

# Sunflower Tanzania

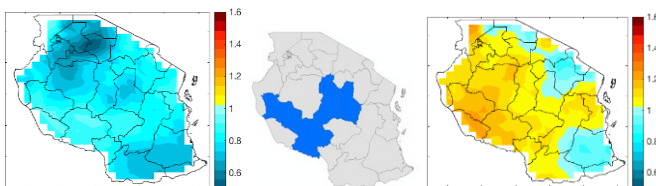


## Sunflower in Tanzania

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 tons 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). The main stakeholders making up the sunflower value chain are agro-dealers, smallholder farmers, middlemen, processors and bigger retail companies.

## Past trends in temperature

The temperature trend (from 1961-2005) for the first rainy season (March, April, May) show that temperature in the western and central sunflower growing areas of the country has been increasing by about 1°C (Figure 1). During the second rainy season (October, November, December), the temperature has increased by 1°C - 1.3°C over western and central sunflower growing areas of the country. The rate of warming has been slightly higher in the second rainy season (OND) as compared to the first season (MAM) by about 0.3°C.



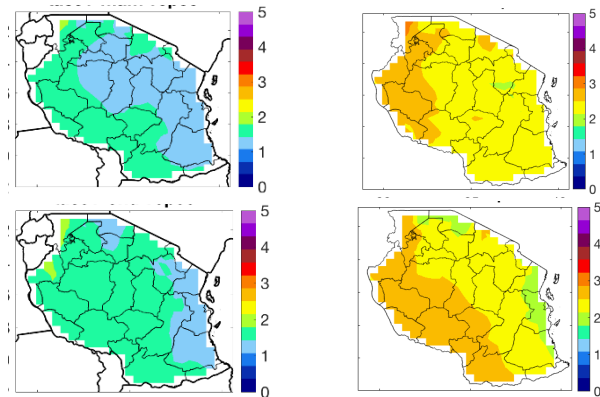
**Figure 1.** Temperature trend from 1961-2005 for the first (OND, LEFT) and second rainy season (MAM, RIGHT). **NOTE:** During both the second (October, November, December) and first (March, April, May) rainy season temperature has increased by about 1°C in sunflower growing areas of Tanzania

# Climate change risks and opportunities

## Climate change in future<sup>1</sup>

### Temperature

During both the first and second rainy seasons, the model projection for 2030's show that temperature in the western and central sunflower growing areas of Tanzania is expected to rise by about 1.4 - 1.8°C (Figure 2). Figure 2 also highlights a pattern in the rate of warming in Tanzania, where temperature in the western part would rise by about 0.4°C, more than the east. The projection model also shows that temperature in the 2050s is expected to rise by about 2.4°C and 2.8°C in the central and western sunflower growing areas, respectively, in both the first and second rainy seasons. Figure 2 demonstrates a rate of warming in Tanzania, whereby temperature over the western sunflower growing areas rises greater than the central by about 0.4°C.

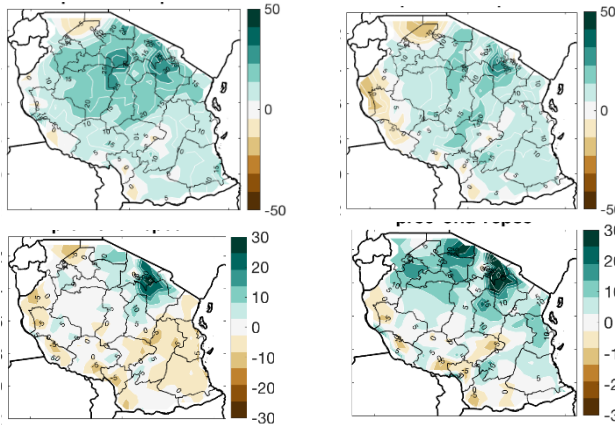


**Figure 2.** Projected seasonal mean changes in temperature for 2030s (LEFT COLUMN) and 2050s (RIGHT COLUMN) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** In the 2050s, temperature in the western sunflower growing areas of Tanzania is likely to rise by about 2.8°C in the second rainy season (OND, BOTTOM RIGHT) and by about 2.4°C in the first (MAM, TOP RIGHT) rainy season.

