www.repoa.or.tz

No PB23/2021.November 2021

Repoa Brief

REPOA Knowledge is Power

# Industrializing Agriculture in a Changing Climate: Effects of Weather Extremes on Rice Production in Tanzania

**By Idil Ires**

## Key messages

- Rice production has increased, but this increase was not steady and mainly stemmed from the expansion of the area under cultivation.
- Climate change and agricultural production are closely linked: recurrent and intensified weather extremes coincide with years of decreased rice production in Tanzania.
- The neglect of these weather extremes undermines the possibility of realizing the rice subsector goals regarding doubling production and threatens farmers.
  Mainstreaming specific goals and strategies to attain them into the agricultural and rice subsector policies is necessary.
- Investment into climate-smart rice farming offers economic and environmental wins.

## Introduction

Agricultural and natural resources worldwide are influenced by unprecedented impacts of climate change, with implications for economic growth. If mean temperatures continue to rise globally by 3.2°C, the global economy could lose up to 18 percent of its GDP and 10 percent of its total economic value by 2050 (WEF 2021). A similar loss is on sight for Tanzania, though its agriculture has not suffered catastrophic natural events in the past 20 years and maintained a steady economic growth (World Bank 2015). In 2019, the European Commission's Index for Risk Management scored Tanzania as under high risk, ranking it 25th out of 191 countries for vulnerability to natural hazards and risks (e.g., tsunamis, droughts, and floods) influenced by a changing climate (IASC/EC 2019).

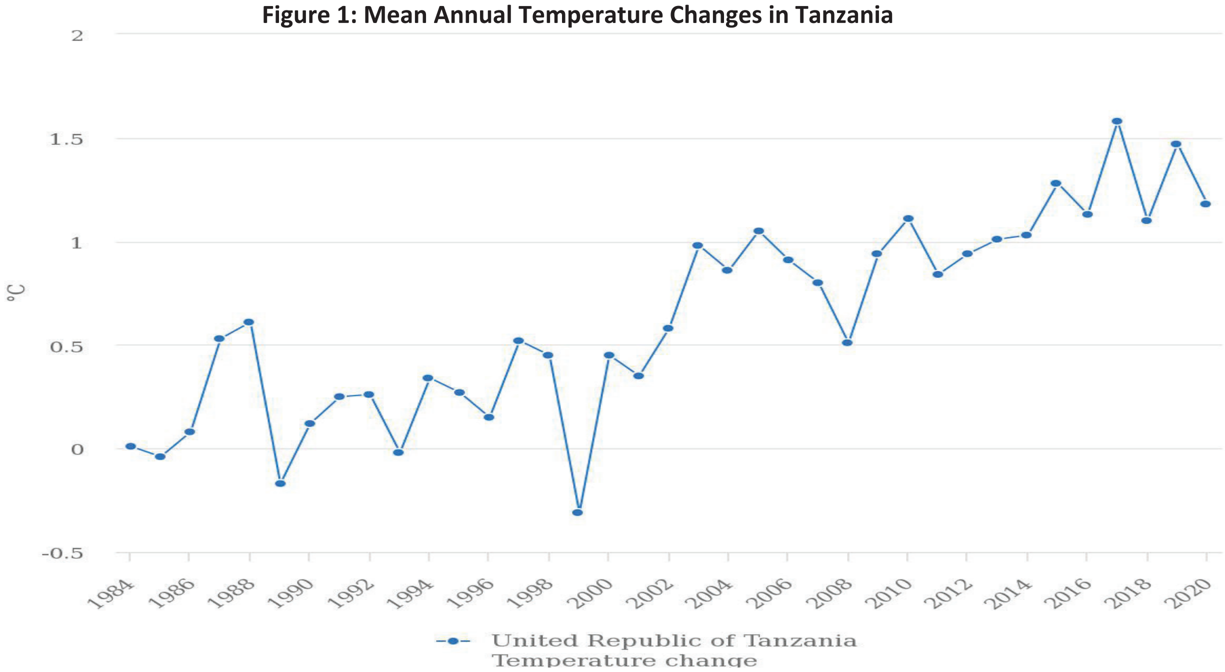
As the second most important staple food after maize and a commercial crop, rice is a strategic agricultural commodity in Tanzania. Increased production and export are vital for the country's increased export revenue and the economy. These outcomes may also improve rural welfare since the subsector employs about 30 percent of the country's population, mainly smallholders (Wilson and Lewis 2015). Hence, the National Rice Development Strategy II (NDRS II) (2019–30) emphasizes growing the area under cultivationfrom 1.1 to 2.2 million hectares, doubling paddy production from 3.08 to 6.15 tons per hectare and rice (milled) from 2 to 4 tons per hectare, and reducing postharvest losses from 30 to 10 percent until 2030 (URT 2019).

