Federal Ministry for Economic Cooperation and Development

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Climate Risk Profile: Tanzania

Summary

This profile provides an **overview of projected climate parameters and related impacts** on different sectors in Tanzania until 2080 **under different climate change scenarios** (called Representative Concentration Pathways, RCPs). RCP2.6 represents the low emissions scenario in line with the Paris Agreement; RCP6.0 represents a medium to high emissions scenario. **Model projections do not account for effects of future socio-economic impacts.**

Agriculture, biodiversity, health, infrastructure and water are highly vulnerable to climate change. **The need for adaptation in these sectors has been stressed in Tanzania's NDC targets and German development cooperation is committed to addressing these challenges by seeking to mainstream climate change adaptation into its cooperation portfolio.**

Depending on the scenario, **temperature** in Tanzania is projected to **rise by between 1.4 and 3.6 °C by 2080**, compared to pre-industrial levels, with higher temperatures and more temperature extremes projected for the east of the country.

Precipitation trends are highly uncertain and project little change to an **annual precipitation decrease of up to 42 mm by 2080**. Future dry and wet periods are likely to become **more extreme**.

Under RCP6.0, the **sea level** is expected to **rise by 41 cm** until 2080. This threatens Tanzania's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs.

Climate change is likely to cause **severe damage to the infrastructure sector** in Tanzania. Especially transport infrastructure is vulnerable to extreme weather events, yet essential for trading agricultural goods. Investments will need to be made into climate-resilient infrastructure.

Models project a possibility of an **increase in crop land exposure to drought**. Yields of maize are projected to remain at current levels, while yields of heat- and drought-resistant crops such as cassava and groundnuts are projected to benefit from CO_2 fertilisation. Farmers will need to adapt to these changing conditions.

Agro-ecological zones might **shift, affecting ecosystems, biodiversity** and **crop production**. Models project regionally varying changes in species richness and an increase in tree cover in response to climate change.

Per capita water availability will decline by 2080 mostly due to population growth. Model projections indicate that **water saving measures are expected to become particularly important after 2030 in western Tanzania.**

The **population affected by at least one heatwave** per year is projected to **rise** from 2 % in 2000 to 19 % in 2080. This is related to 22 more very hot days per year over this period. As a consequence, **heat-related mortality** is estimated to **increase by a factor of more than three** by 2080.

Context

Tanzania is an **East African country** with direct access to the Indian Ocean and with more than **1 400 km of coastline** [1]. The current **population is about 56 million with an annual demographic growth rate of 3.0 %** [2]. The population distribution in Tanzania is extremely uneven with the highest population concentrations in the north near Lake Victoria and around the largest city Dar es Salaam [1]. Although its economy is the second largest in East Africa and despite an annual GDP per capita growth rate of 2.7 %, Tanzania still counts as a **least developed country (LDC)** with a real GDP per capita of 985 USD**.** The services sector dominates the economy, contributing 37.9 % to the country's GDP in 2017, followed by agriculture with 28.7 % and industry with 25.1 % [3]. **Nuts (coconut, Brazil nut and cashew), tobacco and coffee are Tanzania's major agricultural exports**, while gold is the country's most important non-agricultural export at 29 % of total exports [4]. Although services have surpassed the agricultural sector, **75 % of Tanzania's population is employed in agriculture** and heavily relies on the sector for food security and livelihoods [5]. **Important staple crops include maize, rice, beans, groundnuts, cassava, sorghum and millet** [6]**.** However, Tanzania has **one of the lowest levels of agricultural production in sub-Saharan Africa**, making the country dependent on imports, especially of wheat from Russia but also of sorghum from South Africa and Sudan [4], [5]. The majority of agricultural produce comes from smallholder farms and is cultivated on rainfed land. Currently, only 1.5 % of the national crop land suitable for irrigation (29.4 million ha) is irrigated [7]. Therefore, concerns are growing about the effects of climate change including the increase of temperatures, reduced availability of water and the occurrence of floods and other extreme weather events. Hence, especially smallholder farmers suffer from the impacts of climate variability, which can reduce food supply and increase the risk of hunger and poverty. **Limited adaptive capacity in the agricultural sector underlines the country's vulnerability to climate change.**

Quality of life indicators [2],[8]–[10]

Human Development Index (HDI) 2018	ND-GAIN Vulnerability Index 2018	GINI Coefficient 2017	Real GDP per capita 2019	Poverty headcount ratio 2011	Prevalence of undernourishment 2016–2018
0.528 **159 out of 189** (0 = low, 1 = high)	**38.0** **148 out of 181** (0 = low, 100 = high)	**40.5** (0–100; 100 = perfect inequality)	**985 USD** (constant 2010 USD)	**49.1 %** (at 1.9 USD per day, 2011 PPP) [1]	**30.7 %** (of total population)

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[1] Poverty headcount ratio for the year 2011 adjusted to 2011 levels of Purchasing Power Parity (PPP). PPP is used to compare different currencies by taking into account national differences in cost of living and inflation.

