GCRFAFRICAP
CLIMATE SMART AGRICULTURE FOR DEVELOPMENT

DESCRIPTOR DOCUMENT **July 2021**

Zambia - Food Production: Land Use and Yield Changes Low Climate Risk / Low Market Connectivity

Food production change

A small increase in crop and livestock production is projected – around 6% in the case of crop production, and around 5% in the case of livestock production, although uncertainty across climate models spans no change for both crop and livestock (medium confidence). An increase in climate extremes is projected, although this is not as large as high climate risk scenarios. However, as a result, relatively bad years of domestic food production can be expected to increase, even if average changes to production show not much change.

Despite direct effect of climate there is a slight increase to meat and dairy products. There is potential significant trend in livestock production which might be in demand for livestock and livestock products driven by urbanisation, population growth and income increases. Therefore, given the complexity of livestock and crop-livestock systems, a mix of technological, policy and institutional innovations will inevitably be required.

Livestock diversity helps to buffer the shock which might come due to diseases. opportunity to promote dairy, small stock, poultry, and beef as diversification into these agricultural products have been shown to enhance resilience and income of households and communities.

If markets are inclusive and sustainable, production increases may raise incomes. If markets are not inclusive or sustainable, production increases have limited impacts on incomes. Farmers dependent on water supplies for livestock vulnerable to rainfall variability / climate-induced shocks/stress. Increased availability, affordability and accessibility of meat will enhance nutrition outcomes. Decreased availability, affordability and accessibility of meat products will negatively affect nutrition outcomes. If meat/dairy production increases income generating opportunities in the meat and dairy sector and value chains likely to increase. If meat/dairy production decreases income generating opportunities in the meat and dairy sector and value chains likely to decrease.

Land use and irrigation

This scenario is characterised by no changes to the agricultural land use pattern. No increase to irrigation areas is assumed.

Farmers dependent on rain-fed crops are vulnerable to rainfall variability / induced shocks/stress. The average projected increase to irrigation demand is about 40%, noting some uncertainty in the amount of increase. Policy decisions and investment would have to respond to this uncertainty and be aware of cross-sectoral linkages across the Water-Energy-Food Nexus (Pardoe et al., 2020). Sustaining irrigation (without increasing the irrigated areas) has the potential to offset some impacts of climate change on crop production. Maintaining current rates of irrigation has the potential to sustain water resource productivity while alleviating pressure (on) and depletion of water resources which could hinder development of other sectors. Technological innovation would have to prioritise development of more efficient irrigation systems for sustainable irrigation development to maintain relatively lower rates of change in the mean irrigation water use. Improved efficiency in rainfed agricultural systems would reduce the irrigation water demand per unit area and offset pressure on water for irrigation, while making food systems resilient.

Water conflicts can be expected to increase between agricultural users, downstream consumers and other water users (e.g. hydro-electric generation), including conflicts between livestock and crop production needs. There would be increased need for robust cross-sectoral planning and regulation for land and resources (e.g. water, energy, mining/minerals, forests/biodiversity etc.). There would be increased demand on extension services linked to irrigation / crop changes. There is potential for inequality to rise, as upscaling of irrigation technologies does not reach all households and/or households cannot access or afford them.

Yield change, crop diversification and adaptation

Crop diversity increases in this scenario, with non-maize crop areas increasing by 20%, although maize remains the crop with most growing area. No technology trend on crop yields is assumed – i.e. yield change is driven by climate change only. Crop adaptation allows planting dates to vary, and crop varieties to vary, but these varieties are restricted to those available in the baseline.

Crop diversity increases with potential increase in growing land for crops such as cassava, sorghum and beans by 2050. High technology investment including irrigation and crop improvement for non–maize crops is required to improve yield by 2050. Modern technologies coupled with climate-smart cropping systems to adapt to climate change, diverse crop species and varieties, planting stress-tolerant crops, sustainable land management including conservation agriculture, could enhance water and crop productivity. One principle of conservation agriculture is rotating cereal crops with legumes, which has a positive impact on crop diversification.

