SAGCOT
SOUTHERN AGRICULTURAL GROWTH CORRIDOR OF TANZANIA

Climate Change Brief

Future climate change notes for the Southern Agricultural Growth Corridor of Tanzania

Development Corridors Partnership | 2021

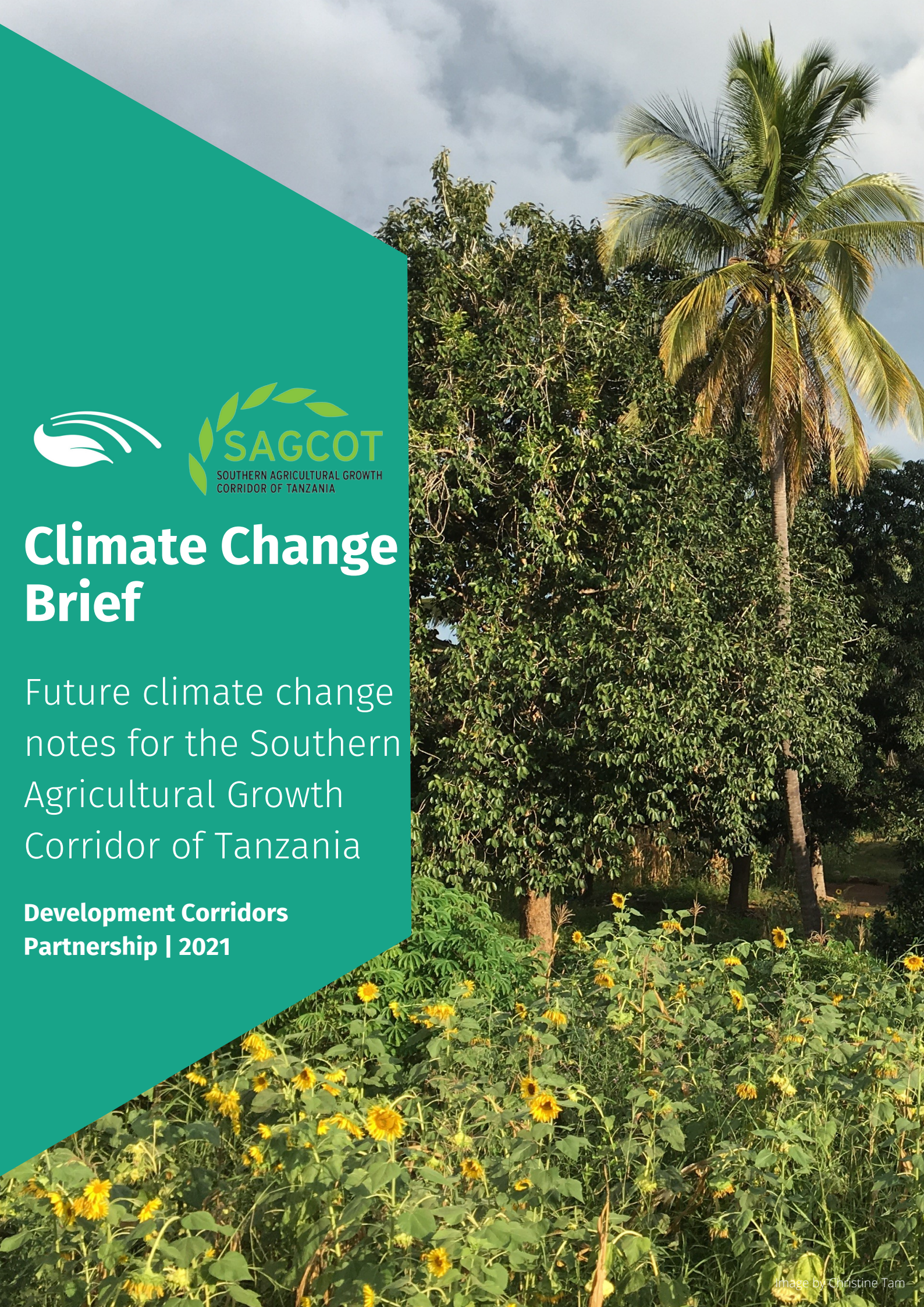


Image by Christine Tam

KEY MESSAGES

Results from ongoing work at the Development Corridors Partnership suggest that as well as increasing temperatures, the main climate signal for SAGCOT is one of greater variability, particularly in rainfall.

More variable rainfall: What's happened to SAGCOT's rainy season?

Rainfall seasonality, and the associated agricultural planting season associated with the onset of a previously more consistent 'rainy season' is being severely impacted. In addition to the 'onset of the rains', the **amount, intensity and duration of rainfall show increasing variability.**

Confidence in climate model projections: Why does SAGCOT need to use a range of climate models?

