GCRFAFRICAP
CLIMATE SMART AGRICULTURE FOR DEVELOPMENT

COUNTRY-LEVEL SUMMARY **Nov 2021**

Zambia

KEY MESSAGES

- **iFEED focusses on changes to nutrition security and climate-smart agriculture at the national level. Analysis includes 2050 projections of national food production, nutrition security and emissions for four contrasting scenarios, with resulting implications for national food system policy processes. Subnational simulations of future climate, crops and emissions underpin projected changes at the national level.**
- **Future scenarios for Zambia were characterised by two critical uncertainties – the magnitude of climate risks and extent of market connectivity. These have been used to develop four future scenarios to explore agricultural productivity and transformation.**
- **In all scenarios, under both high and low climate risk, average temperatures will increase, the frequency of temperature extremes will increase, and there will be a general shortening of the rainy season in Zambia.**
- **Emissions increase substantially in high market connectivity scenarios, due to expansions in agriculture and increased crop yields.**
- **Across all the scenarios nutrition security is not achieved for all nutrients by 2050 under all likely trade scenarios. This is in part driven by population increases. Market connectivity will be an important determinant of the proportion and nutrient composition of foods that would need to be imported to meet requirements if increased reliance on trade were to achieve nutrition security. Per capita nutrition is considerably improved in the high market connectivity scenarios relative to low market connectivity scenarios.**
- **Investment in research and development through the 2nd National Agricultural Investment Plan (NAIP), effective policy implementation to improve farm technologies, varieties and traits, irrigation, etc., and inclusive and sustainable access to markets, will be an effective response to mitigate the effects of climate change on agriculture in Zambia.**
- **Availability and affordability of new farm technologies will determine whether all farmers can realize the benefits. Significant support to farmers will be needed through the Farmer Input Support Programme (FISP), extension and weather services to ensure equitable access to technology and markets.**

Future scenarios

- A participatory workshop was used to describe four contrasting and comprehensive future scenarios for Zambia. These scenarios were characterised by the magnitude of climate risks (low to high) and the extent of market connectivity (low to high): '**isolation and imperative**' RCP8.5 – LT (characterised by high climate risks and low market connectivity); '**risk and**

reward’ RCP8.5 – HT (characterised by high climate risks and high market connectivity); ‘**solitude and self-sufficiency**’ RCP2.6 – LT (characterised by low climate risks and low market connectivity); and ‘**opportunity and exposure**’ RCP2.6 – HT (characterised by low climate risks and high market connectivity).

KEY MESSAGES: climate extremes

- Across all scenarios average temperatures are expected to increase, by between 1 and 2°C, by 2050. Extreme temperature conditions, where daily temperatures are above 35°C, are also expected to increase under all scenarios, with up to 10 more extremely hot days in the hottest months (September to April). Although the data is less robust, it is likely that rainfall in the rainy season will increase slightly, but longer dry spells at the start and end of the rainy season will contribute to a general shortening of the rainy season across all scenarios.
- These changes to the climate will decrease crop yields and increase the occurrence and frequency of yield shocks (when yields in any one year fall to below 1000kg/ha for maize and potatoes, or 500kg/ha for soybean and groundnut) by 2050. However, effective implementation of irrigation and improved crop varieties under the high market connectivity scenarios (RCP8.5 – HT; RCP2.6 – HT) are likely to significantly mitigate the effects of climate change and reduce yield shock rates regardless of the level of climate risk.

KEY MESSAGES: Impacts on and implications for agricultural systems

- Under the two scenarios with low market connectivity (RCP8.5 – LT; RCP2.6 – LT) crop yields are projected to decrease by 2050. Yield losses range from 1% with some autonomous adaptation (reactive individual actions to changes in environmental or social conditions, e.g. changing varieties and/or planting dates), to as much as 10-20%. These yield reductions, coupled with a lack of technological intervention, and a 276% increase in the population by 2050, mean that Zambia is likely to face significant food insecurity, even under low climate risks.
- With improved market connectivity, and the associated greater technological development in agriculture, crop production could increase significantly under both low (252% RCP2.6 – HT) and high (564% RCP8.5 – HT) climate risks. Production is highest with high climate risk and high market connectivity due to a reduction in crop diversification and a resulting prioritization of the highest-yielding crops in Zambia in 2050.
- Livestock meat and dairy production is projected to decrease under the high climate risks and low market connectivity scenario (RCP8.5 – LT) as the impacts of climate change make existing pasture less productive. In this scenario the area under pasture will remain the same in 2050 as the 2000 baseline. In contrast, livestock meat and dairy production increases are likely for all other scenarios, from 4-5% under the low climate risks, low market connectivity scenario (RCP2.6 – LT) with no change to area under pasture, to as much as 250% and 183% for meat and dairy respectively, under the low climate risk, high market connectivity scenario (RCP2.6 – HT) where area under pasture is expected to expand by 25% by 2050. Complimentary and coherent policy will be required to prevent conflicts between livestock and crop production, especially where area under pasture is expanded.
- Only in one scenario (RCP2.6 – LT) is it assumed that the land under irrigation doesn’t change. In all other scenarios all arable land is assumed to be under irrigation by 2050, with associated increases in demand for water (up to as much as 2595% increase in demand in the high climate risk, high market connectivity scenario RCP8.5 – HT). This will potentially lead to increasing tensions over transboundary water resources in the Zambesi river basin and alternative water resources will need to be explored, as well as technology for basin transfers to overcome differences in irrigation potential and demand.