Crop diversification can improve resilience in a variety of ways: by engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission; buffering crop production from the effects of greater climate variability and extreme events; and improving soil fertility though diversification with leguminous crops. We may expect an increased need to diversify away either a) from agriculture, or b) to alternative (more resilient) crops.

Without adaptation, climate change results in mean yields decreasing in this scenario. The impacts of climate change on maize, soybean and groundnut still result in yield losses of around 10% even with autonomous adaptation, but some small gains for potato are projected. (high confidence).

A downward trend in yields (and for potato and soybean, increased variability) contributes to an ~50% increase in the number of years of yield shock in maize and soybean. Groundnut shows signs of being less resilient to extreme weather, with an approximate doubling of yield shocks, and potato shows an approximately 3 times increase in yield shock rate. (medium confidence).

Reductions in yields for cash crops are likely to lead to acute income loss, undermining household resilience and increasing financial vulnerability. Reductions in yields for subsistence crops are likely to lead to increased food insecurity. Reductions in maize yields will likely lead to diversification to alternative staple starch food sources e.g. cassava, potato, rice, wheat etc. If markets are inclusive and sustainable, yield increases may raise incomes. If markets are not inclusive or sustainable, yield increases have limited impacts on incomes. Lastly, there would be increased demand on extension services (e.g. agricultural and climate).

It can take up to 20 years from initial investment in breeding for new varieties to be available and in farmers' fields. With temperatures expected to be warmer by 1C by 2050, 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 or alignment of policies that facilitate the movement of genetic material, improve access to new varieties for farmers, and enhance farmer participation in seeds value chain activities (e.g. seeds production and commercialisation).

Without adaptation maize yields will decline by approx. 20%, across all regions by 2050. However, if varieties can be developed that sustain the duration of the crop, there is potential for yield benefits (increase of approx. 5%) to be realised.

As the intensity of extreme rainfall and temperature increase over the next 30 years, this investment will pay off in particular in mitigating against the significant yield penalties that we expect to occur more frequently for maize than in the present day.

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. Traits that might become particularly important for breeding include drought stress tolerance, adaptation to shorter rainfall seasons, crop pests and disease resistance, nutrition enhancement and food safety traits.

Pests and diseases

Crop pests and diseases (CPD) cause on average a ~25% (±5) reduction in annual yields with estimates of crop-specific losses (maize, beans, cassava, and soya) ranging from 20-60% (Savary et al. 2019). (high confidence). In this

scenario, no significant changes to these levels of pest damage are expected. Biodiversity continues to play an essential role in managing CPD pressures through biocontrol by natural enemies in more diverse and heterogeneous agriculture systems. Small-scale farmers manage CPD impacts by cultural practices - handpick and destroy insects, spray plant extract, wood ash, or chilly powders, and destroy the infected plants. Under low market efficacy, farmers would not afford to use chemical pesticides and CPD-resistant crop varieties.

Zambian agriculture primarily consists of maize and cassava production by small-scale farmers (~85% of farmers with ~1.5 ha land) (Kimhi 2006). A majority of these farmers lose about 20–40% of crop yield pre-harvest due to crop pests and diseases, and additionally attribute about 10-20% yield loss due to poor quality soil and climatic conditions (Mwase and Kapooria 2001; Sileshi et al. 2008). Major CPDs in Zambia include fall armyworm (FAW), larger grain borer (LGB), cotton bollworm, grey leafspot (GLS), maize streak virus, bacterial leaf blight, and several species of stalk and pod borers, grasshoppers and aphids. CPDs like LGB, FAW, and GLS are introduced CPDs and are mainly prevalent in the low-land agriculture areas of Zambia. Farmers generally do not use control measures for the very common and less devastating beetles, aphids, caterpillars and grasshoppers. Under severe disease infections or infestations by large numbers of armyworms or grasshoppers they often handpick and destroy insects, spray ash or chilly powders, or destroy the infected plants. Farmers usually practice farm diversification through agroforestry, regular rotations, and intercropping to reduce crop vulnerability to pest damage (Sileshi et al. 2008).

