

CLIMATE SUMMARY

Kenya's geography is dominated by arid and semi-arid plains, with a temperate highland plateau (reaching over 5,000 m) in the center, and a hotter, wetter climate along the coast and the shores of Lake Victoria. Two-thirds of the country receive less than 500 mm of rainfall per year; coastal and highland areas receive annual averages upwards of 1,100 mm and 2,000 mm, respectively. Kenya has two rainy seasons: "long rains" from March to June (about 70 percent of total annual rainfall); and "short rains" from October to December. In the west and along the coast, additional significant rainfall occurs outside of these two rainy seasons. Temperatures range from an average of 18°C in high elevation areas like Nairobi to 26°C in coastal areas such as Mombasa. Located on the equator, Kenya experiences little seasonal temperature variation. (3, 5, 7, 15, 18, 19, 24)

HISTORICAL CLIMATE

Historic climate trends include:

- Increased average temperature of 0.34°C per decade from 1985–2015; greatest increases March to May and in arid and semi-arid regions.
- Little change in average annual precipitation but declines in the long rains in central Kenya since the 1970s, and possible increased rainfall in the north and decreased rainfall in the south.
- Sea level rise of 5.8 cm from 1932–2001 (Mombasa).
- Glacial volume loss of more than 66 percent in last 100 years; Lewis Glacier (Mount Kenya) has lost 90 percent of its volume since 1934.

FUTURE CLIMATE

Projected changes by the 2050s include:

- Increase in average temperatures of 1.2–2.2°C, with warming greatest in the west.
- Increased duration (+9–30 days) of heat waves.
- A likely increase in average rainfall (projections range from -3 to +28 percent), mainly from October to May and in the coast and highlands.
- Increased interseasonal rainfall variability.
- Increased frequency and intensity of heavy rainfall events.
- Likely decrease in duration of dry spells but increase in severity (-2 to +27 percent).
- Rise in sea levels of 16–42 cm.

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Kenyan agriculture is 98 percent rainfed and highly sensitive to changes in temperature and rainfall. Agriculture accounts for more than 30 percent of GDP and is the primary livelihood for 60 percent of Kenyans. Small-scale farms account for 75 percent of production. Maize, beans, tea and potatoes are the most important crops, and sheep and goats dominate livestock production. Recurrent drought, a significant problem, led to an estimated \$10.2 billion loss in livestock and crops from 2008 to 2011. Higher temperatures are likely to expand production of maize and beans into higher elevations, but farming in lower elevations is expected to see yield losses of up to 20 percent due to heat stress and shifting rainfall patterns, with some areas (like central Kenya) becoming unsuitable for production. Maize, which accounts for about one-third of caloric intake in Kenya, can be damaged by temperatures over 35°C, which are increasingly common in lowland regions. Kenya is a world leader in tea production; tea accounted for \$787 million in exports in 2014. Areas suitable for tea production are

| Climate Stressors and Climate Risks AGRICULTURE | |
|--|---|
| Stressors | Risks |
| Rising temperatures & evaporation rate | Reduced grain yields and quality due to heat and water stress |
| | Heat stress in livestock, leading to reduced reproduction, growth rates and milk production |
| Increased interseasonal rainfall variability | Crop damage and degraded crop and pasture land |
| Increased frequency & intensity of heavy rainfall | Increased incidence of pests and diseases for crops and livestock |
| | Saltwater intrusion and storm surges, impacting coastal production, particularly of mango, cashew and coconut |
| Sea level rise | |

shifting to higher elevations as temperature increase puts current production areas at risk from heat extremes and increasing pests and diseases. In arid and semi-arid regions, pastoralism is the dominant production system; high temperatures are expected to increase heat stress and pest and disease incidence in livestock. (1, 5, 7, 8, 9, 11, 14, 17, 23)

WATER RESOURCES

Kenya's scarce water resources, strained by population growth and severe forest degradation, could be further stressed by increasing temperatures, evaporation rates and rainfall variability. The country relies predominantly on surface water sources, but key rivers and lakes are highly susceptible to climate change. In 2010 Kenya's water availability was 586m³ per person annually, well below the internationally acceptable threshold of 1,000m³ per person; this figure is expected to fall to as low as 293m³ by 2050. Increasingly severe droughts and flooding will impact water availability and diminish water quality, with implications for irrigation and domestic water supply and sanitation, which combined account for 87 percent of current use. Urban areas are already highly water stressed; Mombasa regularly implements water rationing. Glacial loss on Mount Kenya is further straining water resources and

