

Southern African Agriculture and Climate Change: A COMPREHENSIVE ANALYSIS – LESOTHO

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CURRENT CONDITIONS

Lesotho lies on the plateau of the southern African subcontinent. Variations in topography and micro-climate shape the country's ecological zones—the lowlands, the foothills, the highlands, and the Senqu River Valley. Annual precipitation is highly variable, both temporally and spatially, ranging from 500 mm to 760 mm. Temperatures, too, are highly variable, ranging from -10°C to 30°C .

Agriculture accounts for just 10 percent of the country's gross domestic product, but it is the livelihood of most rural residents and employs 60–70 percent of the country's labor force. The principal crops of maize, sorghum, and wheat, which are planted on nearly 85 percent of the cultivated area, have already been drastically affected by changing climate. Livestock contribute 30 percent of total agricultural output and also are threatened by drought and rangeland degradation.

CLIMATE CHANGE SCENARIOS & THEIR POTENTIAL EFFECTS ON YIELDS

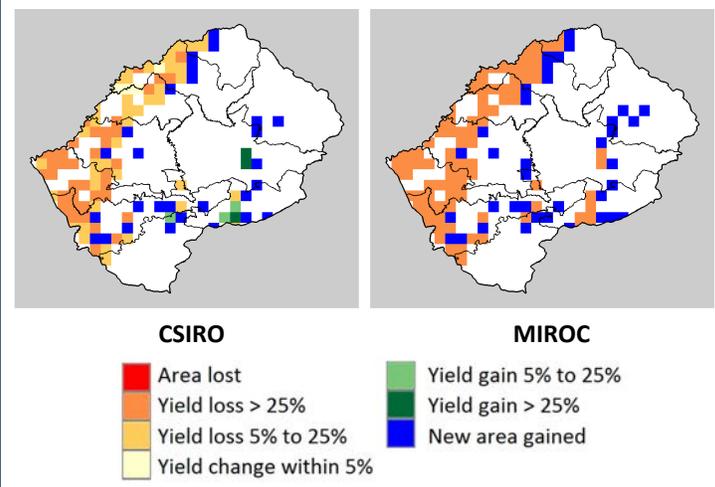
The four downscaled global climate models (GCMs) used in our study, all of which are from the IPCC AR4, predict that Lesotho will become warmer, and that precipitation will diminish, by 2050. The CSIRO model projects a significant decrease in rainfall (between 50 mm and 100 mm annually) in the lowlands, foothills, and southern Senqu Valley, with little change in the mountains and northern Senqu Valley (plus or minus 50 mm). The MIROC model foresees severe reductions in rainfall (between 100 and 200 mm) for the whole country.

The climate change models also projected changes from 2000 to 2050 in average daily maximum temperature for the warmest month of the year. The CSIRO model shows temperature increases of between 1.0°C and 2.0°C throughout the country, with the lower increases in the mountain zone. MIROC shows temperature increases of between 1.5°C and 2.0°C for the whole country.

Significant changes in precipitation and temperature could have severe impacts on people's livelihoods, and especially on agriculture—particularly in the lowlands, foothills, and Senqu Valley, the most densely populated and cultivated regions of the country. In these zones, increasing temperatures and decreasing precipitation could lead to a substantial decrease in harvests.

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

CHANGES IN YIELD WITH CLIMATE CHANGE: RAINFED MAIZE



2050 with climate change to yields with 2000 climate. Maize yield is projected to decrease as precipitation declines and temperatures increase. By contrast, sorghum yield should make substantial gains in some zones, owing to its drought tolerance.

Both the CSIRO and MIROC models point to declining maize yields in the lowlands and foothills. In the southern lowlands zone, a yield loss of more than 25 percent of baseline is anticipated. CSIRO predicts declines of 5 to 25 percent in much of the northern lowland zone, as a result of decreasing precipitation and increasing temperatures.

Some parts of the country are predicted to gain new area for maize under all four models, notably the mountain zone and the edges of the foothill zones, where temperatures are expected to become warm enough to support maize cultivation. These areas are likely to draw farmers away from currently planted areas that become less fertile with climate change. To avoid environmental damage from such migrations, policymakers should consider whether some of the previously uncultivated areas ought to be protected through the creation of national parks or other limitations on access.

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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.

GDP per capita is projected to nearly double between 2010 and 2025 under all scenarios, and then to increase at healthy rates, with the optimistic scenario showing very rapid growth. A slowdown in the pessimistic scenario between 2010 and 2025, relative to growth from 1960 to 2010, is due to the global financial and economic crisis and to high inflation driven by soaring food and oil prices. The optimistic projection assumes that GDP will continue to increase at its past rate, with the contribution of agriculture to the GDP remaining unchanged or increasing slightly.

Under the three scenarios plotted in the IMPACT model, the area planted to maize will remain more or less unchanged, but production and yields will increase by more than 200 percent between 2010 and 2050. Production, yields, and harvested area for sorghum are also expected to increase substantially. All three scenarios showed the global price of maize and sorghum increasing, indicating considerable potential for exports of surplus crops. Wheat production, however, will not keep pace with increases in domestic demand, and Lesotho will have to import the deficit.

Increases in maize production will be highly dependent on increases in productivity, as the area under cultivation is expected to remain unchanged. Increases in cereal productivity will in turn depend on high levels of inputs, as GDP increases and improves farmers' income. Under the optimistic scenario, in which the population will actually shrink by 2050, a decrease in cereal consumption is expected, making exports possible. If this downward trend in population growth materializes, Lesotho might be food-secure by 2050. Population growth may be slowed by a variety of factors, including HIV/AIDS and emigration.

The international price of maize between 2010 and 2050 is projected to increase by 101 percent. The analogous increase for wheat is the expected to be 54 percent; for sorghum, 25 percent.

The IMPACT model also predicted the number of malnourished children under the age of five, and the number of available kilocalories per capita. All three scenarios projected the number of malnourished children under five to rise through 2020. Under the pessimistic scenario, malnutrition will increase from 68,000 children in 2010 to 100,000 by 2020, gradually declining thereafter to 86,000 by 2050. The baseline scenario shows the number decreasing to 70,000 by 2050; the optimistic scenario, to fewer than 50,000.

One of the major causes of illness among Lesotho's children is protein-caloric malnutrition. All three scenarios showed kilocalories per capita decreasing from more than 2,500 in 2010—the recommended level for young men—to 2,000 by 2030. In the pessimistic scenario, the level then remains unchanged through 2050. The problem is that expected increases in income effects may be negated by price increases. The baseline scenario shows kilocalories per capita increasing to 2,200 by 2050, while the optimistic scenario shows an increase to 2800.

RECOMMENDATIONS

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

To avoid adverse effects from climate change, policymakers in Lesotho should:

- support increased investment in the adaptation program highlighted in the NAPA report;
- raise awareness of the effects of climate change within government, nongovernmental organizations, the private sector, and the general public;
- promote the use of drought-tolerant and heat-tolerant crop varieties and hardy livestock;
- strengthen climate change monitoring and early warning systems;
- incorporate climate-change adaptations in long-term planning and developmental programs, for example, by investing in climate-change adaptation strategies;
- support the expansion of irrigation among smallholders in vulnerable communities;
- expand access to seasonal weather forecasts and early warning systems, particularly in poor communities

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