By mid-century, moderate changes in climate if not followed by change in policy for adoption of crop diversification, resistant maize varieties, use of fungicides and biocontrol methods, and improved postharvest and storage technologies, are likely to result in a small increase in maize aflatoxin contamination.

Droughts are likely to occur on a yearly basis, with associated increases in cassava toxicity of around 4x. Given varieties of cassava in the region are ‘bitter’, this may make processing cassava to reach World Health Organization safety guidelines (10ppm) difficult. Reductions in cassava consumption may help to offset this.

Agricultural livelihood outcomes (income, food security) dependent on ability to adapt e.g. availability of / affordability of inputs (pesticides/fungicides, seed varieties, labour requirements for adaptation/adoption), knowledge of new practices. Livelihood opportunities generated if pest-resistant crops can be propagated / biocontrol measures can be produced and sold locally.

Appendix 1: Calibrated Statements

Climate Impacts Calibrated Statements

- RCP2.6 LT: Without adaptation, climate change results in mean yields decreasing in this scenario. The impacts of climate change on maize, soybean and groundnut still result in yield losses of around 10% even with autonomous adaptation, but some small gains for potato are projected. High Confidence.

Food Production Calibrated Statements

Scenario description:

This scenario is characterised by no changes to the agricultural land use pattern. No increase to irrigation areas is assumed.

Crop diversity increases in this scenario, with non-maize crop areas increasing by 20%, although maize remains the crop with most growing area. No technology trend on crop yields is assumed – i.e. yield change is driven by climate change only. Crop adaptation allows planting dates to vary, and crop varieties to vary, but these varieties are restricted to those available in the baseline.

CS1: crop production

The mean percentage change to crop production with RCP2.6, scenario It is 8% (range across climate models -4 to 16%; 0/18 climate models are outliers).

Robustness:
Medium robustness. High robustness with respect to the range of climate model uncertainty as there are 0 outliers. The underlying yield projections are associated with high confidence. For the majority of crops, average projections across these four crops are used, and therefore the productions projections for other crops are less certain. This suggests medium robustness.

Agreement:
Medium agreement. The yield change literature has high agreement with underlying iFEED projections. There is little literature available for the vast majority of crops however; therefore we are downgrading agreement to “medium” in the absence of more specific information on all crops in the region.

Medium Confidence (medium robustness and medium agreement).

CS2: livestock production

The mean percentage change to livestock meat production with RCP2.6, scenario It is 4% (range across climate models -10 to 13%; 0/18 climate models are outliers).

The mean percentage change to livestock dairy production with RCP2.6, scenario It is 5% (range across climate models -5 to 11%; 0/18 climate models are outliers).

Robustness:
Medium robustness. High robustness with respect to climate model uncertainty as 1 outlier for meat production. The underlying yield and crop production projections are associated with medium confidence. Simple methods have been used to translate future crop and pasture production to future livestock production, assuming historical relationships between the two persist. This suggests medium robustness.

Agreement:
Medium agreement. There is literature to suggest that livestock production efficiency could increase in future; however, climate change could also make certain livestock production more difficult due to diseases and heat stress. Overall, there is little to suggest that livestock production could not continue to be related to the available amounts of livestock feed. However, the lack of specific projections with which to compare to iFEED suggests medium agreement.

Medium Confidence (medium robustness and medium agreement).

CS3: irrigation

The mean percentage change to irrigation water with RCP2.6, scenario It is 40% (range across climate models 25 to 72%; 1/18 climate models are outliers). This becomes mean 38%, range 25 to 71% after removing the upper limit outliers.

