Sunflower Tanzania

Climate change risks and opportunities

Sunflower in Tanzania

In Tanzania 6% of the land under production is used for the cultivation of sunflower. In areas like Mbeya (Southern Highlands) and Dodoma and Singida (Central Corridor), the area under sunflower varies from 1 - 10 acres per household. According to FAO, the average yield of sunflower is 979 kilogram per hectare. In 2013 sunflower seed production in Tanzania reached approximately 1 million tonnes cultivated by over 2.5 million smallholder farmers. This has the potential to increase productivity and incomes of farmers in the future (CIAT & World Bank, 2017). Despite the relatively good production and business environment for producing sunflower, Tanzania remains a net importer of edible cooking oil. The sunflower oil produced by local processors only meets 40% of the national cooking oil requirements (Zhihua Zeng, 2017).

Past trends in temperature

The temperature trend (from 1961-2005) for both the short (October, November, December) and long rain season (March, April, May) show that temperature in Tanzania has been increasing for the past few decades by more than 0.5°C (Figure 1). In particular, the temperature trend in the short rainy season has increased by 1°C - 1.3°C over central, north-western, western and south-western part of the country

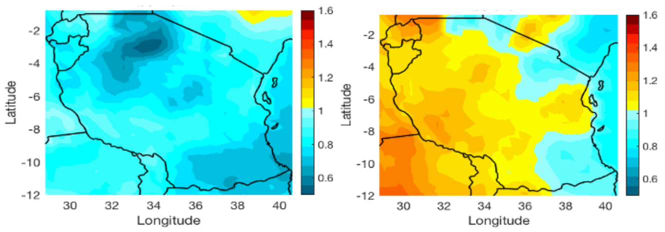

Figure 1. *Temperature trend from 1961-2005 for the long rainy season (MAM, LEFT) and short rainy season (OND, RIGHT).* ***NOTE****: During both the short and long rainy season temperature has increased by more than 0.5ºC in Tanzania*

Climate change in future[1]

Temperature

During both the short and long rainy season, the projection model for mid-century (2050's) shows a temperature rise by about 2.8°C and 2.5°C for western and eastern parts of Tanzania respectively (Figure 2). Figure 2 demonstrates a rate of warming in Tanzania, whereby temperature over the western part rises greater than the east by about 0.3°C. Temperatures in the southern highlands and central corridor would increase as well but less than the furthest western part of the country.

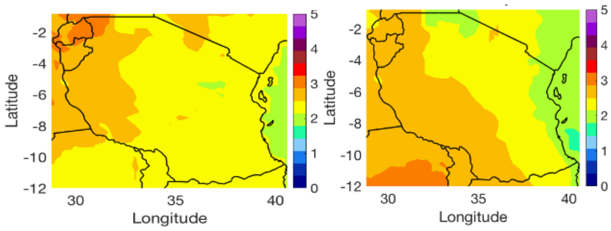

Figure 2*. Projected seasonal mean changes in temperature for 2050s under the RCP8.5 emission scenario, relative to the reference period (1961-2005).* ***NOTE:*** *During both the short (OND, RIGHT) and long (MAM, LEFT) rainy season, temperature is likely to rise by about 2.8°C over western Tanzania and 2.5°C over eastern Tanzania.*

Precipitation

The seasonal mean rainfall in both the short and long rainy season is projected to increase in the northern part of Tanzania by as much as 20-30% by mid-century (Figure 3). In the central, southern and eastern portion of the country, the seasonal mean rainfall is also expected to slightly increase by up to 10%, especially in the long rainy season.