Topography and environment

Tanzania is mainly located on plateaus with an average altitude of approximately 1 000 m [1]. The highest peak is **Mount Kibo at 5 895 m**, which is also Africa's highest mountain. These different topographies translate into different agroecological conditions with specific temperature and moisture regimes, and consequently, specific patterns of crop production and pastoral activities. Similarly, **Tanzania's climate is largely influenced by its altitude,** ranging from the tropical lowlands in the east to the colder highlands in the north and south-west [11]**.** There are **two rainy seasons in the north and the east** while only **one rainy season occurs in the south, west and centre** (Figure 1). **Lake Tanganyika**, Africa's deepest lake, and **Lake Victoria** are important sources of water and fish, surrounded by wetlands and rangeland areas. Tanzania's largest rivers are the Rovuma and Rufiji, both carrying water the whole year round and discharging into the Indian Ocean. The **Rufiji delta contains the largest mangrove forest in East Africa**, which presents a rich source of biodiversity, while supporting large communities dependent on agriculture and fisheries [12]. However, overharvesting of mangroves for fuel wood and agricultural expansion increasingly threaten coastal ecosystems through loss of biodiversity, coastal erosion and salinisation. Furthermore, concerns grow about the development of the upper Rufiji catchment including the construction of a hydropower station, partly realised in the Selous Game Reserve, therefore presenting a serious threat to biodiversity and livelihoods of local farmers and fishermen [13]. Further environmental issues include **climate-related pressures such as droughts, rising sea levels and floods** as well as human-induced impacts like deforestation, land degradation and overgrazing, highlighting the **need for adaptation measures to protect Tanzania's biodiversity and maintain fragile ecosystems and their services**.

Present climate

Tanzania has a diverse climate largely influenced by altitude: Highlands exhibit a mean annual temperature of 18 °C, while lowland areas in eastern Tanzania exhibit values of up to 26 °C. The semi-arid central plateau, which is characterised by steppe, exhibits a mean annual temperature of 23 °C.

Tanzania has two rainy seasons (bimodal precipitation regime) in the upper north and the east – a major one from March to May and a minor one from October to December. One rainy season (unimodal precipitation regime) from October to May occurs in the southern, western and central parts of the country.

Annual precipitation sums range from 500 to 1 000 mm on the central plateau and exceed 1 300 mm in both the lowlands and the highlands.

Figure 1: Topographical map of Tanzania with existing precipitation regimes.[2]

[2] The climate graphs display temperature and precipitation values which are averaged over an area of approximately 50 km x 50 km. Especially in areas with larger differences in elevation, the climate within this grid might vary.

Projected climate changes

How to read the line plots

historical — best estimate
RCP2.6 — likely range
RCP6.0 — very likely range

Lines and shaded areas show multi-model percentiles of 31-year running mean values under RCP2.6 (blue) and RCP6.0 (red). In particular, lines represent the best estimate (multi-model median) and shaded areas the likely range (central 66 %) and the very likely range (central 90 %) of all model projections.

How to read the map plots

Colours show multi-model medians of 31-year mean values under RCP2.6 (top row) and RCP6.0 (bottom row) for different 31-year periods (central year indicated above each column). Colours in the leftmost column show these values for a baseline period (colour bar on the left). Colours in the other columns show differences relative to this baseline period (colour bar on the right). The presence (absence) of a dot in the other columns indicates that at least (less than) 75 % of all models agree on the sign of the difference.
For further guidance and background information about the figures and analyses presented in this profile kindly refer to the supplemental information on how to read the climate risk profile.

Temperature

In response to increasing greenhouse gas (GHG) concentrations, **air temperature over Tanzania is projected to rise** (Figure 2). Compared to pre-industrial levels, median climate model temperature increases over Tanzania amount to approximately 1.4 °C in 2030, 1.7 °C in 2050 and 1.6 °C in 2080 under the low emissions scenario RCP2.6. Under the medium/high emissions scenario RCP6.0, median climate model temperature increases amount to 1.4 °C in 2030, 1.7 °C in 2050 and 2.5 °C in 2080.

