



# Climate Change Adaptation in KENYA

Severe weather events, such as droughts, floods, and storms, have historically imposed heavy costs in Kenya. The projected impacts of climate change in Kenya are likely to add to the toll, resulting in significant consequences for key development areas. In recognition of this, the Government of Kenya has initiated activities to determine vulnerability and adaptation priorities, and the donor community has provided support to facilitate mainstreaming of adaptation considerations into development processes and increase resilience in the health sector. However, a number of adaptation needs remain, including better collection and systematization of data relevant for vulnerability mapping and assessments. Meeting these needs will require overcoming challenges such as limited quantitative, sector-specific data, downscaled regional and local results of global circulation models, capacity to conduct the analyses, and coordination among actors pertinent to adaptation and disaster risk reduction or management.



## CLIMATE IMPACTS AND VULNERABILITY

### Historic Weather and Climate

- Temperatures have risen by about 1.0°C since 1960, an average of 0.21° per decade.
- Precipitation in Kenya has remained the same or slightly decreased primarily due to a reduction in rainfall during extended rain periods.
- Droughts have increased in frequency and extent, and now impact areas that historically were unaffected.
- Sea level rose by 2.1 mm per year between 1986 and 2008 near Mombasa.
- Sea surface temperatures have risen 1°C since 1950.

### Projected Weather and Climate

Most climate models project for Kenya:

- An average increase of 1.0-2.8°C in annual temperatures by the 2060s, and of 1.3-4.6°C by the 2090s.
- Changes in annual precipitation that range from a decrease of 6 percent to an increase of 26 percent from the 1970-99 average.
- A larger percentage of precipitation falling during heavy rainfall events.
- An increase in the frequency and duration of droughts.
- A rise in sea level of 0.75-1.90 m by 2100.

## KEY SECTOR VULNERABILITIES

### Food Security

Climate change and associated alterations in the frequency and intensity of extreme weather events may affect food security through direct impacts on food availability and indirect impacts on food accessibility through livelihoods and income.

Climate Change Impact	Potential Effects	Possible Adaptation Measures
<b>Increased precipitation variability</b>		
Variations in timing, intensity, frequency, and magnitude of rainfall	Uncertainty in weather conditions and water availability	<ul style="list-style-type: none"> <li>• Early warning systems (up to 3-6 months)</li> <li>• Income diversification</li> <li>• Access to credit</li> <li>• Savings and insurance schemes</li> </ul>

\* Chart continues on following page

Climate Change Impact	Potential Effects	Possible Adaptation Measures
<b>Changes in precipitation</b>		
Shifts in the intensity, frequency, and duration of droughts	Decrease or loss of agricultural and horticultural crop production, which can reduce food security or contribute to loss of potential export markets	<ul style="list-style-type: none"> <li>Drought forecasting</li> <li>Greater use of drought-tolerant crops</li> </ul>
	Shifting borders of semi-arid and arid lands, changing grazing potential	<ul style="list-style-type: none"> <li>Rural-rural migration, as in the case of livestock herders (traditional adaptation)</li> </ul>
	Changing livelihood potentials, increased pressure on scarce resources	<ul style="list-style-type: none"> <li>Access to sustainable alternative income and credit/saving mechanisms</li> <li>Management rules and tools for scarce natural resources</li> </ul>
<b>Increased precipitation variability</b>		
Approaching critical heat thresholds	Reduced production of crops such as maize and rice, particularly if affected during the critical reproductive stage of flowering; diminished yields	<ul style="list-style-type: none"> <li>Shifts to different or more tolerant crops</li> </ul>
Increased evaporation	Shorter annual growing period, decreased water availability, stress on crops and ecosystems, expansion of arid and semi-arid lands, changes in grazing opportunities	<ul style="list-style-type: none"> <li>Efficient water use and conservation</li> <li>Shift from cattle to sheep and goats due to alterations in grazing opportunities</li> </ul>
Expanded range of disease vectors due to increased temperatures and precipitation	Changes in the incidence of livestock diseases such as Rift Valley Fever, resulting in loss of livestock	<ul style="list-style-type: none"> <li>Livestock insurance</li> <li>Improved awareness of risk factors</li> <li>Livestock vaccinations</li> </ul>
Changes in the incidence of agricultural pests due to increased temperatures and precipitation	Loss of agricultural and horticultural production	<ul style="list-style-type: none"> <li>Early warning systems linked with integrated pest management</li> <li>Shifts in crops to different or more tolerant crops</li> </ul>
Reduced frost in highlands	Longer growing period	<ul style="list-style-type: none"> <li>Expansion of potential growing area</li> <li>Exploration of opportunities for other commercial crops (e.g. fruit crops such as apple, pear, and apricot)</li> </ul>

## Water Resources

Within Kenya, the availability and accessibility of water resources differs substantially throughout the country depending on a variety of factors, including topography, rainfall patterns, climate, and coverage and quality of infrastructure. Surface water in Kenya accounts for only 2 percent of the total land area, and water resources are concentrated in five drainage basins (Lake Victoria, Rift Valley, Athi River, Tana River, and Ewaso Ng'iro). These areas are subject to frequent droughts and floods due to climate variability. The water resources sector also faces a number of non-climate challenges including aging infrastructure, high rates of unaccounted-for water losses, a need for improved sector investment planning, limited technical capacity, and weak logistics management. Overall, climate change may affect both water quantity and quality, with implications for the availability and accessibility of water resources for human consumption as well as for agricultural, industrial, and energy use.