Unlike the NDRS I (URT 2009), NDRS II mentions climate adaptation in agriculture and the sustainable intensification and expansion of rice systems (URT 2019). However, specification is missing as to how these goals will be achieved. Moreover, adaptation is not among the primary challenges and strategic priorities (i.e., irrigation, inputs, technologies, and marketing) that it identifies to pull public and private investments into. This policy paper seeks to shed light on the linkages between the broader climate events, local weather extremes, and rice production in major rice-producing regions based on the literature review and a past study of the author. Based on these strong linkages, it emphasizes the necessity of mainstreaming climate adaptation into the agricultural and rice sub-sector development strategies.

## Climate Trends in Rice Producing Regions in Tanzania

Climate change is forecasted to wreck agriculture and life in Tanzania. UN agencies estimated continental warming across Africa to exceed 2°C by the mid-century, causing new weather extremes (UNFCCC 2020; WMO 2020). Moreover, model projections demonstrated that if this temperature increase materializes as expected, staple food yields (maize, rice, and sorghum) will dramatically decrease, leading to chronic food insecurity in Tanzania (Rowhani et al. 2011; Kahimba et al. 2015). This is especially a threat in the Southern Highlands—the food basket of the country which has encountered recurrent episodes of prolonged droughts (Kahimba et al. 2015). When one of the worst droughts happened in 2006, food prices peaked, famine was predicted, and water shortages caused power blackouts countrywide. Heavy floods in 2009–10 in Kilosa and 2011 in Dar es Salaam led to the displacement of thousands of people, death and destruction of property and infrastructure, and inflation (IMF 2012; Irish Aid 2018). Though extreme weather repeats every three-four years due to the wider climatic events, floods have been becoming more intense, droughts longer, rains starting and ceasing earlier than before, which are associated with climate change (Irish Aid 2018; Komba and Muchapondwa 2018). These intensifying extremes are likely to undermine Tanzania's efforts to become self-reliant and an export lead in rice (and generally, staple food) if neglected.