### Precipitation

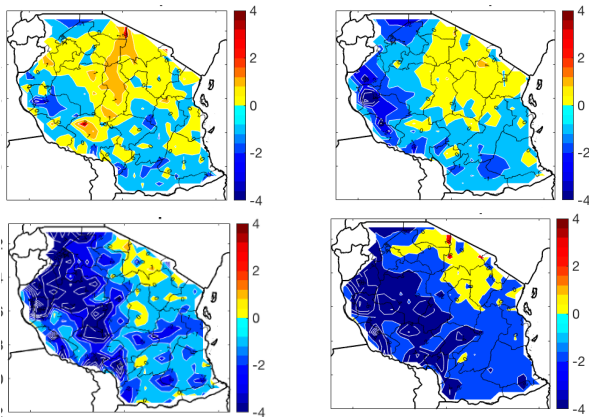
The seasonal mean rainfall in both the second and first rainy season is projected to slightly increase in the central sunflower growing areas of Tanzania by about 10% in the 2030s and 2050s (Figure 3). However, the seasonal mean rainfall in both the 2030s and 2050s is expected to slightly decrease by about 5-10% in the western sunflower growing areas of the country, especially in OND.

<sup>1</sup> 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 3.** Projected seasonal mean changes in rainfall (in percentage) for 2030s (LEFT) and 2050s (RIGHT) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** In both the 2030s and 2050s, the mean rainfall in the second (OND; BOTTOM) and first rainy season (MAM; TOP) is projected to slightly increase in the central sunflower growing areas by 10% for the 2050s.

On the other hand, the longest consecutive wet days in the central sunflower growing areas is expected to slightly decrease (by about 1 day) in the first season (Figure 4). However, the western sunflower growing areas of the country will experience a significance decrease in the length of the longest wet spell (by about 4 days), especially during the second rainy season.

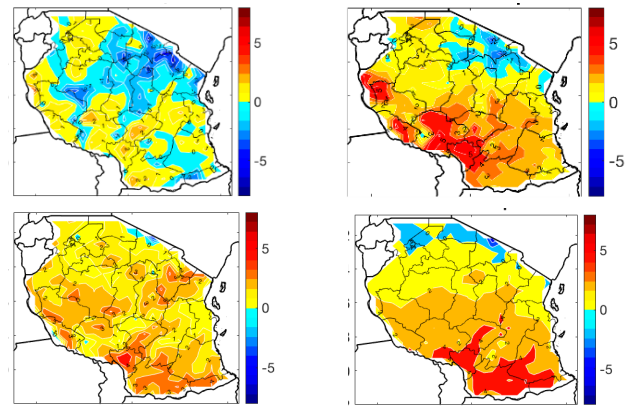


**Figure 4.** Projected seasonal mean changes in consecutive wet days (CWD) for 2030s (LEFT) and 2050s (RIGHT) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** The consecutive wet days are expected to significantly decline (4 days and above) in the west sunflower growing areas especially during the second rainy season (OND; BOTTOM).

### Drought

The projection of the longest consecutive dry days (CDD) show that dry spells will last longer in the 2030s and 2050s in both the western and central sunflower growing areas of Tanzania (Figure 5). The longest dry spells (~5 days and above) is expected in the western sunflower growing areas of the country in both the first and second rainy seasons of the 2050s. The projected increase in CDD in the western and central sunflower growing areas of the country in both the 2030s and 2050s for the second and first rainy seasons along with decrease in wet spells (Figure 4) and seasonal rainfall (Figure 3) could

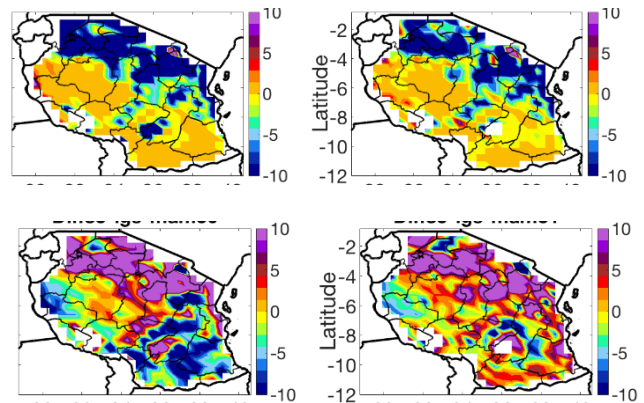
lead to high incidence of drought, which would have a significant impact on the sunflower yield in the region.



**Figure 5.** Projected seasonal mean changes in consecutive dry days (CDD) for 2030s (LEFT) and 2050s (RIGHT) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** Dry spells will last longer (by about 5 days) in the 2030s and 2050s in the western sunflower growing areas in both the second (BOTTOM) and first (TOP) rainy seasons.

