GCRFAFRICAP

CLIMATE SMART AGRICULTURE FOR DEVELOPMENT

SCENARIO SUMMARY **Nov 2021**

Zambia – 'Solitude and self-sufficiency'

Low climate risk (RCP2.6)/low market connectivity (LT)

KEY MESSAGES

- **Under this scenario, by 2050, an increase in average temperatures, and increases in the occurrence and intensity of temperature and rainfall extremes, will lead to decreases in crop and livestock meat and dairy yields, and increases in yield shocks.**
- **Along with a 276% increase in population, low market connectivity and yield reductions will mean that Zambia will not achieve food and nutrition security under all likely trade scenarios; if nutrition security were to be achieved through increased reliance on food trade, 81% of calories would need to be imported.**
- **National greenhouse gas emissions are projected to decrease in this scenario, although net emissions (taking into account both emissions and changes in soil organic carbon) and emission intensity (the amount emitted per unit of food produced) increase.**
- **Research and investment is needed into improved varieties of a diverse range of crops in order to realize yield gains, avoid yield shocks and mitigate the impacts of pests and diseases.**

Scenario climate trends and socio-economic parameters

- Average temperatures are expected to increase by 1-2°C by 2050, with a 50-100% increase in the number of days with average temperatures above 35°C.
- Rainfall trends are less robust, with some significant disagreements between climate models for rainfall projections. There may be a weak tendency towards higher rainfall amounts during the rainy season from October to April (approximately 10mm) and a slight trend towards longer extreme dry spells at the start and end of the rainy season consistent with a general shortening of the rainy season.
- Under this scenario it is assumed that there is no change from the 2000 baseline in the area under crop production or pasture, or in irrigation, but crop diversity is assumed to increase.

Impacts on and implications for agricultural systems

- Crop yields are expected to decrease under this scenario. Yield losses of 10-20% are expected for maize, soybean and groundnut, even with autonomous adaptation, with some small gains for potato.
- Yield shocks occur when yields in any one year fall to below 1000kg/ha for maize and potatoes, and 500kg/ha for soybean and groundnut. The downward trends in yields under this scenario will contribute to a 50% increase in years experiencing yield shocks for maize and soybean, with groundnut yield shocks expected to double and potato yield shocks expected to triple, by 2050.

- Diversification into cassava, sorghum and beans may occur if maize yields decline. This could improve farm resilience by suppressing pest outbreaks and transmission, and by buffering the effects of climate change on any one crop.
- Meat and dairy production could increase by 4-5%, which would help to address the likely increased demand for livestock and livestock products driven by increased urbanisation.
- It is assumed under this scenario that there will be no change in the land area under irrigation. Maintaining current rates may alleviate pressure on and depletion of water resources while offsetting some of the impacts of climate change on crop production.
- It would not be economical under this scenario for farmers to invest in chemical pesticides or resistant crop varieties. Control measures for crop pests and diseases are likely to remain similar to the baseline, and include a mixture of biocontrol from natural areas, handpicking insects and destroying infected plants. Losses of 20-40% of yields to pests and diseases would therefore likely continue. Traditional and integrated management practices implemented through farmer training programs may reduce the negative impact of crop pests and diseases on yields.
- Small increases in aflatoxin contamination of maize is likely by 2050 without technological investment and effective policy implementation. Cassava toxicity is likely to quadruple by 2050, although reduced consumption would help to offset the health impacts.
- National greenhouse gas emissions will decrease by 18% by 2050 under this scenario, compared to the year 2000. At the same time soil organic carbon stocks will also decrease by 6%. Net greenhouse gas emissions (taking into account emissions and soil organic carbon changes) increase by 32%. Emission intensity (the amount emitted per unit of food produced) increases by 23%.
- Reductions in incomes and increased food insecurity is likely for many households under this scenario due to yield losses for both subsistence and cash crops, and a lack of market access. Increased pests will increase labour demands on farm. If farming becomes too labour intensive and expensive, farmers may diversify out of agriculture. It is assumed under this scenario that farmers will diversify their crops to reduce exposure to risks of yield loss. Livelihood outcomes will depend on farmers' ability to implement these adaptations.

Trade and nutrition trade-offs

- In this scenario, for non-optimized trade vignettes, nutrition security is not achieved for all nutrients and deteriorates from the 2000 baseline, in part due to a 276% increase in the size of the population.
- Reliance on domestic production for nutrition security may be hampered by around a four-fold increase in cassava toxicity, posing health risks. Reductions in cassava consumption may help to offset this.
- If nutrition security were achieved through increased reliance on food trade, approximately 81% of the supply of calories would need to be imported, leading to high import dependence in a scenario where market connectivity is low. These calories would need to come from a range of nutrient-dense foods to achieve population-level nutrient requirements.

Potential responses

- Investment in research and development of new maize varieties could realise yield benefits of ~7%, and mitigate the expected yield reductions under this scenario. There is also potential for significant yield gains to be realised within non-maize crops by 2050, in some cases with less significant adaptation required, so investing in breeding in non-maize crops may be cost effective and contribute to improved nutrition outcomes. Continued investment in crop breeding is required in order to ensure that the adaptation of crops can keep pace with changing conditions even under the low climate risk in this scenario.

- Diversification will therefore be an important strategy in realizing yield gains, avoiding yield shocks and mitigating the impacts of pests and diseases.
- Innovation is needed to improve the efficiency of current irrigation in Zambia. Effective implementation of irrigation and improved crop varieties would significantly reduce the rates of yield shock experienced.
- Improved resilience of rainfed agricultural systems under the climate changes expected in this scenario is needed, as obtaining adequate soil water will be a challenge. Adoption of conservation agriculture (where this is suitable) and targeted fertilizer application will help to improve soil health including build-up of soil organic carbon, which will lead to greater crop yields.

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About the Agricultural and Food-system Resilience: Increasing Capacity and Advising Policy (AFRICAP) Programme
The Agricultural and Food-system Resilience: Increasing Capacity and Advising Policy (AFRICAP) programme is a four-year research programme focused on improving evidence-based policy making to develop sustainable, productive, agricultural systems, resilient to climate change. The programme is being implemented in Malawi, South Africa, Tanzania, Zambia, and the UK led by the University of Leeds, in partnership with the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), a pan-African multi-stakeholder policy network. The programme is funded by the UK Government from the Global Challenges Research Fund (GCRF), which aims to support research that addresses critical problems in developing countries across the world. It is administered by the UK's Biotechnology and Biological Sciences Research Council (BBSRC) - UK Research and Innovation (UKRI).

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