**Figure 1: Mean Annual Temperature Changes in Tanzania**

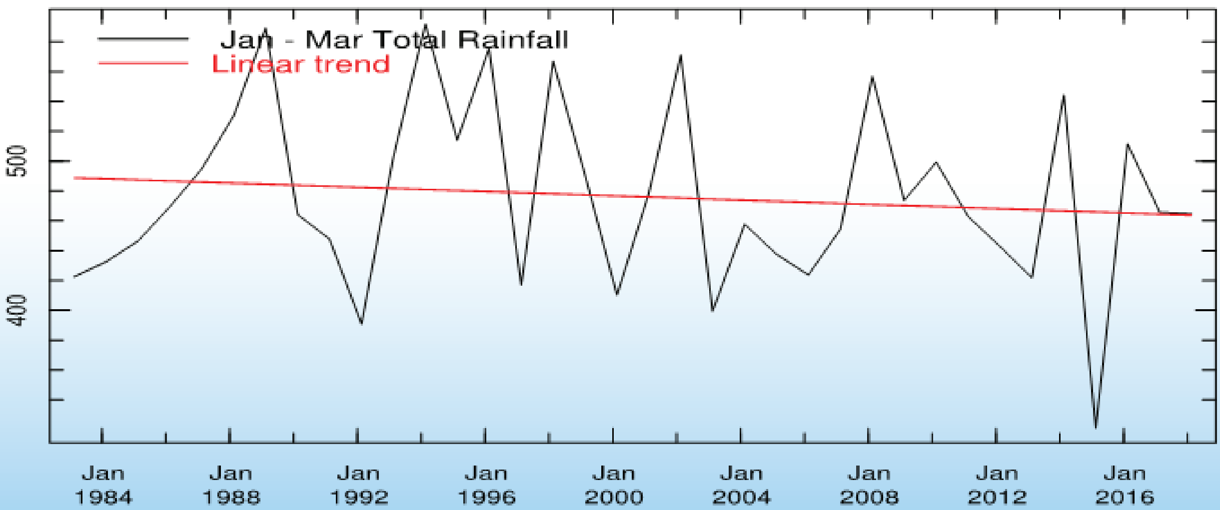


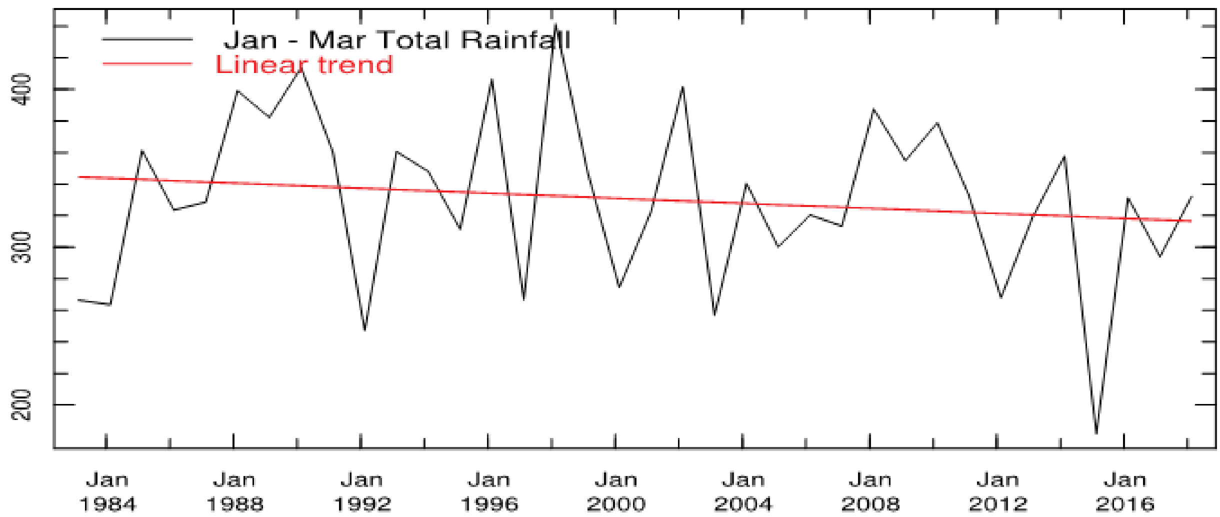

Source: World Bank (2021)

Historical temperature and precipitation trends—two underlying indicators of climate change— tend to confirm this link between climate change and extreme weather episodes in Tanzania. From 1961 to 2013, Tanzania experienced a significant increase in the mean maximum and minimum temperatures throughout the country (World Bank 2021) (Figure 1). The mean minimum temperature rose much faster than the maximum. Precipitation change was little. During the same period, Tanzania's rainfall fluctuations remained statistically insignificant: data pointed to only a slight decline in most of the stations (World Bank 2021). Though the historical rainfall fluctuations in Tanzania were statistically insignificant, six of the major rice producer regions faced severe floods and droughts. These regions are Morogoro in central-western, Tabora, Shinyanga, Geita, and Mwanza in northwestern, and Mbeya in southwestern Tanzania. Scarce and excessive rainfall co-occurring in these different regions likely balanced each other off and did not reflect on national precipitation averages.

For instance, following the Tanzania Meteorological Agency's declaration of "the worst El-Niño" in 2015/16 until that time (FAO 2016: 1), the temperature change peaked to +1.5°C at the end of the 2016/17 season (World Bank 2021). The mean temperature reached a record level of above 23°C, and the rainfall fell short, below 150 millimeters (TMA 2021). With a delayed onset and an early cessation of below-average rainfall, an intensive drought extended from 2015/16 into 2016/17 in the rice-producer areas in the southwest and northwest Tanzania (Figure 2). Meanwhile, other parts of the country experienced extreme floods similar to that of 2009–11, leaving roads, houses, bridges, and farms destroyed (FAO 2016). In 2016, heavy rains killed two people in Mbeya town when precipitation reached 183.2 millimeters in only 24 hours (Flood List 2016). The rainfall extremes of 2015–17 caused twice as destruction as the El-Niño in 1997—a tragic year that triggered a food crisis and left thousands of people homeless in Tanzania (FAO 2016).