Yield Shocks Calibrated Statements

A downward trend in yields (and for potato and soybean, increased variability) contributes to an ~50% increase in the number of years of yield shock in maize and soybean. Groundnut shows signs of being less resilient to extreme weather, with an approximate doubling of yield shocks, and potato shows an approximately 3 times increase in yield shock rate. Medium Confidence.

Pests and Diseases Calibrated Statements

CS1: Pest and diseases cause on average a ~25% (±5) reduction in annual yields with estimates of crop-specific losses (maize, beans, cassava, and soya) ranging from 20-60% (Savary et al. 2019)**.**

Zambian agriculture primarily consists of maize and cassava production by small-scale farmers (~85% of farmers with ~1.5 ha land) (Kimhi 2006). A majority of these farmers lose about 20–40% of crop yield pre-harvest due to crop pests and diseases, and additionally attribute about 10-20% yield loss due to poor quality soil and climatic conditions (Mwase and Kapooria 2001; Sileshi et al. 2008). Major CPDs in Zambia include fall armyworm (FAW), larger grain borer (LGB), cotton bollworm, grey leafspot (GLS), maize streak virus, bacterial leaf blight, and several species of stalk and pod borers, grasshoppers and aphids. CPDs like LGB, FAW, and GLS are introduced CPDs and are mainly prevalent in the low-land agriculture areas of Zambia. Farmers generally do not use control measures for the very common and less devastating beetles, aphids, caterpillars and grasshoppers. Under severe disease infections or infestations by large numbers of armyworms or grasshoppers they often handpick and destroy insects, spray ash or chilly powders, or destroy the infected plants. Farmers usually practice farm diversification through agroforestry, regular rotations, and intercropping to reduce crop vulnerability to pest damage (Sileshi et al. 2008).

Robustness: Local-scale studies based on field trials provide a range of yield loss estimates, which vary between crops and CPD types. The global-scale syntheses provide regional estimates (e.g., sub-Saharan Africa), which may lack local precision. Hence, a general estimate may not provide a robust indicator of yield losses that are highly variable and contextual. Therefore, we place this statement under **Medium robustness.**

Agreement: The estimates of yield losses overlap among studies and there is a general agreement of yield losses of 20-30%. So, there is High agreement on average estimates of yield losses due to CPD.
High Confidence (Medium robustness, high agreement)

Climate Extremes Calibrated Statements

By mid-century, climate models show average temperatures warming by roughly 1-2°C throughout the year compared to 1990-2010, with a corresponding increase in the number of growing degree days during the rainy season. There is also increased occurrence and frequency of temperature extremes, including days with average temperature above 35°C. Rainfall trends are much less robust; however, climate models show a weak tendency toward lower rainfall totals during the wettest months (December-April) accompanied by more rainfall on very wet days. There are also slight trends towards longer extreme dry spells around the start and end of the rainy season (October and April) and shorter extreme wet spells during the October-April period. This is consistent with a general shortening of the rainy season across Zambia. The number of months experiencing drought conditions is also projected to increase. However, there is significant disagreement between climate models for projections of rainfall and related quantities.

Appendix 2: Implication Statements

Irrigation Water Use Implication Statements

This scenario is characterised by no changes to the agricultural land use pattern. No increase to irrigation areas is assumed. This scenario is also associated with an 8% increase in crop production. The mean percentage change to irrigation water for this scenario is 40% (range across climate models 25 to 72%; 1/18 climate models are outliers). This becomes mean 38%, range 25 to 71% after removing the upper limit outliers.
Implications

- Sustaining irrigation (without increasing the irrigated areas) has the potential to offset some impacts of climate change on crop production.
- Maintaining current rates of irrigation has the potential to sustain water resource productivity while alleviating pressure (on) and depletion of water resources which could hinder development of other sectors.
- Technological innovation would have to prioritise development of more efficient irrigation systems for sustainable irrigation development to maintain relatively lower rates of change in the mean irrigation water use.
- Improved efficiency in rainfed agricultural systems would reduce the irrigation water demand per unit area and offset pressure on water for irrigation, while making food systems resilient.