Whilst all climate models show warming in most places into the future, different climate models can simulate **very different patterns of rainfall.** In some cases, drier and wetter conditions can be projected for the same location. Most studies of future climate, therefore, **include results from different climate models.** Due to the uncertainties of climate change model results, we refer to climate model results as '**projections**'.

For SAGCOT, planning and making decisions using climate model projections should **always consider a range of outcomes,** not just the average of multiple models.

Extreme weather: What climate events can SAGCOT expect in the future?

Based on a range of climate model projections (totalling 34 different models), we can be confident that the intensity of rainfall in SAGCOT will increase. Taken with our confidence in projections that show an increase in the mean number of days with temperatures more than 30°C, there is a higher likelihood of localised flooding and droughts.

Image by Christine Tam

Taking climate change projections into account for particular planning decisions, and considering the range of futures, can support sustainability.

Given the possible reoccurrence of multi-year droughts that occurred early in the 20th century and the ongoing development of new hydropower infrastructure, it would be prudent to develop a **multi-agency drought management plan** for single and multi-year events in SAGCOT at the scale of the Rufiji Basin.

RUFIJI RIVER BASIN, SAGCOT

Recent rainfall and temperature behaviour

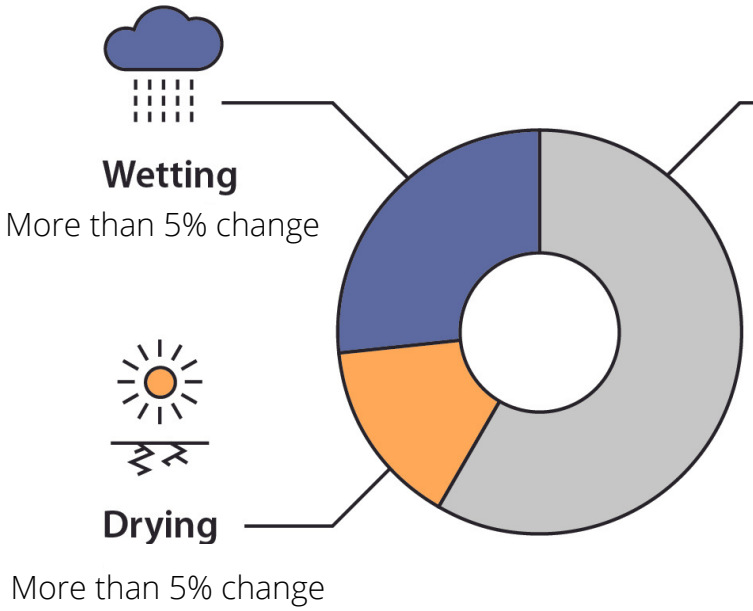
A clear warming trend is apparent in annual temperature (roughly 0.03°C per year) during recent decades throughout the SAGCOT region, including the Rufiji basin.

Rainfall is highly seasonal, averaging 935mm per year with a large gradient across the Rufiji basin, from 500mm per year (northern part of the basin) to more than 1500mm per year (central part of the basin, Kilombero valley).

Between 1981 and 2016 there were areas of modest drying in northern parts of the Rufiji Basin (up to around 2mm/year) and areas of modest wetting in the central part of the basin, particularly the Kilombero valley and Lower Rufiji (around -2 to -4mm/year). A prolonged dry period occurred between 1906/07 and 1929/30 with just six years in 23 wetter than average. Since a very wet year in 1997/1998 (a major El Niño and Indian Ocean Dipole event), rainfall over the whole area has been generally lower than the long-term average, contributing to some hydropower disruption in smaller reservoirs in the Rufiji River basin during the 2000s.

Based on analysis of 34 models of climate projections, what might the future climate look like in Tanzania and the SAGCOT region?

Figure 1: Proportion of climate models that project changes in total annual rainfall across Tanzania, including drier or wetter conditions



While rainfall patterns are changing, there is less confidence in predicting which areas will become wetter or drier.

There is much higher confidence that rainfall variability and intensity will **increase**.

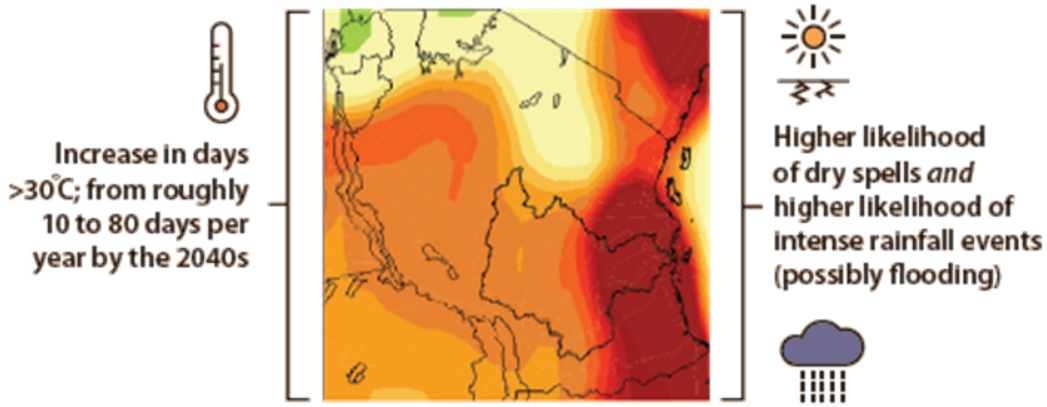
RUFIJI RIVER BASIN, SAGCOT

As climate evolves we will see an overall increase in the frequency and intensity of heatwaves.

