GCRFAFRICAP
CLIMATE SMART AGRICULTURE FOR DEVELOPMENT

SCENARIO SUMMARY **Nov 2021**

Zambia – 'Opportunity and Exposure'

Low climate risk (RCP2.6)/high market connectivity (HT)

KEY MESSAGES

- **Under this scenario, by 2050, while average temperatures and the occurrence and intensity of temperature and rainfall extremes will increase, effective policy for technology development and improved varieties will mean increases in yields.**
- **However, with a 276% increase in population, Zambia will not achieve nutrition security for all nutrients under all likely trade scenarios; if nutrition security were to be achieved through increased reliance on food trade, 43% of calories would need to be imported.**
- **National greenhouse gas emissions are projected to more than triple 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) fall.**
- **There are opportunities to promote a diversity of livestock, and potential for integrated crop-livestock production systems but policies will need to be complementary and coherent in order to prevent conflicts between livestock and crop production.**

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 the area under crops expands by 5%, the area under livestock pasture expands by 25%, the area under irrigation increases, and crop diversity increases.

Impacts on and implications for agricultural systems

- Under this scenario, crop, livestock meat and dairy production will all increase (252%, 250% and 183% respectively) due to significant policy efforts to improve farm efficiency through technology, irrigation and improved varieties.
- It is assumed that the same percentage change to crop yields experienced from 1961 to 2010 (i.e. management and technology improvements to yields) will continue to 2050 – i.e. a substantial yield improvement compared to the baseline. This amounts to more than a doubling of crop yields on average.

- Effective implementation of irrigation and improved crop varieties are likely to result in significantly reduced yield shock rates (when yields in any one year fall to below 1000kg/ha for maize and potatoes, and 500kg/ha for soybean and groundnut).
- With good market incentives, availability of improved cultivars, diverse crops and varieties, planting early-maturing and/or stress-resistant crops, coupled with good agronomic practices and sustainable land management, it may be possible to achieve a cereal yield gain of over 5t/ha by 2050 from the 1t/ha currently.
- Under this scenario all arable land is under irrigation by 2050. This will lead to a significant increase in demand for water (mean change of 2582%), potentially increasing tensions over transboundary water resources in the Zambesi River Basin.
- While overall crop diversity increases under this scenario, increased export orientated production will reduce farm-level diversity, lead to landscape-level homogenisation, and negatively affect long-term resilience of agricultural systems to crop pests and diseases.
- High market connectivity and homogenisation of landscapes will increase the risk of transboundary pest introductions and invasions, which may increase pest-driven yield losses by 2-3% and increase the frequency of pest outbreaks.
- Market integration will mean farmers have better access to crop varieties, fertilisers and pesticides. However, these investments will increase the cost of production, reducing profit margins, increasing food prices and so reducing the proportion of household income available for non-food expenditure.
- Policies for resistant maize varieties, fungicides and biocontrol, and improved post-harvest and storage technologies will likely result in relatively no change in levels of aflatoxin contamination under the low climate risk in this scenario. Although more frequent drought could lead to a fourfold increase in cassava toxicity in local varieties, market access may enable a shift to lower toxicity varieties.
- National greenhouse gas emissions are projected to increase by 245% compared to the year 2000 baseline based on the increase in crop and livestock production under this scenario. At the same time soil organic carbon stocks are expected to increase by 134% due to higher carbon returns to the soil through climate smart land management practices (resulting in net emissions decreasing by 976%). However, increasing livestock production may lead to increased use of crop residues as livestock feed thereby reducing biomass availability for use as mulch, leading to a decline in soil carbon stock in some areas. Emission intensity (the amount emitted per unit of food produced) decreases by 349%.
- If markets are inclusive and sustainable then yield increases may well raise incomes. Food prices could decline with greater availability, so increasing the affordability of food.
- There is some potential for increased inequalities as households who cannot afford technologies and improved varieties are exposed to climate risks and potential pests and diseases under this scenario.

Trade and nutrition trade-offs

- For non-optimised trade vignettes, nutrition security is not achieved for most nutrients and generally deteriorates relative to the 2000 baseline, owing partly to a 276% increase in the population. Vitamin C, B6 and thiamine supplies are adequate, protein supply is marginally adequate.

- Reliance on domestic production for nutrition security may be hampered by around a four-fold increase in cassava toxicity, posing health risks, and the need to invest in pest management that may increase costs and so food prices, reducing profit margins and therefore household incomes.
- If nutrition security were achieved through increased reliance on food trade, approximately 43% of the supply of calories would need to be imported, leading to high import dependence for nutrition security. These calories would need to come from a range of nutrient-dense foods to achieve population-level nutrient requirements.

Potential responses

- Realisation of this scenario requires investment and effective policy implementation to improve farm technologies and crop varieties, expand irrigation, and improve access to markets.
- With temperatures expected to increase, continued investment in crop breeding is required in order to ensure that the adaptation of crops can keep pace with changing conditions. This may include investments in technologies that speed up the breeding process. Well connected and efficient markets may contribute to demand driven investments in crop breeding under this scenario.
- There is also potential for significant yield gains to be realised for non-maize crops, for which there may be new market opportunities 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.
- There may also be opportunity to promote dairy, small stock, poultry, and beef as diversification into these agricultural products could enhance the resilience and incomes of households and communities.
- Policies will need to be complementary and coherent in order to prevent conflicts between livestock and crop production, especially given the expansion of pasture and increases in meat and dairy production under this scenario.
- Integrated crop-livestock production systems where livestock manure is properly processed and applied to soils for crop and pasture production will also help to reduce costs (e.g. fertilizers) and sustain the benefits of improved soil health.

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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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For More Information

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