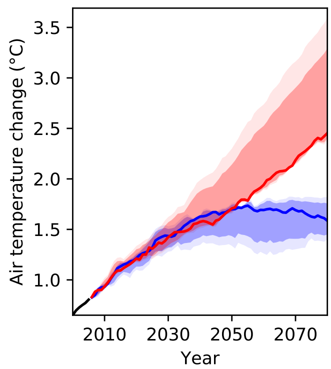

Figure 2: Air temperature projections for Tanzania for different GHG emissions scenarios.[3]

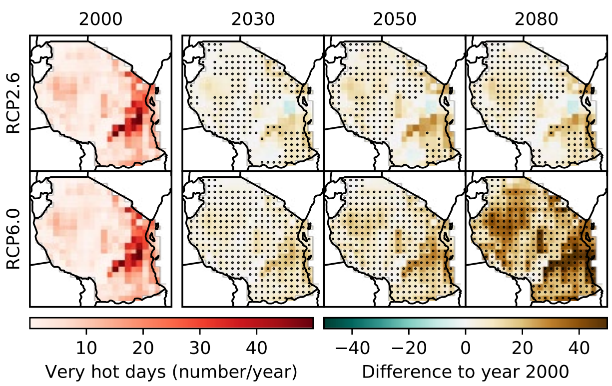

Figure 3: Projections of the annual number of very hot days (daily maximum temperature above 35°C) for Tanzania for different GHG emissions scenarios.

Very hot days

In line with rising mean annual temperatures, the annual number of very hot days (days with daily **maximum temperature above 35 °C**) is projected to rise substantially and with high certainty, in particular over eastern Tanzania (Figure 3). Under the medium/high emissions scenario RCP6.0, the multi-model median, averaged over the whole country, projects **6 more very hot days per year in 2030 than in 2000, 11 more in 2050 and 22 more in 2080**. In some parts, especially in eastern Tanzania, this amounts to about 100 days per year by 2080.

Sea level rise

In response to globally increasing temperatures, the sea level off the coast of Tanzania is projected to rise (Figure 4). Until 2050, similar sea levels are projected under both emissions scenarios. Under RCP6.0 and compared to year 2000 levels, the median climate model projects **a sea level rise by 11 cm in 2030, 21 cm in 2050 and 41 cm in 2080**. This threatens Tanzania's coastal communities and may cause saline intrusion in coastal waterways and groundwater reservoirs, rendering water unusable for domestic use and harming biodiversity.

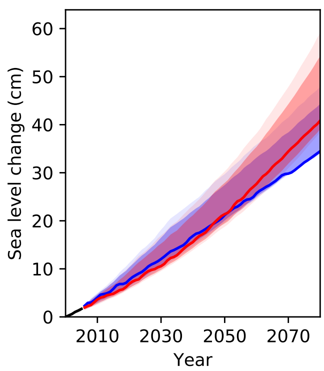

Figure 4: Projections for sea level rise off the coast of Tanzania for different GHG emissions scenarios, relative to the year 2000.

Precipitation

Future projections of precipitation are less certain than projections of temperature change due to high natural year-to-year variability (Figure 5). Out of the three climate models underlying this analysis, none of the models projects a clear trend in mean annual precipitation over Tanzania under RCP6.0. Under RCP2.6, two models project a decrease, while for one model, the trend remains unclear. Median model projections for RCP2.6 show **a decrease in precipitation by 42 mm until 2080**, while median model projections for RCP6.0 show **almost no change in precipitation by 2080** compared to year 2000.

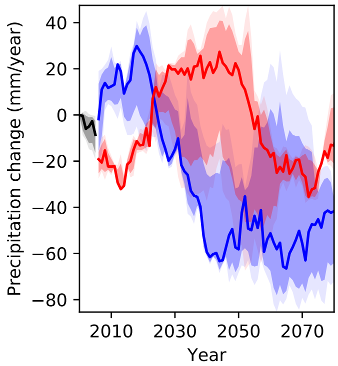

Figure 5: Annual mean precipitation projections for Tanzania for different GHG emissions scenarios, relative to the year 2000.

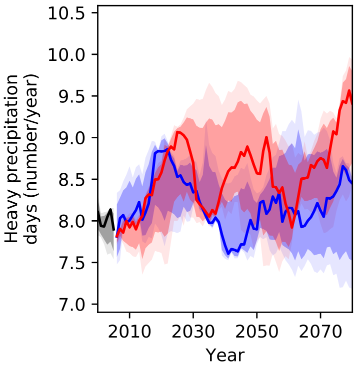

Figure 6: Projections of the number of days with heavy precipitation over Tanzania for different GHG emissions scenarios, relative to the year 2000.

Heavy precipitation events

In response to global warming, **heavy precipitation events are expected to become more intense** in many parts of the world due to the increased water vapour holding capacity of a warmer atmosphere. At the same time, the number of days with heavy precipitation events is expected to increase. This tendency is also found in climate projections for Tanzania (Figure 6), with climate models projecting **a slight increase in the number of days with heavy precipitation**, from 8 days per year in 2000 to 9 days per year in 2080 under RCP6.0. Under RCP2.6, the number of days with heavy precipitation does not change.

[3] Changes are expressed relative to year 1876 temperature levels using the multi-model median temperature change from 1876 to 2000 as a proxy for the observed historical warming over that time period.