ENERGY AND INFRASTRUCTURE

Increased evaporation rates and more severe drought threaten Kenya's hydropower production, which accounts for about one-half of domestic electricity production. Hydro production is reduced by up to 40 percent in drought years, leading to persistent power outages and reliance on more expensive petroleum-based thermal generation. Projections of sea level rise and increased heavy precipitation events leading to flooding and landslides put energy, transportation and building infrastructure at risk. Models estimate that in Mombasa as much as \$4.8 billion worth of assets will be exposed to flooding and inundation from sea

ECOSYSTEMS

Kenya's diverse ecosystems (represented in more than 50 national protected areas and a portion of the Coastal Forests of Eastern Africa biodiversity hotspot) provide important ecosystem services and are critical to the country's \$2.5 billion tourism industry, which accounts for 3.7 percent of GDP. Coastal mangroves and coral reefs, critical for fisheries, storm surge protection and tourism, are damaged by rising seas and increasing ocean temperatures. Reefs in particular are highly sensitive to heat stress and have not yet fully recovered from an extensive 1998 El Niño-induced coral bleaching event. Inland grasslands and forests are at risk from increasing temperatures and more variable rainfall, leading to drought conditions, increased risk of

Climate Stressors and Climate Risks WATER RESOURCES

| Stressors | Risks |
|---|--|
| Rising temperatures & evaporation rate | Increased water scarcity and variability for irrigation, domestic use, hydropower and industry |
| Increased rainfall variability | Accelerated glacial loss; reduced river flows from Mt. Kenya |
| Increased frequency and intensity of heavy rainfall | Increased flood damage to water supply and sanitation infrastructure |
| Sea level rise | Saltwater intrusion into coastal aquifers (supplying a population of 3 million); decreased water quality |

turning once glacially-fed perennial rivers, such as the Ewaso Ng'iro, to seasonal flows, leading to conflict over water resources between communities upstream and downstream. (3, 5, 7, 20)

Climate Stressors and Climate Risks ENERGY AND INFRASTRUCTURE

| Stressors | Risks |
|---|--|
| Rising temperatures & evaporation rate | Reduced hydropower production |
| Increased frequency and intensity of heavy rainfall | Increased flooding and landslides, damaging power generation, transmission and distribution infrastructure as well as transportation and building infrastructure |
| Sea level rise | Damage to Port Kilindini and coastal infrastructure |

level rise by 2050, including Port Kilindini, the largest seaport in East Africa. (5, 6, 7, 12)

Climate Stressors and Climate Risks ECOSYSTEMS

| Stressors | Risks |
|--------------------------------|--|
| Rising temperatures | Reduced grassland productivity and degradation; increased severity of forest fires |
| Increased rainfall variability | Reduced and shifted ranges for native species; biodiversity loss |
| Sea level rise | Degradation/loss of coastal wetland habitats, mangroves, coral reefs and fisheries |
| | Economic losses to tourism |

grassland and forest fires, and shifting distributions of native and invasive species. These changes may have detrimental impacts on the African elephant, lion and buffalo – important for both ecosystem functioning and tourism. (2, 5, 7, 25)

HUMAN HEALTH

A warmer, wetter climate is expected to increase malaria, Rift Valley fever and dengue transmission in both temperate highland and arid lowland regions. At particular risk are the highlands, where about 70 percent of Kenyans live. These populations historically have had limited contact with diseases like malaria and thus have lower resistance. Malaria is already responsible for 5 percent of deaths in children under five and accounts for significant health-related expenses. Heat stress from increased temperatures will particularly affect the elderly and those in dense urban areas, such as informal settlements in Nairobi and Mombasa, where temperatures can rise dramatically due to the urban heat island effect. Heat-related mortality among the elderly is projected to increase from 2 deaths annually per 100,000 people in 1990 to 45 by 2080. Increased heavy rainfall leading to more frequent and intense flooding raises the risk of drowning and displacement. Waterborne diseases such as typhoid, cholera, hepatitis A and diarrhea are particularly dangerous for the 17 million people