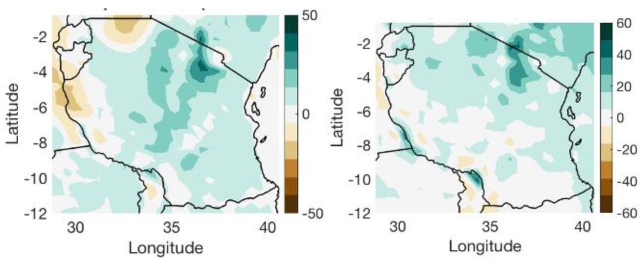

Figure 3. *Projected seasonal mean changes in rainfall (in percentage) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005).* ***NOTE****: The mean rainfall in both the short (RIGHT) and long rainy season (LEFT) is projected to increase in the northern part of Tanzania by 20-30% for the 2050s and in the central, southern and eastern portion of the country by 10%.*

Similarly, the longest consecutive wet days for the northern part of Tanzania increases by about 1 day (Figure 4). However, the rest of the country will experience a decrease in the length of the longest wet spell.

[1] For this work on climate change projections, dynamically downscaled daily rainfall, maximum, minimum and mean temperature from the Rossby Center (SMHI) regional climate model (RCA4) are used. The regional model (RCA4; Dieterich et al., 2013) was used to downscale four Global Circulation Models (EC-EARTH, MPI-ESM-LR) from the Coupled Model Inter-comparison Project Phase 5 (CMIP5). The regional model was run at a grid resolution of 0.44 x 0.44 over the African domain and all other details about the simulation can be found in Dieterich et al. (2013). The global models (GCMs) projections were forced by the Representative Concentration Pathways (RCPs), which are prescribed greenhouse-gas concentration pathways (emissions trajectory) and subsequent radiative forcing by 2100. In this study, we used RCP4.5 and RCP8.5, which are representatives of mid-and high-level of emission scenarios respectively.

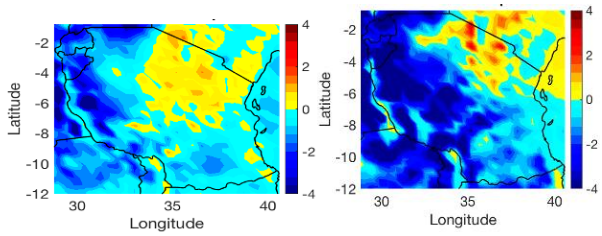

*Figure 4. Projected seasonal mean changes in consecutive wet days (CWD) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** Except for the northern part of the country (where CWD slightly increases by 1 day for both the short (RIGHT) and long (LEFT) rainy season), the length of the longest wet spell is expected to significantly decrease by about 2 - 3 days in most parts of Tanzania by 2050s.*

In the northern part of the country, the increase in the seasonal mean rainfall accompanied by an increase in the number of consecutive wet days could translate into enhanced extreme rainfall.

Drought

The projection of the longest consecutive dry days (CDD) show that dry spells will last longer for mid-and-end of the century for most of Tanzania with much longer dry spells projected (by about 5 days) over central, western and southern part of the country (Figure 5). However, the CDD decreases (by about 1 day) in the northern and north-eastern part of the country. The projected increase in CDD in most parts of the country in both rainy seasons along with decrease in wet spells (Figure 4) and seasonal rainfall could lead to high incidence of drought, which would have a significant impact on rain-fed agriculture.

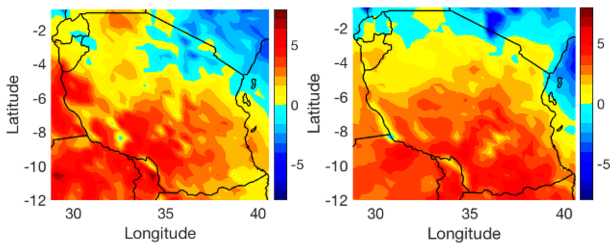

*Figure 5. Projected seasonal mean changes in consecutive dry days (CDD) for mid-century under the RCP8.5 emission scenario, relative to the reference period (1961-2005). Left: RCPs 8.5 2050s – MAM consecutive dry days. Right: RCPs 8.5 2050s – OND consecutive dry days **NOTE**: Dry spells will last longer for the 2050s for most of Tanzania with much longer dry spells projected increase by 5 days over southern and south-western part of the country*

In summary, during both the short (OND) and long (MAM) rainy seasons, the model projections for 2050s show that temperature is expected to rise in all parts of Tanzania ranging from 2.0°C to 2.8°C. A likelihood of more dry spells with an implication of more incidences of agricultural drought is expected over most parts of Tanzania by 2050s.