There is agreement in model projections with regards to the direction of change in the mean percentage change. However, there is still considerable degree of uncertainty (as can be seen from the spread in the projected change) and policy decisions and investment would have to respond to that and be aware of cross-sectoral linkages across the Water-Energy-Food Nexus (Pardoe et al., 2020).

Aflatoxins Implication Statements

Implications

By mid-century, moderate changes in climate if not followed by change in policy for adoption of crop diversification, resistant maize varieties, use of fungicides and biocontrol methods, and improved postharvest and storage technologies, are likely to result in small increase in maize aflatoxin contamination.

Crop and Livestock Diversification Implication Statements

- Crop diversity increases with potential increase in growing land for crops such as cassava, sorghum and beans by 2050.
- High technology investment including irrigation and crop improvement for non–maize crops is required to improve yield by 2050.

- Modern technologies coupled with climate-smart cropping systems to adapt to the rapid climate changes, diverse crop species and varieties, planting early-maturing and/or stress-tolerant crops, sustainable land management including conservation agriculture, could enhance water and crop productivity.
- One principle of conservation agriculture is rotating cereal crops with legumes, which has a positive impact on crop diversification

Crop diversification can improve resilience in a variety of ways: by engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission; buffering crop production from the effects of greater climate variability and extreme events; and improving soil fertility though diversification with leguminous crops

- Despite direct effect of climate there is a slight increase to meat and dairy products. There is potential significant trend in livestock production which might be in demand for livestock and livestock products driven by urbanization, population growth and income increases. Therefore, given the complexity of livestock and crop-livestock systems, a mix of technological, policy and institutional innovations will inevitably be required.

Livestock diversity helps to buffer the shock which might come due to diseases. opportunity to promote dairy, small stock, poultry, and beef as diversification into these agricultural products have been shown to enhance resilience and income of households and communities

Crop Pests and Diseases Implication Statements

IS1: Most farmers lose about 20–40% of crop yield at pre-harvest due to CPD.

IS2: Biodiversity plays an essential role in managing CPD pressures through biocontrol by natural enemies in more diverse and heterogenous agriculture systems.

IS3: Small-scale farmers manage CPD impacts by cultural practices - handpick and destroy insects, spray plant extract, wood ash, or chilly powders, and destroy the infected plants.

IS4: Under low market efficacy, farmers would not afford to use chemical pesticides and CPD-resistant crop varieties.

Cassava Toxicity Implication Statements

Mid century

Droughts are likely to occur on a yearly basis, with associated increases in cassava toxicity of around 4x. Given varieties of cassava in the region are 'bitter', this may make processing cassava to reach World Health Organization safety guidelines (10ppm) difficult. Reductions in cassava consumption may help to offset this.

End of century

Droughts will become more common than in the mid-century period, with associated increases in cassava toxicity of around 4x. Given varieties of cassava in the region are 'bitter', this may make processing cassava to reach World Health Organization safety guidelines (10ppm) difficult. Reductions in cassava consumption may help to offset this.

Seed Systems Implication Statements

It can take up to 20 years from initial investment in breeding for new varieties to be available and in farmers' fields. With temperatures expected to be warmer by 1C by 2050, 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 or alignment of policies that facilitate the movement of genetic material, improve access to new varieties for farmers, and enhance farmer participation in seeds value chain activities (e.g. seeds production and commercialisation).

Without adaptation maize yields will decline by approx. 20%, across all regions by 2050. However, if varieties can be developed that sustain the duration of the crop, there is potential for yield benefits (increase of approx. 7%) to be realised.

As the intensity of extreme rainfall and temperature increase over the next 30 years, this investment will pay off in particular in mitigating against the significant yield penalties that we expect to occur more frequently for maize than in the present day.

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.
Traits that might become particularly important for breeding include drought stress tolerance, adaptation to shorter rainfall seasons, crop pests and disease resistance, nutrition enhancement and food safety traits.

