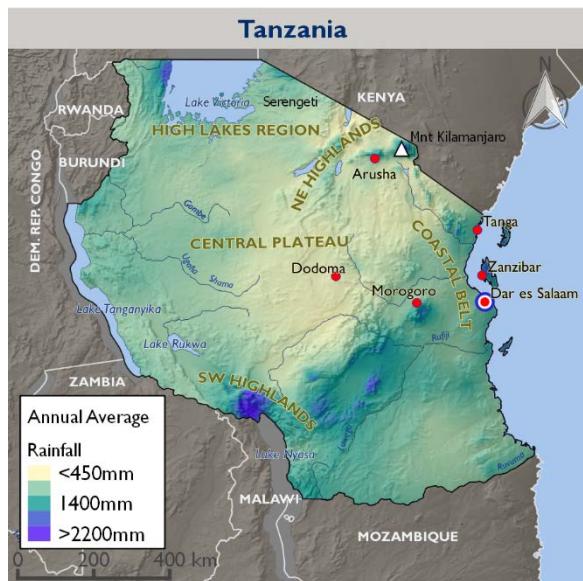




CLIMATE RISK PROFILE TANZANIA

COUNTRY OVERVIEW

Tanzania is one of the largest countries in East Africa and has a rapidly growing population and economy. Economic growth has contributed significantly to poverty reduction in recent years; however, 28 percent of Tanzanians remain below the nationally determined poverty line. Rising temperatures, longer dry spells, more intense heavy rainfall and sea level rise make Tanzania the 26th most vulnerable country to climate risks. The current population of 56 million is expected to increase to 130 million by 2050. Thirty-two percent of the population lives in urban areas, and 75 percent of that population lives in informal settlements that are increasingly at risk from water scarcity, flooding and heat extremes. In rural areas, there is high dependence on rainfed agriculture and limited access to health care, education and electricity. Yields for critical crops, including maize, beans, sorghum and rice, are projected to decrease in coming decades, endangering livelihoods and food security. Livelihoods and food supply also depend on coastal and inland fisheries, which are increasingly threatened by warming ocean and freshwater temperatures, and sedimentation after heavy rains. Sea level rise is putting coastal infrastructure, coastal populations (about 25 percent of the total population), and coastal ecosystems at risk of inundation, salinization and storm surge. (12, 18, 19, 23, 24, 25)



CLIMATE PROJECTIONS



1.4–2.3°C increase in temperatures by 2050



Increase in duration of heat waves and dry spells



Increase in frequency and intensity of heavy rainfall



16–42 cm rise in sea level by 2050s

KEY CLIMATE IMPACTS

Agriculture

Reduced food crop and coffee yields
Increased heat stress and diseases
Degradation/loss of suitable crop land



Water Resources

Reduced river flows/water scarcity in some areas; increased flows, flooding, sedimentation in others



Human Health

Decreased food security
Increased water and vector-borne disease
Flood-related displacement and drowning



Energy

Constrained hydropower production
Damage to electricity infrastructure



Ecosystems

Increased habitat degradation
Loss or shift in range of species
Increased risk to tourism revenues



Infrastructure

Flood damage to buildings, roads, etc.
Inundation of coastal infrastructure



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CLIMATE SUMMARY

Tanzania's topographical diversity gives rise to four distinct climate zones: 1) *hot and humid coastal belt (including the Zanzibar archipelago)*: has the warmest temperatures, averaging 27–30°C, and receives 750–1,250 mm of annual rainfall, with Zanzibar receiving 1,400–2,000 mm; 2) *hot and arid central plateau*: receives just 500 mm of rainfall; 3) *cooler semi-temperate high lakes region* in the north and west (home to the lakes and valleys of the East African Rift System): receives 750–1,250 mm of rainfall annually; and 4) *highlands of the northeast* (i.e., Kilimanjaro) and *southwest*: includes the coldest parts of the country with average temperatures of 20–23°C. The southwest highlands and the Lake Tanganyika basin in the west receive the most rain, over 2,000 mm annually. Influenced by the Inter-Tropical Convergence Zone, rainfall is highly seasonal. The north and east have two rainy seasons, the main season from March to May and a secondary season from October to December. The south, west and central regions have just one rainy season from October to May. (2, 6, 10, 13, 17, 19, 20, 26)