Soil moisture

Soil moisture is an important indicator for drought conditions. In addition to soil parameters and management, it depends on both precipitation and evapotranspiration and therefore also on temperature, as higher temperatures translate into higher potential evapotranspiration. **Annual mean top 1-m soil moisture projections for Tanzania show a decrease of 4 % under both RCP2.6 and RCP6.0 by 2080** compared to the year 2000 (Figure 7). However, looking at the different models underlying this analysis, there is large year-to-year variability and modelling uncertainty, which makes it difficult to identify a clear trend.

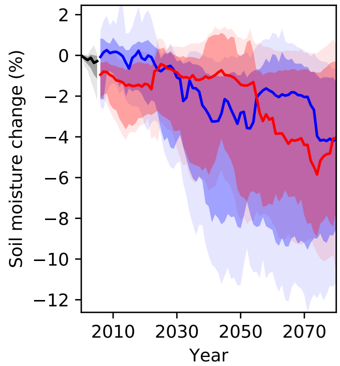

Figure 7: Soil moisture projections for Tanzania for different GHG emissions scenarios, relative to the year 2000.

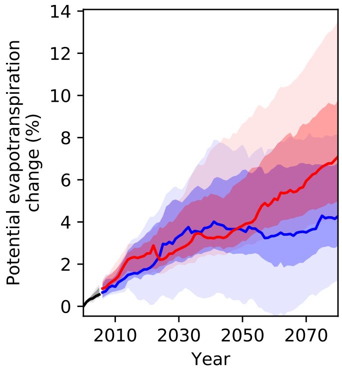

Figure 8: Potential evapotranspiration projections for Tanzania for different GHG emissions scenarios, relative to the year 2000.

Potential evapotranspiration

Potential evapotranspiration is the amount of water that would be evaporated and transpired if sufficient water was available at and below the land surface. Since warmer air can hold more water vapour, **it is expected that global warming will increase potential evapotranspiration in most regions of the world.** In line with this expectation, hydrological projections for Tanzania indicate a stronger and more continuous rise of potential evapotranspiration under RCP6.0 than under RCP2.6 (Figure 8). Under RCP6.0, **potential evapotranspiration is projected to increase by 2.7 % in 2030, 3.8 % in 2050 and 7.1 % in 2080** compared to year 2000 levels.

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Sector-specific climate change risk assessment

a. Water resources

Current projections of water availability in Tanzania display high uncertainty under both GHG emissions scenarios. Assuming a constant population level, multi-model median projections suggest no change in per capita water availability over Tanzania by the end of the century under RCP6.0 and only a slight decrease under RCP2.6 (Figure 9A). Yet, when accounting for population growth according to SSP2 projections[1], **per capita water availability for Tanzania is projected to decline by 76 % under both RCPs by 2080** relative to the year 2000 (Figure 9B). While this decline is primarily driven by population growth rather than climate change, it highlights the urgency to invest in water saving measures and technologies for future water consumption.

Projections of future water availability from precipitation vary depending on the region and scenario (Figure 10). Under RCP2.6, **water availability will decrease by up to 25 % in northern and south-eastern Tanzania**, with most models agreeing on this trend. The picture for RCP6.0 is different: The model agreement on the direction of change is low for all parts of Tanzania.

Water shortage has been an issue in Tanzania for decades and is likely to continue in the future. Several studies show that climatic changes in Tanzania have resulted in a decrease in total precipitation, a shift of the onset of the rainy season and an increase in the frequency and duration of droughts [14][15]. These changes have materialised, for example, in the **extreme decrease of water levels** of Lake Victoria and Lake Tanganyika, and the 7-km recession of Lake Rukwa over the past 50 years [16]. Additional challenges related to water availability include an **increasing demand associated with agricultural expansion and intensification and with the domestic needs of a growing population** [17]. Unreliable precipitation in the highland areas has been the main driver for **shifting agricultural production towards lower wetland areas**, which offer comparatively fertile soils and year-round water availability [18]. However, the conversion of wetlands in favour of agricultural production has **negative trade-off effects on affected ecosystems.**

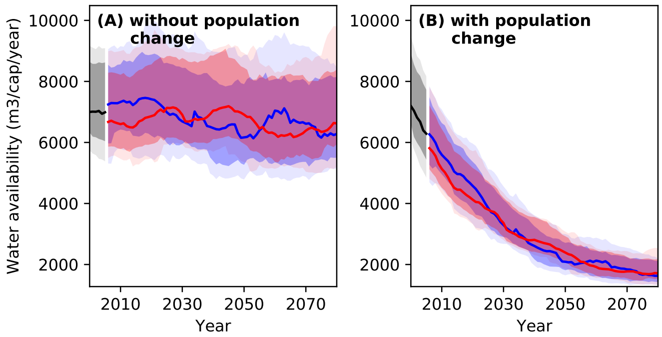


Figure 9: Projections of water availability from precipitation per capita and year with (A) national population held constant at year 2000 level and (B) changing population in line with SSP2 projections for different GHG emissions scenarios, relative to the year 2000.