**Figure 2: PrecipitationTrends in Southwest and Northwest Tanzania**






Source: Tanzania Meteorological Agency (2021)

The years of rice yield decrease are concurrent with the years of extreme rainfall prompted by such broader climatic events; this concurrence is uncoincidental. Although the average yield has increased over time, this increase mainly stemmed from the expansion of the area under cultivation. The NRDS II mid-term goals set for 2019–25 include a rise in the cultivated area from 1.1 to 1.43 million hectares and paddy production from 3.08 to 4.3 tons per hectare (URT 2019). In 2019/20, according to the national agricultural census, the average paddy production was 2.3 tons per hectare, below this goal, but the cultivated area stood at 1.5 million hectares, above (URT 2021). This trend shows that while the NRDS's land expansion goals have been already met and overachieved, production levels lagged behind. Therefore, the yield increase likely stemmed from the land expansion. Moreover, the increase in paddy production has been unsteady. A closer look into data from different years reveals that in 2016/17, in the aftermath of the weather extremes this year, the average production was only 1.3 tons per hectare, the lowest in the last decade (2011–21) (URT 2017). Evidently, rice production is not independent of the weather.

The extremity of the 2015–17 drought and its impacts on rice production levels was confirmed by farmers during a study conducted in the Mbeya region the same year (Ires 2021b, 2021a). Irrigation farmers suggested that despite the use of improved hybrid cultivars and intensified fertilizer use, the paddy harvest was low, while many rainfed farmers reported endemic crop failures.

Dipped production as a result of recurrent extreme weather often leads to adjustments in food policy and trade. Export embargoes are usually one of the first measures deployed to control domestic food prices and ensure food security. For example, as a result of the decreased rice production in 2015/17, prices rose dramatically in large cities (and doubled in Arusha) in only one year from January 2016 to January 2017, while shortages persisted into 2017 (FAO 2017). Soaring food prices led the former president (the late President John Pombe Magufuli) to enact several rounds of export bans to sustain food security though the country had committed to trade liberalization—against its ambitions to become an export lead in the region.

## Conclusion and Recommendation

A scrutinization of the historical and regional data on temperature, rainfall, and rice production trends supports the suggestion that production cannot consistently and significantly increase unless concrete steps are taken to strengthen climate adaptation. While commercial rice farming has not proven to protect smallholders from adverse climate impacts, recurrent food shortages will likely continue influencing Tanzania's trade policies and drive export bans against its goals to become a rice export giant in the region and expand into the international markets. Hence, it is critical for policymakers and donors to mainstream climate change into the agricultural and rice sector strategies and introduce specific adaptation goals to be realized in the mid- and long-term, until 2025 and 2030, respectively. This addendum should elaborate on how and which seeds and fertilizers will decrease crop water requirements and sustain soil fertility, as well as climate-smart investments from which sources will help manage excessive and scarce water situations, backed up by research-based evidence. Further investment is needed to develop weather forecasting, warning, and advisory systems to avoid disastrous outcomes before climate impacts materialize and harm producers and traders.

## References


FAO (Food and Agricultural Organization of the United Nations). 2016. "Rapid Agriculture Needs Assessment in Response to the 'El - Niño' Effects in the United Republic of Tanzania."

FAO (Food and Agricultural Organization of the United Nations). 2017. "Monthly Report on Food Price Trends." Food Price Monitoring and Analysis Bulletin 1 (February): 18. http://www.fao.org/3/a-i6829e.pdf.

Flood List. 2016. "Tanzania – 3 Dead, 100s Displaced After Floods in Mbeya, Zanzibar and Kilimanjaro Regions." 2016. http://floodlist.com/africa/tanzania-floods-mbeya-zanzibar-kilimanjaro.