HISTORICAL CLIMATE

Historical climate trends include:

- Increased average temperature of 1°C (1960–2006).
- Little change in overall precipitation; slight decrease from 1961 to 2013, mainly from March to June (corresponding to main rainy season).
- Accelerated loss of glacial volume on Mount Kilimanjaro; with an 85-percent reduction of the Kibo Summit Glacier from 1912 to 2009.
- Rise in sea levels of 4–20 cm per decade (1955–2003) everywhere except Zanzibar, which recorded a decrease in sea levels (1984–2004).

FUTURE CLIMATE

Projected changes by the 2050s include:

- Increased average annual temperature of 1.4 to 2.3°C; greatest warming in the west/southwest.
- Increased duration of heat waves (by 7–22 days) and dry spells (by up to 7 days).
- Likely increase in average annual rainfall (range of -3 to +9 percent), with greatest increase in the northeast; likely rainfall decline July–September.
- Increased heavy rainfall event frequency (7–40 percent) and intensity (2–11 percent).
- Rise in sea levels of 16 to 42 cm.
- Disappearance of glaciers from Kilimanjaro.

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Increasing temperatures, longer dry spells and more frequent and intense rains put crop and livestock production in Tanzania at risk. The agricultural sector makes up about 25 percent of GDP and employs 75–80 percent of Tanzanians. About 80 percent of agricultural production comes from rainfed, low-input smallholder farms highly vulnerable to weather variability. One third of crop land, 4 million hectares, is devoted to maize, which accounts for 40 percent of caloric intake nationally. While increasing temperatures may benefit rainfed maize in the highlands, national production is projected to decrease 8–13 percent by 2050 due to increased heat stress, drying, erosion and flood damage. Bean, sorghum and rice yield projections follow similar trends, with decreases of 5–9 percent by 2050. Increasing heat stress and expansion of the coffee berry borer beetle are expected to decrease coffee productivity from 225 kg/ha currently to less than 100 kg/ha in 2060. Along the coast, cassava and rice crops are subject

Climate Stressors and Climate Risks AGRICULTURE	
Stressors	Risks
Rising temperature	Reduced food crop and coffee yields due to heat stress
Increased heat wave duration	Heat stress in livestock leading to reduced reproduction, growth rates and milk production; higher morbidity and mortality
Increased frequency and intensity of heavy rainfall	Damage to crops and land from heavy rainfall, flooding, erosion and waterlogging
Sea level rise	Increased pest and disease damage
	Salinization, waterlogging and inundation of coastal agriculture

to salinization, waterlogging and inundation from sea level rise. Livestock production, practiced by 60 percent of rural households and accounting for about 25 percent of agricultural GDP, is at risk from increasing heat extremes, flood losses, degraded pasture land and disease outbreaks, including Rift Valley Fever. (1, 3, 4, 7, 16, 18, 20, 25, 26)

WATER RESOURCES

Tanzania has extensive water resources (96 km² per year renewable); however, large swaths of arid and semiarid land (up to 50 percent of the country) and strong rainfall seasonality lead to spatial and temporal water scarcity. Increased temperatures, longer dry spells and heavy rainfall events threaten Tanzania's nine major river basins and the continent's three largest lakes (Victoria, Tanganyika and Nyasa). While future river flows will be highly influenced by nonclimate factors such as changes in land use, climate projections indicate increased runoff for the Pangani and Rufiji basins, which will increase risk of flooding and sedimentation, and decreased runoff for Wami/Ruvu basin, which will increase water stress in Dar es Salaam, Morogoro, Kibaha and Dodoma (with a combined population of more than 6 million). Water availability will also depend on the development of rivers upstream by neighboring countries, as 13 percent of Tanzania's renewable water resources are transboundary.