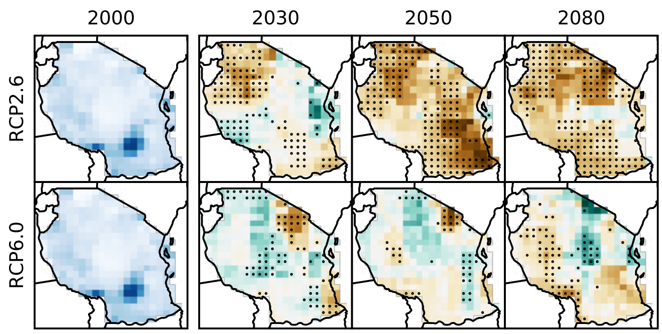


Figure 10: Water availability from precipitation (runoff) projections for Tanzania for different GHG emissions scenarios.

[4] Shared Socio-economic Pathways (SSPs) outline a narrative of potential global futures, including estimates of broad characteristics such as country level population, GDP or rate of urbanisation. Five different SSPs outline future realities according to a combination of high and low future socio-economic challenges for mitigation and adaptation. SSP2 represents the "middle of the road"-pathway.

b. Agriculture

Smallholder farmers in Tanzania are increasingly challenged by the uncertainty and variability of weather caused by climate change [19], [20]. Since **crops are predominantly rainfed**, they depend on water availability from precipitation and are prone to drought. However, the length and intensity of the rainy season is becoming increasingly unpredictable and the **use of irrigation remains limited.** The national crop land suitable for irrigation is estimated at 29.4 million ha [7]. Currently, only 1.5 % of this potential is irrigated. However, **Tanzania has been investing in irrigation** and is planning to almost triple its total irrigated area to 1.24 million ha by 2035 [21]. This expansion is motivated by hopes to increase the productivity of rice, which, along with maize, is the main irrigated crop in Tanzania [21].

Currently, the high uncertainty of projections regarding water availability (Figure 10) translates into high uncertainty of drought projections (Figure 11). According to the median over all models employed for this analysis, **the national crop land area exposed to at least one drought per year will increase by a factor of five in response to global warming.** Under RCP6.0, the likely range of drought exposure of the national crop land area per year widens from 0.05–1.0 % in 2000 to 0.5–6.2 % in 2080. The very likely range widens from 0.01–1.8 % in 2000 to 0.2–10.1 % in 2080. This means that **most models project a significant increase in drought exposure over this time period.**

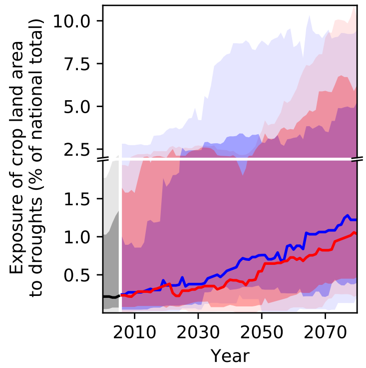
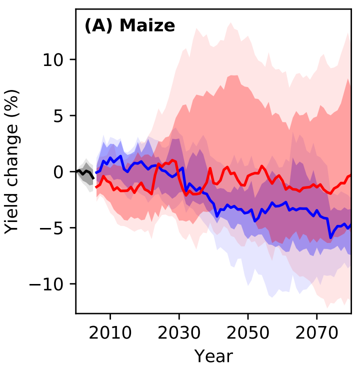


Figure 11: Projections of crop land area exposed to drought at least once a year for Tanzania for different GHG emissions scenarios.

In terms of yield projections, **millet, sorghum, rice, groundnuts and cassava are projected to gain from climate change** (Figure 12)[5]. Under RCP6.0, crop yields are projected to increase by 22 % for millet and sorghum, 18 % for rice, 22 % for groundnuts and 31 % for cassava by 2080 relative to the year 2000. These positive results can be ascribed to the CO_2 fertilisation effect, which benefits plant growth. Rice, groundnuts and cassava are so-called C3 plants, which follow a different metabolic pathway than maize (C4 plant), and thus benefit more from the CO_2 fertilisation effects under higher concentration pathways. **Maize yields are projected to slightly decrease under RCP2.6 and remain at current levels under RCP6.0**. The decrease under RCP2.6 can be explained by non-temperature related parameters such as changes in precipitation patterns, while the projections for RCP6.0 can be explained by CO_2 fertilisation. Regional climate variability will likely cause crop yields to increase in some areas, while simultaneously decreasing in others.