- Under all scenarios it is likely that farmers will have to cope with continued losses from pests and diseases in 2050, although these risks worsen with high climate risks. Rising temperatures and atmospheric CO_2 will likely favour the growth and survival of crop pests and diseases, with the incidence and severity of outbreaks increasingly unpredictable. High market connectivity may exacerbate the impacts of pests and diseases if homogenous farming systems and mono-cropping are driven by greater market access. Increased trade movements could also introduce and spread novel invasive species yield losses increased by approximately 2-3 %.
- Under all scenarios cassava cyanide toxicity is projected to increase four-fold by 2050 due to more frequent droughts. This has significant implications for human health, especially as cassava often functions as a drought tolerant alternative crop. Greater market access under the two high market connectivity scenarios (RCP8.5 – HT; RCP2.6 – HT) may enable a shift to lower toxicity varieties and/or access to alternative foodstuffs.
- Aflatoxin contamination is expected to rise to varying degrees except under the low climate risk, high market connectivity scenario (RCP2.6 – HT) where a combination of policies for resistant maize varieties, control measures, and improved storage will likely keep aflatoxin contamination in 2050 similar to levels found currently.
- Under the high market connectivity scenarios (RCP8.5 – HT; RCP2.6 – HT) incomes are expected to increase through yield increases driven by investment in farm technology and crop varieties, irrigation, etc., regardless of the level of climate risk. However, markets will need to be inclusive and sustainable for these increased incomes to be realized by all farmers. Otherwise, inequalities may be increased as households who cannot afford technologies and improved varieties are left behind. Reducing inequalities should be an important consideration for FISP. Without market connectivity (RCP8.5 – LT; RCP2.6 – LT) yield losses will reduce incomes, undermining household resilience and increasing food insecurity.

KEY MESSAGES: trade and nutrition trade-offs

- Across all the scenarios nutrition security is not achieved for all nutrients by 2050 under all likely trade scenarios. In part this is driven by a projected 276% increase in the size of the population.
- Market connectivity and functionality has a much more significant impact on nutrition outcomes than does climate risk, with more market connectivity and functionality associated with better nutrition security outcomes.
- In all but one scenario (RCP8.5 – HT) there is a deterioration in nutrient security from the year 2000 baseline, although in RCP2.6 – HT vitamin C, B6 and thiamine supplies are adequate and protein supply is marginally adequate.
- In all scenarios many foods will need to be imported to meet domestic nutrient requirements. When using trade to achieve nutrition security given domestic production shortfalls, the required food imports vary from 23% of calories in the RCP8.5 – HT scenario to 82% in the RCP8.5 – LT scenario. Importantly, these need to be sourced from a particular combination of nutrient-dense foods (a much greater diversity of foods than in the baseline year) to ensure that all nutrient requirements are met rather than just caloric requirements. Differences between scenarios are driven by differences in market connectivity and differences in production outlined above. In both the low market connectivity scenarios (RCP8.5 – LT; RCP2.6 – LT) yield losses driven by changes in climate, increased pests and diseases, crop contamination, and so on, contribute not only to lower subsistence production but also to lower incomes, undermining household resilience and increasing food insecurity. In the high market connectivity scenarios (RCP8.5 – HT; RCP2.6 – HT) investment in research and development, and effective policy implementation serve to improve

farm technologies and crop varieties, expand irrigation, etc.. This helps to mitigate the impact of the changing climate and increase yields and raise incomes.

KEY MESSAGES: policy responses

- The scenarios demonstrate how investment in research and development through the 2nd National Agricultural Investment Plan, effective policy implementation to improve farm technologies, varieties and traits, irrigation, etc., and inclusive and sustainable access to markets, will be an effective response to mitigate the effects of climate change on agriculture in Zambia.
- Diversification will be important to mitigate against the losses caused by a changing climate, and associated increase in pest and disease burden, and could be supported through NAIP and FISP. Non-maize crops may present significant opportunities for yield gains and to improve nutritional outcomes, and new market opportunities for these crops may also arise by 2050, creating opportunities to improve incomes. However, if agricultural investment prioritizes the highest yielding crops (reducing crop diversity), food production may increase on average, but perhaps at the cost of reduced resilience to climate extremes, due to a lack risk-spreading across crops.
- Water for agriculture will present a significant challenge under both low and high climate risks. While expansion of irrigation will help to mitigate the effects of shortening of the rainy season and increased temperatures expected under all scenarios, it will cause a significant increase in demand and needs to be supported by a complementary and coherent cross-sectoral water policy to prevent conflicts and enhance water use efficiency.
- Ultimately, availability and affordability of new farm technologies will determine whether all farmers can realize the benefits. Significant support to farmers will be needed through FISP, extension and weather services to ensure equitable access to a variety of seeds, technology and markets.

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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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