Climate change impact (modelling study)

Climate change is likely to considerably erode existing opportunities for yield increases in sunflower seeds. Figure 6 (Baseline) shows that under current climatic conditions, farmers can achieve yields of between 3 – 4 tonnes per hectare with the application of optimum nutrient, pest and disease management options. However, Figure 6, also shows the result of a modelling study (RCP 8.5) indicating that by the 2050s, farmers are unlikely to achieve yields of more than 2.6 tonnes per hectare even under optimum nutrient management conditions and biotic control. Further yield increases will have to be achieved through the adoption of improved sunflower varieties and the application of irrigation.

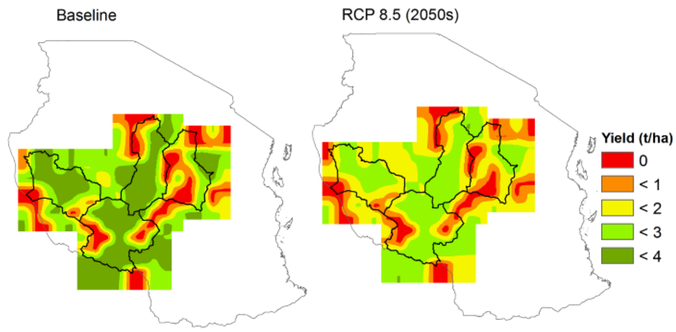

Figure 6. Modelled impacts of climate change on sunflower seed yields under rain fed, optimum nutrient conditions and biotic control (Duku, forthcoming)

Stakeholders' perceptions of climate change and its impact (field survey results)

A field survey on climate change and its impact amongst different stakeholders in the sunflower value chain showed similarities in perceptions but also large differences. Almost all smallholder farmers (male, female) perceived an increase in extreme high temperature, a majority reported that availability of water had declined and perceived a delay in the start of the long rainy season. However, perceptions with respect to changes in the end of the long rainy seasons and changes in crop productivity due to climate change varied largely across stakeholders and between males and females. Stakeholders reported the following high/medium climate related risks; a delay of the start of the rainy seasons, delay of the end of the rainy seasons, increase in length of dry spells and more frequent extreme temperatures.

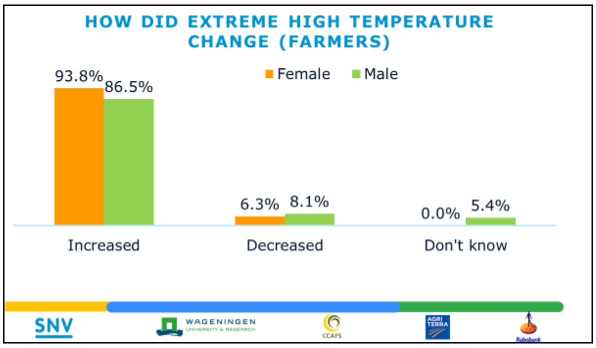

Figure 7. Smallholder farmers' (male & female) perceptions of changes in extreme high temperature due to climate change

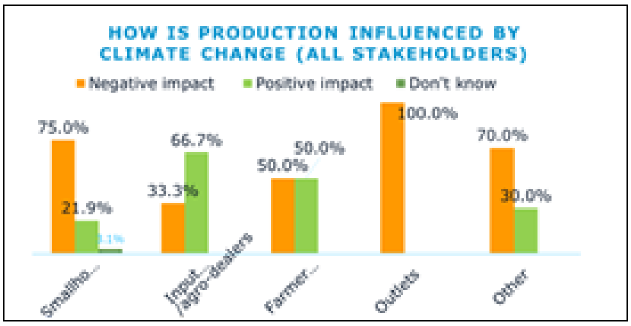

Figure 8. Stakeholder perceptions of effect of climate change on sunflower production

