GCRFAFRICAP

CLIMATE SMART AGRICULTURE FOR DEVELOPMENT

iFEED COUNTRY-LEVEL SUMMARY **January 2022**

South Africa

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.
- Four future scenarios for South Africa, derived from a participatory stakeholder workshop, were characterised by two critical uncertainties – the magnitude of climate risks (low, 'RCP2.6'; high, 'RCP8.5') and the extent of land reform (low, 'LT'; high 'HT').

Modelling results

- Extreme conditions are likely to increase across all scenarios, making relatively bad years in terms of domestic food production more likely.
- Food production ranges from a doubling to a more than doubling from the year 2000 baseline, with the increase (up to 178% (RCP8.5, LT) for crops) depending largely on the climate scenario. Maize remains the main crop in all scenarios, but crop diversity increases with portions of cropland previously used for maize instead used for other crops (10% in the low climate risk scenarios and 25% in the high risk scenarios).
- In the low climate risk scenarios, pasture areas increase. In the high climate risk and low land reform scenario, cropland increases and increased land conflicts and ecosystem degradation are expected. In the corresponding high land reform scenario, crop and pasture areas decrease (by 10% and 15% respectively), leading to expectable improvements in ecosystem services.
- Crop yields increase on average by more than 50% from the baseline across all scenarios, after accounting for climate impacts. Climate change exerts a small negative impact on maize, soybean and potato yields of 4% (RCP2.6) to 14% (RCP8.5), even with incremental adaptation.
- Across all 4 scenarios, on a per capita basis, nutrient supply generally improves compared to the 2000 baseline despite a projected population increase of 68%. Climate risk generally has a more significant impact on nutrition security than does land reform (better outcomes under RCP8.5 than RCP2.6). If trade is reorientated to optimise nutrition security, under all scenarios a significant proportion of calories produced domestically can be exported without compromising essential micronutrient supplies for domestic consumption.

- Net emissions (taking into account both greenhouse gas emissions and soil organic carbon (SOC) changes) increase in all 4 scenarios, ranging from 57% to 60% in the low climate risk scenarios, and 128% to 150% in the high climate risk scenarios (RCP8.5). Non-. CO_2 GHGs also increase across all scenarios by around 50%. SOC losses occur in all scenarios while emissions intensities (GHGs emitted per unit of food produced) decline in all scenarios, except in high climate risk, high land reform where it increases by 5%.

Implications

- Government support will be necessary for the successful uptake of new agricultural technologies in newly created medium-sized land reform farms. Without government support, land reform farms could see productivity decline, and an increased reliance on rain-fed and diversified cropping systems.
- In the low climate risk scenarios, there is likely to be no significant changes to pest and disease impacts unless international trade increases or government-backed land reform leads to increasing homogenisation of agricultural systems, which would likely result in increased pest and disease pressures (RCP2.6, high land reform). In the high climate risk scenarios, pest and disease impacts are likely to worsen due to climate change (potentially resulting in a 13% crop yield loss), with a possible increased reliance on pesticides, and a resulting decline in environmental sustainability (likely to be exacerbated if government-backed land reform leads to increasing homogenisation of agricultural systems (RCP8.5, high land reform)).
- With increased food production and crop diversity and an increased availability of nutritionally-diverse food crops, we might expect lower food prices and increased livelihood resilience across all 4 scenarios – improving food security outcomes.
- Across all scenarios (even with high land reform and support from government), additional careful policy considerations are needed to minimise the impacts of increased food production on ecosystem degradation and biodiversity loss, and limit potential conflict over land and water use.

FOOD PRODUCTION, LAND USE AND IRRIGATION

Crop yields increase on average by more than 50% from the year 2000 baseline across all scenarios, even after taking into account climate impacts. Climate change exerts a small negative impact on maize, soybean and potato yields of 4% (RCP2.6) to 14% (RCP8.5), even with autonomous adaptation. Yield shock rates remain similar to the baseline in low climate risk scenarios (RCP2.6), and largely decrease in hih-risk scenarios (RCP8.5) due to the application of technology. Maize remains the main crop in all scenarios, but crop diversity increases with portions of cropland previously used for maize (10% in the low climate risk scenarios and 25% in the high-risk scenarios) instead used for other crops. Food production also increases in all scenarios through increased intensification.

- In the two scenarios with low land reform (LT), crop production increases by 117% (RCP2.6) to 178% (RCP8.5); meat production increases from 122% (RCP2.6) to 129% (RCP8.5); and dairy production increases from 123% (RCP8.5) to 155% (RCP2.6). In these instances, food production increases as a result of crop diversification in both scenarios. For RCP2.6, technological innovation to improve yields and an increase in livestock pasture area also contribute; for RCP8.5 additional contributory factors are adaptative measures to climate change impacts, and an expansion of crop area and irrigation. Land conflicts are expected to increase, for example between livestock and crop production in both low land reform scenarios, and a decline in ecosystem services and environmental sustainability/health outcomes would be expected due to agricultural land expansion.

