°C. The projected increase in temperatures would result in higher evapotranspiration and reduced moisture, threatening crops and varieties that are not heat-tolerant.

The accompanying maps depict the results of the Decision Support System for Agrotechnology Transfer (DSSAT) crop modeling software projections for rainfed maize, comparing crop yields for 2050 with climate change to yields with the 2000 climate.

CHANGE IN YIELD WITH CLIMATE CHANGE: RAINFED MAIZE



The results for the CSIRO model, used with DSSAT, show a brighter prediction for maize in the northern and central regions, with most areas showing a gain in yield of 5 to 25 percent. The projection is not as optimistic in the southern region, where there remain small areas with projected yield gains of more than 25 percent, but also large areas showing a 5 to 25 percent decline in rainfed maize yield. The MIROC model yields similar projections.

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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.

The optimistic scenario projects an increase in GDP per capita to almost $2,500 by 2050. In contrast, the pessimistic and intermediate scenarios show incomes rising to just $650 and $740, respectively, by the same year.

The results indicate that the total acreage allocated for the production of maize from 2010 to 2050 will remain almost the same under the three scenarios, and with very little difference between climate models. Yield will rise by more than 15 percent between 2010 and 2030, then remain flat or decline slightly thereafter. Production will follow yield very closely. However, despite increased world prices for maize, net exports will decrease considerably owing to increased population growth through 2050.

For cassava, the IMPACT model projects that yield will grow by nearly 50 percent from 2010 to 2050 under each of the three scenarios. During the same period, however, planted area will shrink and net exports will fall substantially under all scenarios. Despite increases in the world price of cassava and other roots and tuber crops, the IMPACT model projects that Malawi will begin importing these commodities.

In contrast with maize and cassava, cotton production over the 40-year period is projected to increase significantly under all scenarios. The total production and yield per hectare for cotton will more than double by 2050 under the three scenarios, even though the area planted to cotton is expected to increase only slightly owing to land scarcity. However, net exports will more than triple, reflecting rising world prices of cotton.

In the IMPACT model, the pessimistic and baseline scenarios give similar estimates in both cases with the share of malnourished children under 5 rising by 3 percentage points in all scenarios until 2020, then declining thereafter. Both the pessimistic and baseline scenarios result in a decline of around 7 percentage points, from 32 to 25 percent, between 2010 and 2050. The optimistic percentage falls to around 15 percent malnourished.

Levels of available kilocalories per capita are expected to remain the same under the three scenarios until 2030 when differences will emerge. The optimistic scenario projects that available kilocalories per capita will increase to about 2,800 by 2050. The other two scenarios suggest that about 1,800 kilocalories per capita will be available by the year 2050. In these two scenarios, large price increases seem to negate income increases.

RECOMMENDATIONS

Malawi needs dedicated policy instruments to manage the effect of climate change on agriculture, sustainable livelihoods, and other factors important for socioeconomic development.

The following are among the recommendations advanced in the monograph from which this brief was drawn. Malawi's policymakers should:

- develop an enabling policy environment and clear policies to better manage the effects of climate change on socioeconomic activity, as well as plans to implement adaptive measures;
- develops a disaster risk policy and related implementation plan that will enable better management of site-specific floods and droughts;
- Implement the ASWAp (Agriculture Sector-Wide Approach) component of agriculture commercialization;
- Include other crops in the modeling of a larger basket of cash and staple crops;
- strengthen the capacity and coordination of grassroots institutions—such as district, area, and village committees—to enable them to provide better services to the rural communities that are most affected by climate change events, especially floods and droughts; and
- enhance the capacity of rural communities to adapt to climate change by expanding access to agricultural inputs, facilitating smallholders' access to credit, establishing a weather-based insurance program, building a system to provide seasonal weather predictions, expanding the quality and reach of extension services offering technical assistance, increasing investment in agricultural research to develop and test varieties likely to be resistant to climate change.

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