Households and Livelihoods Implication Statements

7a Climate and extremes

IS Applicable to all Scenario Quadrants:

1. Increased demand on extension services - particularly for climate and weather forecasting information
2. See statements 7b-7h

7b Climate impacts

Low Climate / Low market efficacy (LT)

Without adaptation, climate change results in mean yields decreasing in this scenario. The impacts of climate change on maize, soybean and groundnut still result in yield losses of around 10% even with autonomous adaptation, but some small gains for potato are projected. High confidence.

1. Reductions in yields for cash crops are likely to lead to acute income loss, undermining household resilience and increasing financial vulnerability
2. Reductions in yields for subsistence crops are likely to lead to increased food insecurity
3. Reductions in maize yields will likely lead to diversification to alternative staple starch food sources e.g. cassava, potato, rice, wheat etc.
4. If markets are inclusive and sustainable, yield increases may raise incomes
5. If markets are not inclusive or sustainable, yield increases have limited impacts on incomes

7c Crop pests

IS Applicable to all Scenario Quadrants:

1. Reductions in yields for cash crops are likely to lead to acute income loss, undermining household resilience and increasing financial vulnerability
2. Reductions in yields for subsistence crops are likely to lead to increased food insecurity
3. There would be increased demand on extension services, particularly for (chemical) crop pest and disease management practices and/or biocontrol measures
4. There would be increased demand for R&D on biocontrol measures
5. Increase in pests/diseases will lead to an increased reliance/need for pesticides, herbicides and fungicides
6. Increased need for chemical control has multiple implications:
    a. Technologies may not reach all households
    b. Not all households can afford to purchase inputs
    c. Not all farmers are able/prepared to use them
    d. Gendered inequality exacerbated as women typically have less access to inputs than men
7. Increase in pests lead to increased labour demand on farms to implement control measures
8. There is potential for inequality to rise, as upscaling of pest/disease control technologies does not reach all households and/or households cannot access or afford technologies
9. If agriculture becomes unviable (e.g. too expensive, too labour intensive, or successive pest/disease outbreaks), we may expect an increased need to diversify away either a) from agriculture, or b) to alternative crops
10. Increased use of chemical inputs has negative impacts on human and environmental health
11. Agricultural livelihood outcomes (income, food security) dependent on ability to adapt e.g. availability of / affordability of inputs (pesticides/fungicides, seed varieties, labour requirements for adaptation/adoption), knowledge of new practices
12. Livelihood opportunities generated if pest-resistant crops can be propagated / biocontrol measures can be produced and sold locally

7d Emissions and soils

IS Applicable to all Scenario Quadrants:

1.With increased GHG emissions (or to meet the reductions), it is possible that mitigation-focussed CSA may increase, e.g. increase in 'payment for ecosystem services'-type programmes, with potential income for agricultural households/farmers, e.g. to plant trees
2.There would be increased demand on extension services (e.g. forestry/agroforestry).

3.There is potential for inequality to rise, as upscaling of mitigation technologies does not reach all households and/or households cannot access or afford technologies
4. Labour demand/costs to farmer to improve soil organic carbon stocks

7e Food production

Low Climate / Low market efficacy (LT)

The mean percentage change to crop production with RCP2.6, scenario lt is 8% (range across climate models -4 to 16%; 0/18 climate models are outliers).

1. If markets are inclusive and sustainable, yield increases may raise incomes
2. If markets are not inclusive or sustainable, yield increases have limited impacts on incomes
3. If markets are not available for cash crops, yield increases have limited impacts on incomes
4. Reductions in yields for cash crops are likely to lead to acute income loss, undermining household resilience and increasing financial vulnerability
5. Reductions in yields for subsistence crops are likely to lead to increased food insecurity
6. Farmers dependent on rain-fed crops vulnerable to rainfall variability / induced shocks/stress

The mean percentage change to livestock meat production with RCP2.6, scenario lt is 4% (range across climate models -10 to 13%; 0/18 climate models are outliers).