| Climate Stressors and Climate Risks HUMAN HEALTH | |
|--|--|
| Stressors | Risks |
| Rising temperatures and increased duration of heat waves | Increased heat stress-related mortality and morbidity, particularly among the elderly |
| | Increased food insecurity and malnutrition |
| Increased heavy rainfall | Increased risk of vector- and waterborne diseases, including malaria and cholera |
| Sea level rise | Inland and coastal flooding, leading to increased drowning, displacement and food insecurity |

without access to improved water sources. With access to basic sanitation at just 30 percent, diarrhea is already a leading cause of mortality and cases tend to surge after flooding, as seen in the coastal and western regions in 2012. The impacts of climate variability and sea level rise on agriculture may exacerbate food insecurity in the country where 26 percent of children under five already experience stunting. (4, 7, 10, 16, 21, 22)

POLICY CONTEXT

Kenya is a leader in addressing climate change and was one of the first countries in Africa to enact a comprehensive law and policy to guide national and subnational climate action. The Climate Change Act and the National Climate Change Policy Framework of 2016 provide guidance for low-carbon and climate-resilient development.

INSTITUTIONAL FRAMEWORK

The country's institutional framework for climate change is in development, as the 2016 climate change legislation is in the process of being implemented. The legislation directed the formation of the National Climate Change Secretariat, the lead government agency on national climate change plans and actions. The Secretariat, housed in the Ministry of Environment and Forestry, is responsible for coordinating and assisting climate change responses among subnational entities and managing the [Kenya Climate Change Knowledge Portal](#). The legislation also directs the formation of a National Climate Change Council chaired by the president and responsible for mainstreaming climate action by national and county government entities. The country can access climate financing through the National Environment Management Authority, a National Implementing Entity for the Adaptation Fund and accredited by the UNFCCC Green Climate Fund.

NATIONAL STRATEGIES AND PLANS

Kenya's National Adaptation Plan and National Climate Change Action Plan are intended to be reviewed every five years to inform the Medium Term Plans of the Vision 2030 strategy. Key policies and strategies include:

- [Climate Change Act](#) and [National Climate Change Framework Policy](#) (2016)
- [Kenya National Adaptation Plan 2015–2030](#) (2016)
- [National Climate Change Action Plan \(NCCAP\) 2013–2017](#) (2013)
- [National Climate Change Response Strategy \(NCCRS\)](#) (2010)
- [Strategy for Northern Kenya and Other Arid Lands and National Policy for the Sustainable Development of Northern Kenya and Other Arid Lands](#) (2011)
- [Drought Risk Management and Ending Drought Emergencies Sector Plan 2013–2017](#) (2012)
- [National Water Master Plan](#) (2014)
- [Vision 2030](#)

KEY RESOURCES

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Map source: WorldClim Global Climate Data and Hijmans, R.J. et al. 2005. Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965–1978.

SELECTED ONGOING EXPERIENCES

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

| Program | Amount | Donor | Year | Implementer |
|--|-----------------|---------------------------------|--------------|--|
| Kenya Water Security and Climate Resilience Project | \$236.5 million | World Bank | 2013–2022 | World Bank, Ministry of Environment and Forestry |
| Climate Resilient Agricultural Livelihoods Programme (KCEP-CRAL) | \$10 million | EU, IFAD, WFP, FAO | 2017–ongoing | Ministry of Agriculture, Livestock and Fisheries |
| Decentralized Climate Information Services for Decision Making In Western Kenya (regional) | n/a | DFID | 2012–ongoing | UK Met Office, Kenya Met Department, CARE Kenya |
| Building Resilience To Climate Change & Adaptive Capacity Of Vulnerable Communities | \$10 million | Adaptation Fund (AF) | 2015–2018 | National Environmental Management Authority (NEMA) |
| Strengthening Adaptation and Resilience to Climate Change in Kenya (StARCK) | \$11.9 million | UK's International Climate Fund | 2013–2018 | DAI |
| Kenya: Adaptation to Climate Change in Arid and Semi-Arid Lands (KACCAL) | \$5.5 million | World Bank | 2012–2017 | World Bank, Ministry of Agriculture, Livestock and Fisheries |
| Low Emissions and Climate Resilient Development | \$7.76 million | USAID | 2014–2017 | UNDP, Ministry of Environment and Forestry |