IASC (Interagency Standing Committee)/EC (European Commission). 2019. "INFORM Country Profile Map." 2019. https://drmkc.jrc.ec.europa.eu/inform-index/Countries/Country-Profile-Map.
IMF (International Monetary Fund). 2012. "Staff Report United Republic of Tanzania: Fourth Review under the Policy Support Instrument and Request for an Arrangement under the Standby Credit Facilities." No. 12/185. IMF Country Report.
Ires, Idil. 2021a. Brokering Development? The Private Sector and Unalleviated Poverty in Tanzania's Agricultural Growth Corridors. Transcript Verlag.
Ires, Idil. 2021b. "Intensive Agriculture as Climate Change Adaptation? Economic and Environmental Tradeoffs in Securing Rural Livelihoods in Tanzanian River Basins." Frontiers in Environmental Science 9. https://doi.org/10.3389/fenvs.2021.674363.
Irish Aid. 2018. "Tanzanaia Country Climate Change Risk Assessment Report."
Kahimba, F.C., A.S. Sife, S.M.S. Maliondo, E.J. Mpeta, and J. Olson. 2015. "Climate Change and Food Security in Tanzania: Analysis of Current Knowledge and Research Gaps." Tanzania Journal of Agricultural Sciences 14 (1): 21–33.
Komba, Coretha, and Edwin Muchapondwa. 2018. "Adaptation to Climate Change by Smallholder Farmers in Tanzania." In Agricultural Adaptation to Climate Change in Africa: Food Security in a Changing Environment. https://doi.org/10.4324/9781315149776.
Rowhani, Pedram, David B. Lobell, Marc Linderman, and Navin Ramankutty. 2011. "Climate Variability and Crop Production in Tanzania." Agricultural and Forest Meteorology 151 (4): 449–60. https://doi.org/10.1016/j.agrformet.2010.12.002.
TMA (Tanzania Meteorological Agency). 2021. "Data Analysis Tool (Maproom)." 2021. https://www.meteo.go.tz/.
UNFCCC (United Nations Framework Convention on Climate Change). 2020. "Climate Change Is an Increasing Threat to Africa." 2020. https://unfccc.int/news/climate-change-is-an-increasing-threat-to-africa.
URT (United Republic of Tanzania). 2009. "The National Rice Development Strategy Final Draft." Dar es Salaam, Tanzania.
URT (United Republic of Tanzania). 2017. "Annual Agricultural Sample Survey 2016/17." https://nbs.go.tz/nbs/takwimu/Agriculture/2016_17_AASS_ report.pdf.
URT (United Republic of Tanzania). 2019. "National Rice Development Strategy Phase II,2019-2030."
URT (United Republic of Tanzania). 2021. "National Sample Census of Agriculture 2019/20." National Report.
WEF (World Economic Forum). 2021. "This Is How Climate Change Could Impact The Global Economy." 2021. https://www.weforum.org/agenda/2021/06/impact-climate-change-global-gdp/.
Wilson, T.R., and I. Lewis. 2015. "The Rice Value Chain In Tanzania. A Report from the Southern Highlands Food Systems Programme." www.fao.org/publications.
WMO (World Meteorological Organization). 2020. State of the Climate in Africa 2019. World Meteorological Organization.
World Bank. 2015. "Tanzania Agricultural Sector Risk Assessment: Agriculture Global Practice Technical Assistance Paper."
World Bank. 2021. "Tanzania - Climatology | Climate Change Knowledge Portal." 2021. https://climateknowledgeportal.worldbank.org/country/tanzania/climate-data-historical.

*This policy brief was produced with the financial support of the European Union, through the EU-ACP TradeCom II Programme, as part of the 'Targeted support to strengthen capacity of policy makers, exporters, and trade associations to assess and review trade and related economic policies to promote trade competitiveness and diversification for widening trading opportunities with the EU'' project implemented by implemented by REPOA and ISS-Erasmus. Its contents are the sole responsibility of REPOA and do not necessarily reflect the views of the European Union, the EU-ACP TradeCom II Programme or ISS-Erasmus.*

*The Member States of the European Union have decided to link together their know-how, resources and destinies. Together, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.*

**REPOA HQs**
157 Mgombani/REPOA streets, Regent Estate, PO Box 33223, Dar es Salaam, Tanzania.
Tel: +255 22 2722283 Cell: +255 75 409 1677 Fax +255 22 2705738

Website: https://www.repoa.or.tz
Email: repoa@repoa.or.tz

**Branch Office**
2nd Floor Kilimo Kwanza Building
41105 Makole East, Kisasa,
Dodoma, Tanzania