1. If markets are inclusive and sustainable, production increases may raise incomes
2. If markets are not inclusive or sustainable, production increases have limited impacts on incomes
3. Farmers dependent on water supplies for livestock vulnerable to rainfall variability / climate-induced shocks/stress
4. Increased availability, affordability and accessibility of meat will enhance nutrition outcomes
5. Decreased availability, affordability and accessibility of meat products will negatively affect nutrition outcomes

6. If meat/dairy production increases income generating opportunities in the meat and dairy sector and value chains likely to increase
7. If meat/dairy production decreases income generating opportunities in the meat and dairy sector and value chains likely to decrease

The mean percentage change to livestock dairy production with RCP2.6, scenario lt is 5% (range across climate models -5 to 11%; 0/18 climate models are outliers).

1. If markets are inclusive and sustainable, production increases may raise incomes
2. If markets are not inclusive or sustainable, production increases have limited impacts on incomes
3. Farmers dependent on water supplies for livestock vulnerable to rainfall variability / climate-induced shocks/stress
4. Increased availability, affordability and accessibility of meat will enhance nutrition outcomes
5. Decreased availability, affordability and accessibility of meat products will negatively affect nutrition outcomes

6. If meat/dairy production increases income generating opportunities in the meat and dairy sector and value chains likely to increase
7. If meat/dairy production decreases income generating opportunities in the meat and dairy sector and value chains likely to decrease

7f Irrigation

IS Applicable to all Scenario Quadrants: *(severity of issue likely to increase with scale of increase)*

1. Water conflicts expected to increase between agricultural users, downstream consumers and other water users (e.g. hydro-electric generation), including conflicts between livestock and crop production needs
2. There would be increased need for robust cross-sectoral planning and regulation for land and resources (e.g. water, energy, mining/minerals, forests/biodiversity etc.)
3. There would be increased demand on extension services linked to irrigation / crop changes
4. There is potential for inequality to rise, as upscaling of irrigation technologies does not reach all households and/or households cannot access or afford them.

7g TNT

IS Applicable to all Scenario Quadrants (except for each Trade optimisation scenario):

1.Hunger/food insecurity would lead to increased reliance on food aid and imports
2.Acute and chronic undernutrition would lead to detrimental health impacts, particularly for children and mothers and already-vulnerable populations
3.There would be declines in labour productivity, due to hunger/ill-health
4.Rise in food prices will likely lead to inequitable food access, with the poorest becoming increasingly vulnerable to food insecurity/ hunger/ undernutrition
5. Inequalities would be exacerbated owing to gender differentiated care roles

IS Applicable across the Scenario Quadrants for Trade optimisation scenario:

1.1.If food is affordable, accessible and nutritionally adequate, then there should be a healthy population.
2.If food is not affordable nor accessible, then only the wealthiest will benefit and marginalised populations will not achieve food or nutrition security

4h Yield Shocks

Low Climate / Low market efficacy (LT)

1.There would be increased demand on extension services (e.g. agricultural and climate).
2,Reductions in yields for cash crops are likely to lead to acute income loss, undermining household resilience and increasing financial vulnerability
3.Reductions in yields for subsistence crops are likely to lead to increased food insecurity
4.We may expect an increased need to diversify away either a) from agriculture, or b) to alternative (more resilient) crops

This work was supported by UK Research and Innovation as part of the Global Challenges Research Fund, Grant Ref: BB/P027784/1

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).

Implementing Partners: FANRPAN; University of Leeds; University of Aberdeen; the UK Met Office; Chatham House - Royal Institute of International Affairs; the Civil Society Agriculture Network (CISANET), Malawi; Department of Agriculture Research Services (DARS), Malawi; National Agricultural Marketing Council (NAMC), South Africa; Economic and Social Research Foundation (ESRF), Tanzania; and the Agricultural Consultative Forum (ACF), Zambia.

For More Information
Website: https://africap.info/Twitter: @gcrfafricapEmail: contact@africap.info