HUMAN HEALTH

Diarrheal diseases and malaria, both leading causes of death in Tanzania, are likely to escalate due to increasing temperatures and heavy rainfall events. While health indicators have been improving overall, life expectancy is just 65 years. Projected increased flooding threatens further outbreaks of waterborne diseases such as cholera and typhoid, as just 61 percent of the population has access to improved drinking water sources and only 19 percent to improved sanitation. Aggressive health programs have reduced malaria morbidity and mortality in recent years, yet 93 percent of the population remain at risk to malaria, and new cases are emerging in historically malaria-free regions such as Tanga, Kilimanjaro and the Arusha highlands. Rapid and largely unplanned urbanization is exposing

ENERGY

About 40 percent of Tanzania's limited electricity supply comes from hydropower vulnerable to increasing evaporation, siltation from heavy rainfall events and longer dry spells. A prolonged dry spell in October 2015 led to a near cessation of hydropower production across the country. While future flows may increase in the Pangani and Rufiji basins, both important for hydropower, increasing evaporation and siltation will constrain Tanzania's inadequate electric supply, which only reaches 16 to 18 percent of the population. (6, 7, 14, 19, 24)

Climate Stressors and Climate Risks WATER RESOURCES	
Stressors	Risks
Increased temperature and evaporation rates	Decreased river flows in the Wami/Ruvu basin leading to water scarcity for irrigation, domestic and hydropower uses
Increased frequency and intensity of heavy rainfall	Disappearance of glacial contribution to river flow
Sea level rise	Increased flooding from heavy rainfall events threatens water infrastructure and quality Salt water intrusion into coastal (e.g., Dar es Salaam) and island (e.g., Zanzibar) aquifers

Mainland urban areas rely primarily on surface water sources that are increasingly polluted and further threatened by heavy rainfall events that wash mining, commercial and domestic pollution into rivers, lakes and wetlands. With reduced surface water quantity and quality, coastal cities will increasingly rely on groundwater, which is already at risk of salt water intrusion. (6, 14, 19, 25)

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	Risks
Increased temperature and heat wave duration	Increased risk of vector-borne diseases (e.g., malaria) and waterborne diseases.
Increased heavy rainfall	Increased risk of drowning, displacement due to flooding
Sea level rise	Increased mortality and morbidity related to heat stress Increased malnutrition from decreased agricultural productivity

more people to flooding after heavy rainfall events. In Dar es Salaam, flooding in December 2011 and January 2012 led to 40 deaths and displaced more than 10,000 people. (6, 7, 11, 22, 23, 25, 26)

Climate Stressors and Climate Risks ENERGY	
Stressors	Risks
Increased temperature and evaporation rate	Increased evaporation rates and siltation reduce hydropower production
Increased frequency and intensity of heavy rainfall	Increased flooding and landslides damage electricity infrastructure

ECOSYSTEMS

From coral reefs, to the Serengeti, to the highest point in Africa on Mount Kilimanjaro, Tanzania has globally significant ecosystems and biodiversity. The country includes four internationally recognized wetlands (Ramsar sites) and the southern portion of the Coastal Forests of Eastern Africa biodiversity hotspot. Tourism, which accounts for more than 20 percent of foreign exchange earnings, is largely derived from Tanzania's ecosystems and biodiversity, which are now at risk from combined climate and nonclimate stressors such as land conversion, deforestation, and unsustainable fishing. Increasing ocean temperature, sea level rise and saline intrusion threaten mangrove forests and coral reefs important for fisheries, wildlife and storm surge protection. Warming of Tanzania's freshwater lakes has led to decreased nutrient cycling and reduced fishery productivity. Sedimentation, exacerbated by heavy rains, further threatens fisheries, which provide more than 4 million jobs and an important protein source in coastal and inland regions.