- In the two scenarios with high land reform (HT), crop production increases by 101% (RCP2.6) to 139% (RCP8.5); meat production increases from 122% (RCP2.6) to 124% (RCP8.5); and dairy production increases from 103% (RCP2.6) to 116% (RCP8.5). Here, food production increases are due to climate change adaptation, technological innovation, and crop diversification. Additionally, in RCP2.6 pasture areas are extended; in RCP8.5 irrigation increases. In RCP2.6, land conflicts are expected to increase between livestock and crop production, and between conservation/tourism and pastureland. A decline in ecosystem services and environmental sustainability/health outcomes would be expected due to pastureland expansion. Conversely, in RCP8.5, crop and pasture areas decline (by 10% and 15% respectively), potentially improving environmental sustainability/health outcomes and ecosystem services.

The way that land reform is implemented (under the high reform scenarios) could impact land use and food production. Without sufficient support and advice from government, small to medium scale farmers who received land through redistribution programme may struggle to cultivate the land and access supply chains. Conversely, with support as set out in the 2019 National Development Plan, mechanisation could increase in addition to global market access - increasing overall production. Industrial agriculture focused on commodity crops would likely increase, together with an increase in fertiliser and pesticide use, and fewer people employed in farming overall.

In the two scenarios with the highest climate risks, the demand for irrigation water increases substantially from 67% (RCP8.5, HT) to 84% (RCP8.5, LT). Thus, in both high risk scenarios, water conflicts are expected to increase between agricultural users (livestock and crop producers) and downstream consumers including the potential for escaliating transboundary tensions.

In the low climate risk scenarios, there are unlikely to be any significant changes to pest and disease impacts unless government-backed land reforms lead to increasing homogenisation of agricultural systems, which would likely result in increased pest and disease pressures (RCP2.6, HT). In the high climate risk scenarios, pest and disease impacts are likely to worsen due to climate change (potentially resulting in a crop yield losses of approximately 13%), with a possible increased reliance on pesticides, and a resulting decline in environmental sustainability. These impacts are likely to be exacerbated if government-backed land reform leads to increasing homogenisation of agricultural systems (RCP8.5, HT).

TRADE AND NUTRITION SECURITY

Across all four scenarios, population-level nutrition supply for most nutrients in 2050 is projected to remain adequate and generally improve relative to the 2000 baseline, despite a projected population increase of 68%. However, per capita calcium and iron supplies remain inadequate across scenarios. Climate risk generally has a more significant impact on nutrition security than does land reform (better outcomes under RCP8.5 than RCP2.6). In any given scenario, nutrition security outcomes are broadly similar between self-sufficiency, business-as-usual, and stakeholder-expectation trade vignettes. Reorienting trade flows to optimise for nutrition security, given domestic production patterns, results in similar import and export patterns for the same level of climate risk, irrespective of the level of land reform. This allows for a significant proportion of calories produced domestically to be exported (ranging from 37% in RCP2.6 HT to 61% in RCP8.5 LT), without compromising essential micronutrient supplies for domestic consumption. This suggests a low import dependence for nutrition security in all scenarios and potential to reorientate domestic agriculture to better reflect domestic nutritional requirements. Across all scenarios, nutrition optimisation results in the per capita supply of calories being sourced from a much greater diversity of foods than under baseline conditions.

With increased food production and crop diversity, an increased availability of nutritionally-diverse food crops, lower food prices and increased livelihood resilience might be expected across all four scenarios – improving food security outcomes, though reductions in yields for subsistence crops are likely to lead to increased food insecurity.

CLIMATE EXTREMES

Extreme conditions are likely to increase across all scenarios, making relatively bad years in terms of domestic food production more likely. In the low climate risk scenarios, average temperatures warm by roughly 1°C by mid-century. Extremely hot days increase by an average of roughly 1-3 days per month compared to the present day, with the highest number of extremely hot days and the largest average increase compared to present-day expected in January. In the high climate risk scenarios, average temperatures warm by roughly 2.5°C by mid-century. Extremely hot days increase by an average of roughly 4-6 days per month compared to the present-day, with the highest number of extremely hot days and the largest average increase compared to present-day expected in January. The number of months experiencing drought conditions is projected to increase, in addition to a general shortening of the rainy season across South Africa and a reduced average rainfall amount during the wet months of October-April.

CLIMATE SMARTNESS

Climate-smart agriculture impacts are mixed across all four scenarios, as productivity increases through intensification of the production system are accompanied by emissions increases and soil organic carbon decreases. Net production emissions range from 57-60% in the low climate risk scenarios to 128-150% in the high climate risk scenarios. Non-CO2 GHGs also increase across all scenarios by around 50%. Emissions intensity (GHGs emitted per unit of food produced) declines in all scenarios (ranging from -16% in RCP8.5 LT to -28% in RCP2.6 LT), except in scenario RCP8.5 HT where it increases by 5%.

In all four scenarios, SDGs 2, 3, 13 are likely to be achieved by the production system but there may be negative impacts on SDG6 and SDG12 (due to higher irrigation).

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: @gcrfafricap Email: contact@africap.info