Overall, adaptation strategies such as switching to high-yielding improved varieties in climate change sensitive crops should be considered, yet carefully weighed against adverse outcomes, such as a resulting decline of agro-biodiversity and a loss of local crop types.



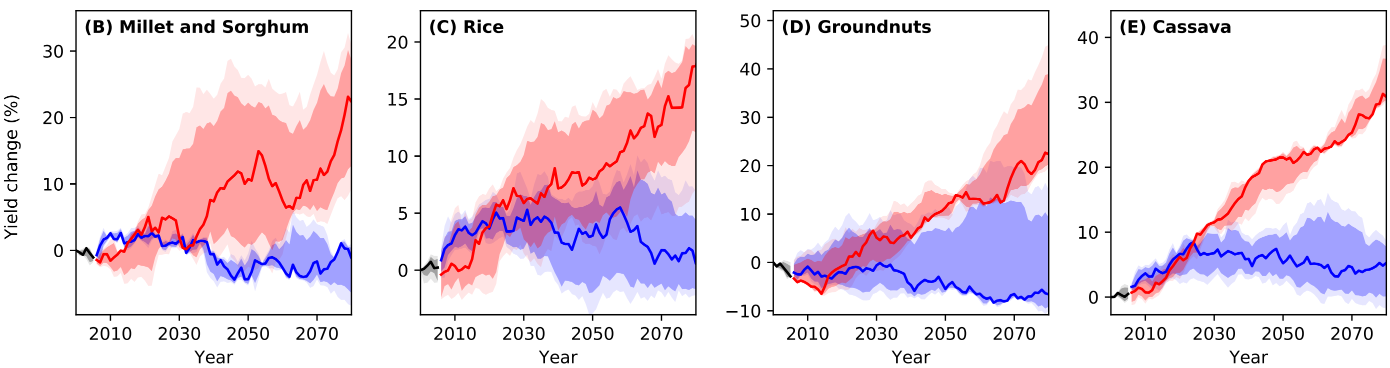


Figure 12: Projections of crop yield changes for major staple crops in Tanzania for different GHG emissions scenarios assuming constant land use and agricultural management, relative to the year 2000.

[5] Modelling data is available for a selected number of crops only. Hence, the crops listed on page 2 may differ. Maize, millet and sorghum are modelled for all countries.

c. Infrastructure

Climate change is expected to significantly affect Tanzania's infrastructure sector through extreme weather events. High precipitation amounts can lead to **flooding of transport infrastructure**, especially in the coastal areas, while high temperatures can cause **roads, bridges and protective structures to develop cracks and degrade more quickly**. This will require earlier replacement and lead to higher maintenance and replacement costs. Tanzania's transport sector is **dominated by road transport, which accounts for 80 % of passenger traffic and 95 % of freight traffic** [24]. Transport infrastructure is very vulnerable to extreme weather events, yet essential for social, economic and agricultural livelihoods. Roads serve communities to trade goods and access healthcare, education, credit as well as other services, especially in rural and remote areas. Overall, Tanzania has one of the lowest paved-road densities in Africa, relying on few major roads [24]. Thus, investments will have to be made to build climate-resilient road networks.

Extreme weather events will also have **devastating effects on human settlements and economic production sites**, especially in urban areas with high population densities such as Dar es Salaam or Mwanza. **Informal settlements are particularly vulnerable to extreme weather events**: Makeshift homes are often built in unstable geographical locations including riverbanks and coastal areas, where flooding can lead to loss of housing, contamination of water, injury or death. Dwellers usually have low adaptive capacity to respond to such events due to high levels of poverty and lack of risk-reducing infrastructures. The flooding-poverty nexus is particularly strong in Dar es Salaam, where many households experience floods on an annual basis and even during average precipitation events [25]. **In April 2018, 11 976 people in Dar es Salaam have been affected by a flood event** [26]. 42 houses and 21 latrines collapsed, and 342 houses were severely damaged. **Flooding and droughts will also affect hydropower generation**: Tanzania is planning to increase its hydropower capacity from 0.5 gigawatts in 2015 to a planned volume of 3.4 gigawatts in 2030. However, variability in precipitation and climatic conditions could severely affect river levels and disrupt hydropower generation [27].

Despite the **risk of infrastructure damage being likely to increase**, precise predictions of the specific location and extent of exposure are difficult to make. For example, projections of river flooding are subject to substantial modelling uncertainty, largely due to the uncertainty of future projections of precipitation amounts and their spatial distribution, affecting flood occurrence (see also Figure 5). In Tanzania, **projections show no change in the exposure of major roads to river floods under RCP2.6 and a slight increase under RCP6.0** (Figure 13). In 2000, 1.3 % of major roads were exposed to river floods at least once a year, while by 2080, this value is projected to slightly increase to 1.5 % under RCP6.0. In a similar way, **exposure of urban land area to river floods is projected to increase only under RCP6.0**, from 0.11 % in 2000 to 0.24 % in 2080 (Figure 14).