All models show an increase in the number of days with temperatures above 30°C

Figure 2: Summary of changes in extremes across Tanzania

The map shows the pattern of increase in number of days above 30 °C (darker shading indicates greater increase)



How will changes in mean climate affect SAGCOT?

- Future climate projections show continued warming (roughly 0.8°C to 1.8°C by the 2040s) and mixed patterns of future rainfall. Most climate models (19 out of 24) project a modest to high increase in annual rainfall. In comparison to the present day, the rainfall change for 2021-2050 ranges from -10% to +30%.
- For Rufiji, the effects of temperature and rainfall changes on Rufiji River streamflow are more pronounced, ranging from approximately -30% to over +60%, but with an even split between drier and wetter futures due to the effects of higher evaporation.
- Daily rainfall intensity is projected to increase throughout the region, and about three-quarters of the climate models suggest an increase in year-to-year variability.

Streamflow could be affected by -30% to over +60% (approx).

Daily rainfall intensity to increase

What climate extremes will SAGCOT experience?

- Changes in climate factors on daily timescales show increases in the mean number of days with temperatures more than 30°C (a threshold sometimes used to examine the sensitivity of maize to heat stress), consistent across all climate models. This points towards an increase in frequency of heat extremes.
- For rainfall there is strong agreement for decreases in the mean number of rain days and increases in the amount of rainfall on each rainy day (the 'rainfall intensity'). Taken together these changes suggest more variable rainfall, with both higher likelihood of dry spells and higher likelihood of intense rainfall events (often associated with flooding).

Increased frequency of heat extremes

Increased flooding

Increased droughts

PLANNING SAGCOT

01 Using climate model results

No model is able to predict the future with 100% confidence. Planning based on projections from climate models must therefore include opportunities to update any climate information used.

02 Why use climate models in planning?

Climate projections are useful to consider in planning, particularly for activities that are sensitive to temperature and water availability, such as those found in SAGCOT particularly for agriculture and hydropower.

03 Confidence in modelling

Temperature modelling

- A high level of agreement between models on temperature increase provides confidence in this projection.
- Promoting a crop that is heat sensitive and already near the margins of tolerance for growth, for example, is likely to be unsustainable in the long run.

Rainfall modelling

- There is less agreement between models on rainfall, but there are some characteristics for which we have confidence.
- One is for a drying trend in October-November-December in southern Tanzania – a critical time, for example, for the agricultural sector.
- Awareness of this means that longer-term agricultural decisions can be planned accordingly to avoid crop failure due to the reduced length of the growing season and/or water availability.

SAGCOT's Sustainable Future: Climate Change Adaptation

Setting feasible short- and long-term adaptation goals is essential to protect the social-economic infrastructural progress of SAGCOT from the impacts of droughts and flooding, which are likely to increase in intensity and frequency. Practical adaptation actions should be ramped up immediately for institutional capacity building on risk management and towards adoption of Nature-based Solutions (NbS), ultimately building a more comprehensive climate-resilient system with institutional, ecological, and infrastructural components.

Climate resilience could be strengthened from the services found in the region's natural ecosystems. For example, natural ecosystems can be exploited for sustainable benefits to absorb enough water when flooding occurs and release water when droughts occur to the advantage of the SAGCOT region.

Priorities for SAGCOT climate adaptation:

- **To strengthen institutional capacity building**
  - Build climate risk management capacity across all sectors at the local level
  - Seek regular engagement and partnership building with climate information services e.g. weather forecast agencies, NGOs, and climate researchers
- **Integrated adaptation technology systems**
  - There is a great potential to innovatively integrate grassroots technologies into an efficient adaptation implementation package
  - Land use changes e.g. forest cover conversion, should be well designed and incorporated into adaptation planning to minimise the increase in surface run-off and soil erosion.

Resources

Conway, D., Siderius, C., Geressu, R., Kashaigili, J., Thorn, J., Kolusu, S., Pettinotti, L., Todd, M.,Marchant, R. and Harou, J. (2021) Climate Change Impacts – Implications for Policy and Practice inTanzania's Rufiji River Basin. FCFA Technical Brief. 16pp. Cape Town: CDKN. Available at: https://futureclimateafrica.org/wp-content/uploads/2021/02/UMFULA_Rufiji_Basin_climate_change_results_Brief.pdf

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Image by Christine Tam