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West African Agriculture and Climate Change: A COMPREHENSIVE ANALYSIS – LIBERIA

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CURRENT CONDITIONS

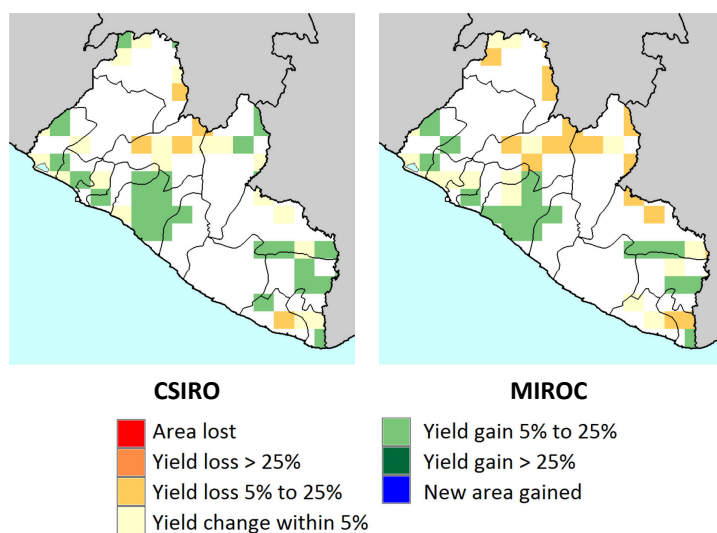
Agricultural production in Liberia is based primarily on rainfed farming, with an April–November rainy season. Rice and cassava are the first and second staple food crops, while rubber is the major cash crop. The share of GDP from agriculture increased slowly from about 30 percent in the mid-1960s to 40 percent in 1990.

Life expectancy increased slightly between 1960 and 1979, stabilized at about 48 years through the late 1980s, and has been increasing since (to about 60 years in 2008). The mortality rate for children under five years has been dropping steadily. The malnutrition rate for children under five was estimated at 20.4 percent in 2007. The road network is largely underdeveloped, and many areas are frequently cut off during the rainy season. In the high variant scenario, Liberia's population will double by 2040. Population growth will present challenges for a country still reeling from more than a decade of civil war.

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, which predict diverse results for changes in annual rainfall by 2050. The CNRM GCM has no significant change projected for the northern two-thirds of the country, but farther south, rainfall is projected to increase by as much as 135 mm. The CSIRO model predicts a wetter situation than the CNRM model, not because the maximum rainfall is greater than what is predicted in the CNRM model, but because increases in rainfall are projected for 80 percent of the country. The highest increases of between 100 and 130 mm are along the coast. The ECHAM model also predicts wet conditions in central Liberia, but it also projects a reduction in rainfall of 50–100 mm in the Grand Kru, River Geo, and Maryland counties. The MIROC model predicts very dry conditions across the country, with decreases in rainfall of up to 300 mm, and decreases of greater than 200 mm covering 90 percent of the country.

YIELD CHANGE UNDER CLIMATE CHANGE: RAINFED RICE



All the models predict a relatively uniform increase across the country in the average daily maximum temperature during the warmest month. The CNRM predicts an increase of 2–2.5° C. Both the CSIRO and MIROC models predict an increase of 1–1.5° C. However, the ECHAM model predicts an increase of 1.5–2° C.

The maps above depict the results of the Decision Support System for Agrotechnology Transfer (DSSAT) crop modeling software projections for rainfed rice, comparing crop yields for 2050 with climate change to yields with 2000 climate. The CSIRO and MIROC models give similar results, with yield increases along the coast and in the eastern part of the country, and yield losses in the northern part of the country.

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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 and low population growth, a pessimistic scenario with low per capita income growth and high population growth, and an intermediate (or baseline) scenario.

The pessimistic scenario for per capita GDP is almost identical to the baseline scenario, with income quadrupling in the pessimistic scenario between 2010 and 2050, with another 50 percent above that for the baseline scenario. In the optimistic scenario, per capita GDP in 2050 is almost 10 times more than that of 2010.

IMPACT projects rice yield more than tripling in Liberia between 2010 and 2050, averaging the yield across all scenarios and climate models. Variation between yields from climate models in the intermediate scenario is moderate, with the high yield being 10 percent greater than the low yield. All scenarios project very little change in harvested area for rice. As a result, total rice production triples, but that still is not enough to keep up with domestic demand which is growing rapidly due to population growth and income growth, particularly in the optimistic scenario, for which net imports grows very rapidly.

Rice yields are much higher in IMPACT than in DSSAT because the DSSAT crop model did not allow for climate change adaptation or for technological improvement like the IMPACT model does.

Cassava yields are projected to rise between 2010 and 2050, but much more modestly than for rice, averaging 33 percent over all scenarios and climate models. The high-yield climate model projected a 35 percent higher yield than the low-yield climate model. The harvested area of cassava will decrease by 12 percent.

Loss of area, combined with population growth, will cause the country to become an importer of cassava (by increasing amounts).

Sugarcane yields rise only 10 percent between 2010 and 2050. There is 8 percent variance in the yield between climate models. Harvest area, on the other hand, is projected to more than double. Therefore, production is likely to more than double, which is not enough to keep up with increased demand.

In the baseline and pessimistic scenarios, low per capita GDP and relatively higher population result in an increase in the number of malnourished children under five. For the baseline scenario, this trend will continue until the year 2030, and for the pessimistic scenario, the trend will continue until 2035. However, malnutrition rates may fall slightly during those years due to a fast population growth rate

Average calorie consumption results varied. Available kilocalories per capita will eventually rise with an increase in per capita GDP, although it is fairly constant between 2010 and 2025. There is a correlation between the availability of kilocalories and the reduction of malnutrition in children under the age of five.

RECOMMENDATIONS

Among the recommendations advanced in the monograph from which this brief was drawn are that policymakers should:

- address the challenges associated with population growth;
- improve rural infrastructure to facilitate transport of agricultural products from rural to urban areas;
- support the development of suitable varieties of major crops, particularly staple foods and rice; and
- strengthen policy on food and nutrition security (including the provision of safety nets) for vulnerable groups, especially those who depend on agricultural activities for their livelihoods.

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