The **exposure of the GDP to heatwaves is projected to increase** from around 2 % in 2000 to 6 % (RCP2.6) and 16 % (RCP6.0) by the end of the century (Figure 15). It is recommended that policy makers start identifying heat-sensitive economic production sites and activities, and integrating climate adaptation strategies such as improved solar-powered cooling systems, "cool roof" isolation materials or switching the operating hours from day to night [28].

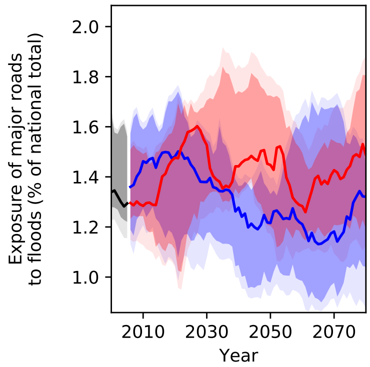


Figure 13: Projections of major roads exposed to river floods at least once a year for Tanzania for different GHG emissions scenarios.

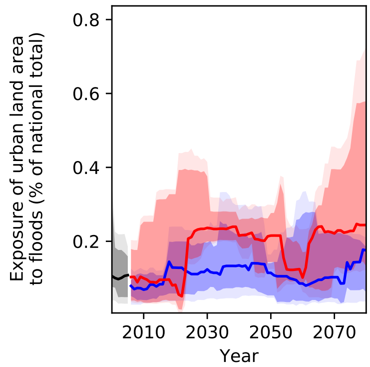


Figure 14: Projections of urban land area exposed to river floods at least once a year for Tanzania for different GHG emissions scenarios.

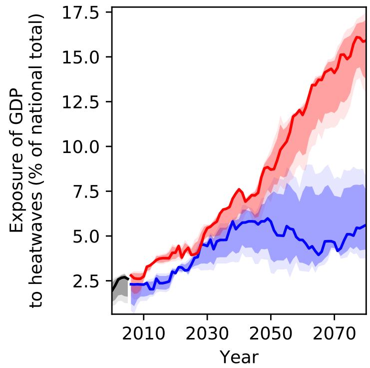


Figure 15: Exposure of GDP in Tanzania to heatwaves for different GHG emissions scenarios.

d. Ecosystems

Climate change is expected to have a significant influence on the ecology and distribution of tropical ecosystems, though the magnitude, rate and direction of these changes are uncertain [29]. With rising temperatures and increased frequency and intensity of droughts, **wetlands and riverine systems are increasingly at risk of being converted to other ecosystems** with plant populations being succeeded and animals losing habitats. Increased temperatures and droughts can also impact succession in forest systems while concurrently increasing the risk of invasive species, all of which affect ecosystems. In addition to these climate drivers, low agricultural productivity and population growth might motivate further agricultural expansion resulting in increased deforestation, land degradation and forest fires all of which will impact animal and plant biodiversity.

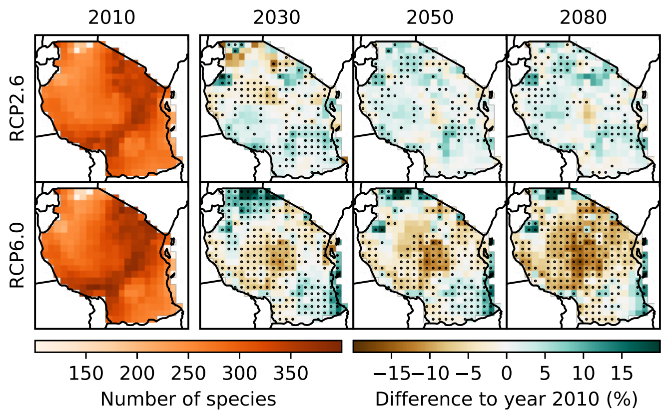


Figure 16: Projections of the aggregate number of amphibian, bird and mammal species for Tanzania for different GHG emissions scenarios.

Model projections of species richness (including amphibians, birds and mammals) and tree cover for Tanzania are shown in Figure 16 and 17, respectively. **Projections of the number of animal species show a strong decrease by 2080** (Figure 16): Under RCP6.0, most models agree that **the number of animal species will decrease by up to 15 %, especially in central Tanzania,** while other areas in northern and eastern Tanzania are projected to gain in the number of species. With regard to tree cover, **median model projections agree on a decrease by 2 % in Tanzania under RCP 2.6 and an increase of up to 9 % in central Tanzania under RCP6.0** by 2080 (Figure 17). The latter can be explained by increasing precipitation amounts in this region.