INFRASTRUCTURE

Tanzania is the most flood-affected country in East Africa. Intensifying heavy rainfall events are likely to increase flood impacts to infrastructure and associated energy, water and transportation services. Each year from 2014 to 2017, floods affected critical infrastructure from the coast to the highlands, destroying roads, bridges and public and private buildings. Sea level rise is expected to cost about \$200 million per year by 2050 in lost land and flood damage. In Dar es Salaam, infrastructure

Climate Stressors and Climate Risks ECOSYSTEMS

Stressors	Risks
Increased temperature and evaporation rates	Decreased productivity of freshwater and coastal fisheries
	Increased severity of wildfires
	Degradation of habitats (mangroves, reefs, rangelands) and loss of native species (wildebeest, wild dog, etc.) threaten important ecosystem services and tourism revenue
Sea level rise	

Increasing temperatures raise the risk of wildfires, including in important water catchment areas, such as the slopes of Kilimanjaro, where burning has led to rapid runoff and diminished long-term water yields. Increasing temperatures and heavy rainfall also shift the suitable ranges of plant and wildlife species with detrimental impacts for migrating wildebeest, endemic fresh water fish and the endangered African wild dog. (8, 9, 13, 15, 19, 21, 24, 27)

Climate Stressors and Climate Risks INFRASTRUCTURE

Stressors	Risks
Increased frequency and intensity of heavy rainfall	Increased heavy rainfall and flooding damage buildings, bridges, roads, etc.
	Sea level rise inundates low-lying areas of Dar es Salaam and other coastal infrastructure and population centers
Sea level rise	

assets valuing \$5.3 billion are increasingly at risk from flooding and sea level rise. (7, 19, 23)

POLICY CONTEXT

INSTITUTIONAL FRAMEWORK

The Vice President's Office, Division of Environment, is the national climate change focal point under the United Nations Framework Convention on Climate Change (UNFCCC) and coordinates the National Climate Change Strategy (2012). The National Climate Change Steering Committee (NCCSC) and the National Climate Change Technical Committee (NCCTC) are the government bodies responsible for climate change activities. The NCCSC is tasked with analysis, policy guidance and coordinating climate change activities across sectors, while the NCCTC provides technical advice to the national climate change focal point. (5, 19)

NATIONAL STRATEGIES AND PLANS

- [Second national communication, UNFCCC \(2014\)](#)
- [Intended Nationally Determined Contributions \(2015\)](#)
- [National Climate Change Strategy \(2012\)](#)
- [National Climate Change Communication Strategy, 2012–2017 \(2012\)](#)
- [Agriculture Climate Resilience Plan, 2014–2019 \(2014\)](#)
- [National Adaptation Programme of Action \(2007\)](#)

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SELECTED ONGOING EXPERIENCES

Below are selected projects focused on climate change adaptation, or some aspect of it, in Tanzania.

Program	Amount	Donor	Year	Implementer
Ecosystem-based adaptation for rural resilience	\$28.4 million	GEF LDCF	2017–ongoing	UNEP, Ministry of Agriculture and Food Security, Ministry of Water
Strengthening Climate Information and Early Warning Systems in Tanzania	\$4 million	GEF LDCF	2012–ongoing	UNDP, Ministry of Water, Meteorological Agency, Disaster Management Department
Water Resources Integration Development Initiative (WARIDI) in Tanzania	\$48.8 million	USAID	2016–2020	Tetra Tech, Winrock, International SSG, Iris, Water for Life Solutions
Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains	€1.4 million	EU	2015–2019	ONGAWA Engineering for Human Development, Tanzania Forest Conservation Group, Muheza District
GEF Small Grants Programme	\$10.8 million	GEF, UNDP	ongoing	UNDP, Vice-President's Office, Division of Environment
Planning for Resilience in East Africa Through Policy, Adaptation, Research and Economic Development (PREPARED) (regional)	\$40 million	USAID	2012–2018	Tetra Tech