Climate Risk Assessment workshop (15 -16 April, 2019)

The Climate Risk Assessment workshop brought together 26 participants representing the different stakeholders of the sunflower value chain. The majority of the participants were male and female smallholder farmers. Stepwise they shared and discussed experiences with climate change, its impact on their business and the effectiveness of current coping strategies.

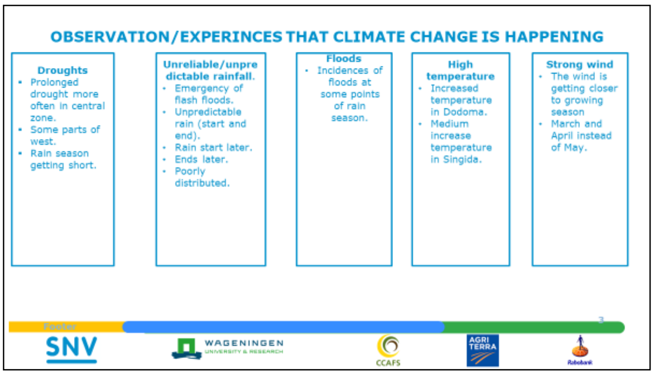

Figure 9. Results of discussion on climate change impact on the business (Source: CRA workshop sunflower, 15 -16 April, 2019)

Based on insights into climate change projections and participants' adaptive capacity, different adaptive strategies were discussed to anticipate and prepare for future conditions.

Adaptation strategies (examples)

- Boreholes
- Drip irrigation (male, female farmers, processors)
- Improved farming practices (ploughing, weeding) (female farmers)
- Improved seeds (drought tolerant, shorter growing cycle (agro-dealers, processors)
- Nurseries (male farmers)
- Diversifying income generating activities (agro-dealers)

Adaptation strategies with potential benefit for the entire value chain were further explored from a business perspective.

Climate smart business ideas were discussed to address high climate related risks and to improve the viability of the value chain.

Climate smart business ideas addressing high-medium climate change risks (examples)

- Package borehole, irrigation, capacity building, improved seeds and ploughing equipment (hoes)
- Improved seeds

References:

1. CIAT & World Bank. 2017. *Climate-Smart Agriculture in Tanzania. CSA Country Profiles for Africa Series.* International Center for Tropical Agriculture (CIAT); World Bank, Washington, D.C. 25 p.
2. Duku, C. (forthcoming). *Impact of climate change on sunflower production in Tanzania.*
3. Thornton, Philip & van de Steeg, Jeannette & Notenbaert, An & Herrero, Mario. (2009). The Impacts of Climate Change on Livestock and Livestock Systems in Developing Countries: A Review of What We Know and What We Need to Know. *Agricultural Systems*. 101. 113-127.
4. SNV (forthcoming). *Climate change field survey on common beans value chain, Tanzania,* April 2019.
5. Zhihua Zeng, Douglas. 2017. *The sunflower sector in Tanzania – A great potential for industrial competitiveness (English)*. Washington, D.C.: World Bank Group.

Acknowledgement

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Project Information

The Climate Resilient Agribusiness for Tomorrow (CRAFT) project (2018 - 2022), funded by the Ministry of Foreign Affairs of the Netherlands, will increase the availability of climate smart foods for the growing population in Kenya, Tanzania and Uganda. The CRAFT project is implemented by SNV (lead) in partnership with Wageningen University and Research (WUR), CGIAR's Climate Change Agriculture and Food Security Programme (CCAFS), Agriterra, and Rabo Partnerships in Kenya, Tanzania and Uganda

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