### Onset and length of growing spell

The onset, cessation and length of growing spell for the first rainy season (MAM) is estimated for the historical (1961-2005) and the 2030s and 2050s. Results show that onset of the rainfall is expected to be slightly delayed (by about 1-3 days) in both the western and central sunflower growing areas of the country (Figure 6, TOP). Similarly, the length of the growing spell in the western and central sunflower growing of Tanzania is expected to decrease by about 5 days (Figure 6, BOTTOM).



**Figure 6.** Projected seasonal mean changes in onset for 2030s (TOP-LEFT) and 2050s (TOP-RIGHT) and length of growing spell for 2030s (BOTTOM-LEFT) and 2050s (BOTTOM-RIGHT) under the RCP8.5 emission scenario, relative to the reference period (1961-2005). **NOTE:** Onset of the rainfall in the western sunflower growing areas is expected to be delayed and the length of the growing spell is projected to shorter by about five days.

In summary, during both the second (OND) and first (MAM) rainy seasons, the model projections for 2030s and 2050s show that temperature is expected to rise by about 1.4°C to 2.8°C in the sunflower growing areas of Tanzania. A likelihood of more dry spells

with an implication of more incidences of agricultural drought is expected over both the western and central sunflower growing areas of the country.

### Climate change impact (literature review)

Climate change is likely to considerably erode existing opportunities for yield increases in sunflower seeds. Figure 7 (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 7, 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.

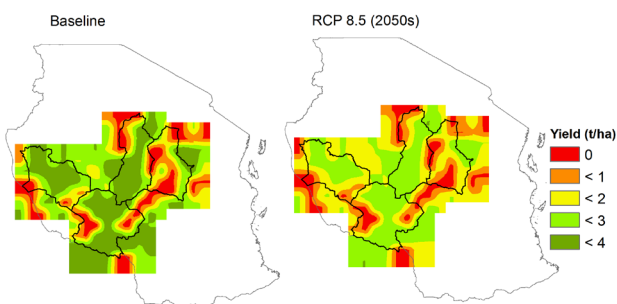


Figure 7. Modelled impacts of climate change on sunflower seed yields under rain fed, optimum nutrient conditions and biotic control (Duku, forthcoming)

### 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.

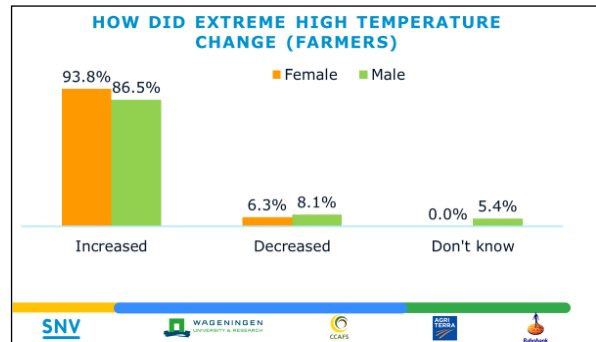


Figure 8. Smallholder farmers' (male-female) perception of changes in extreme high temperature due to climate change



Figure 9. Stakeholders' perception 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.

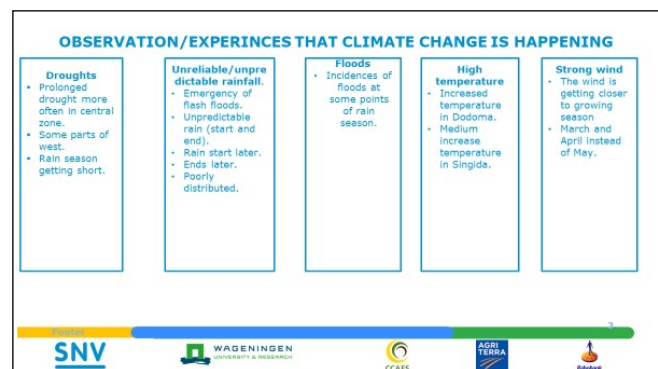


Figure 10. Results of discussion on climate change impact on the business (Source: CRA workshop sunflower, 15 -16 April, 2019)

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:

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### Acknowledgement

This document was developed by Annemarie Groot, Confidence Duku and Monserrat Budding-Polo (Wageningen Environmental Research) with contributions from: Teferi Demissie (CCAFS), Godfrey Kabuka (SNV), Emanuel Nkenja (SNV), Kasian Ninga (SNV), Raymond Lyimo (Agriterria), Pierre Schonenberg (Rabo Partnerships B.V), April, 2019. It highlights activities and examples of results of a climate risk assessment for the sunflower value chain implemented in the period January - April 2019. The assessment was carried out in the context of the **Climate Resilient Agribusiness For Tomorrow (CRAFT)** project.

### 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), Agriterria, and Rabo Partnerships in Kenya, Tanzania and Uganda

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