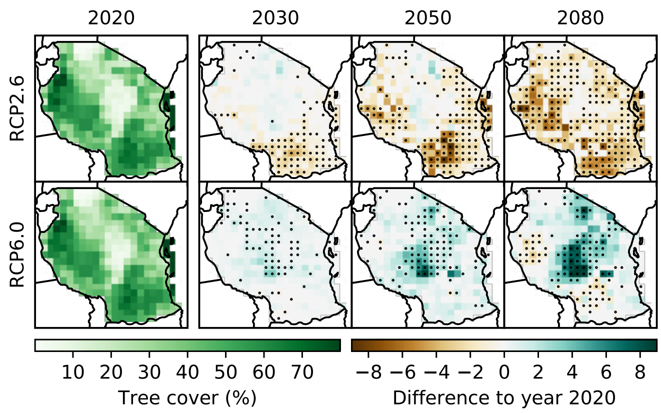


Figure 17: Tree cover projections for Tanzania for different GHG emissions scenarios.

Although these results paint a rather positive picture for climate change impacts on tree cover, it is important to keep in mind that **model projections exclude any impacts on biodiversity loss from human activities such as land use**, which have been responsible for significant losses of global biodiversity in the past, and which are expected to remain its main driver in the future [30]. For example, extensive land-use change in the densely vegetated foothills of Mount Kilimanjaro accounted for an expansion of cultivated land from 54 % in 1973 to 63 % in 2000, all at the expense of natural vegetation [31]. Overall, Tanzania **lost 2.51 million hectares of tree cover** from 2001 to 2019, which is equivalent to a decrease of 9.5 % [32].

e. Human health

Climate change threatens the health and sanitation sector through more frequent incidences of heatwaves, floods, droughts and storms. Among the key health challenges in Tanzania are morbidity and mortality through respiratory diseases, tuberculosis, HIV/AIDS, vector-borne diseases such as malaria, and impacts of extreme weather events (e.g. flooding) including injury and mortality as well as related waterborne diseases such as diarrhoea. Many of these health challenges are expected to become more severe under climate change, which will likely impact food security and water supply, thereby increasing the **risk of malnutrition, hunger and death by famine**. Studies identified climate change as a primary driver of malnutrition in Tanzania, in addition to demographic change and poverty [33]. According to the Tanzanian Demographic and Health Survey 2015 / 2016, 34 % of all children under five years of age suffer from stunting and 14 % from underweight [34]. Furthermore, **climate change is likely to extend the transmission periods and alter the geographic range** of vector-borne diseases, for example, due to rising temperatures and changes in precipitation. Malaria, for instance, has been a common disease in Tanzania's low-lying rural areas, but is becoming increasingly prevalent in the previously malaria-free highlands due to climatic changes [35]. Although malaria admission and death rates have been decreasing in recent years, Tanzania has the third largest population at risk of this disease in Africa, with 90 % of the population living in malaria areas [36]. Coastal regions bordering the Indian Ocean and Lake Victoria exhibit particularly high vulnerability to malaria as well as to dengue [37], [38].

Rising temperatures will result in **more frequent heatwaves** in Tanzania, leading to **increased heat-related mortality.** Under RCP6.0, the population affected by at least one heatwave per year is projected to increase from 2 % in 2000 to 19 % in 2080 (Figure 18). Furthermore, under RCP6.0, **heat-related mortality will likely increase from 1.8 to 6.5 deaths per 100 000 people per year**, which translates to an increase by a factor of more than three towards the end of the century compared to year 2000 levels, provided that no adaptation to hotter conditions will take place (Figure 19). Under RCP2.6, heat-related mortality is projected to increase to about 3.5 deaths per 100 000 people per year in 2080.

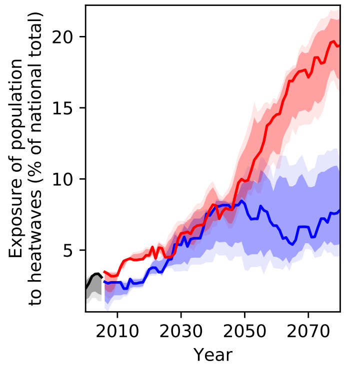


Figure 18: Projections of population exposure to heatwaves at least once a year for Tanzania for different GHG emissions scenarios.

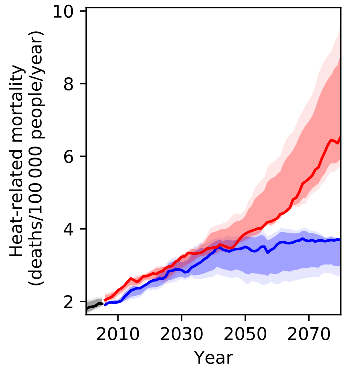


Figure 19: Projections of heat-related mortality for Tanzania for different GHG emissions scenarios assuming no adaptation to increased heat.

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