## Health

Current climate variability also affects health in Kenya, and climate change is likely to impose new stresses, resulting in a number of direct and indirect impacts (summarized below).

Impact Mode	Impacts	Consequences
<b>Direct</b>	<ul style="list-style-type: none"> <li>Exposure to thermal extremes, especially heat waves.</li> <li>Altered frequency and/or intensity of other extreme weather conditions (droughts, floods, storms, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>Altered rates of heat- and cold-related illness, especially cardiovascular and respiratory diseases.</li> <li>Deaths, injuries, and damage to public health infrastructure.</li> </ul>
<b>Indirect (due to disturbances of ecological systems)</b>	<ul style="list-style-type: none"> <li>Effects on ranges and activity of vectors and parasites.</li> <li>Altered local ecology of water and food borne infective agents.</li> <li>Altered food (especially crop) productivity due to changes in climate, weather, and associated pests and diseases.</li> <li>Shifts in the quality, quantity, and distribution of fresh water.</li> <li>Sea level rise with population displacement and damage to infrastructure.</li> <li>Increased levels and biological impacts of air pollution including pollens and spores.</li> <li>Social, economic, and demographic dislocations due</li> </ul>	<ul style="list-style-type: none"> <li>Change in geographic ranges and incidence of vector-borne diseases.</li> <li>Changed incidences of diarrhea and infectious diseases such as cholera.</li> <li>Regional malnutrition and hunger with consequent impairment of child growth and development, especially in vulnerable communities.</li> <li>Injuries, increased risk of various infectious diseases (due to migration, overcrowding, contamination of drinking water).</li> <li>Asthma and allergic disorders, other acute and chronic respiratory disorders and deaths.</li> <li>Wide range of consequences affecting public health (e.g. mental health, nutritional impairment, infectious diseases, civil strife).</li> </ul>

The incidence of malaria in highland areas, where prevalence has previously been low, is also expected to increase owing to higher temperatures. The communities in these areas are likely to have a greater sensitivity to malaria due to their relative lack of previous exposure and limited immunity. In addition, the adaptive capacity to cope with malaria in these areas may be weak because many health care systems are inadequately equipped to deal with the disease. An important part of responding to these challenges will be monitoring the non-climate impacts affecting adaptive capacity.

## KEY ECOSYSTEM VULNERABILITIES

### Rangelands and Forests

Rangelands in Kenya support millions of pastoralists and agro-pastoralists and are also vulnerable to climate variability. Floods can wash away grass seeds and alter pasture productivity, while droughts can diminish rangeland productivity, resulting in the loss of livestock and increasing potential human and wildlife competition for resources. Projected shifts in the intensity and frequency of these extreme events as a result of climate change may exacerbate these impacts.

Forest ecosystems in Kenya provide a wide range of resources, products, and services that support human health and economic well-being. Forests are threatened by deforestation and degradation, largely driven by the increasing demand for energy in a country where an overwhelming majority relies on biomass to meet energy needs. Other causes of deforestation and degradation are illegal settlements, encroachment, logging, and livestock grazing. Climate change may place additional pressures on these already stressed resources. Potential impacts include:

- Reductions in biodiversity and the capacity to provide forest goods and services due to changes in growth, composition, and regeneration capacity.
- Increased frequency and intensity of forest fires because of warmer temperatures and more extended periods of drought. Forest fires have affected Kenya's major forests in the past, including the Mau and Mt. Kenya forests, and have resulted in the loss of more than 5,700 ha of forest over the past 20 years.
- Alterations in the occurrence and distribution of pests, pathogens, and invasive species that may harm or damage other species, and affect tree-growth, survival, and yield as well as the quality of tree products.
- A shift in vegetation to higher elevations as climate zones shift, and possible species loss.

### Mangroves, Coral Reefs, and Fisheries

Mangroves support the livelihoods of numerous communities in Kenya and serve as fish nurseries. They also act as buffers to storms and related climate events. Some studies estimate that, over the past 50 years, about half of Kenya's mangroves have been destroyed as a result of both climate and non-climate stressors. Non-climate stressors include over-harvesting for timber products, pollution, and large-scale conversion to ports, settlements, tourist infrastructure, aquaculture, rice farms, and salt pans. Mangroves are also vulnerable to an increase in heavy rainfall events, which can cause erosion and sedimentation.

Coral reefs serve as important habitats for biodiversity, sources of food, providers of ecological services, and major tourist attractions. They are already under stress from both climate and non-climate change impacts, and extensive coral bleaching has occurred in a number of areas. Increased incidence of coral bleaching may ultimately lead to coral mortality, as corals are stressed beyond their ability to recover from periodic traumas.

Fisheries support diverse ecosystems and are an important source of protein for communities neighboring Lake Victoria. Lake Victoria is threatened by a number of non-climate stressors such as pollution, the introduction of invasive plant and fish species, and overexploitation of resources through practices such as overfishing, use of unregulated gill net mesh sizes, and exploitative fishing techniques. These have led to degraded water quality, a reduction in nearly all endemic species, greater fish mortality, a higher proportion of immature fish in catches, and a lesser number of fish per catch. Climate change impacts may exacerbate these impacts, potentially resulting in irreversible environmental damage, poorer nutrition, and greater poverty for Lake Victoria communities.

## NATIONAL STRATEGIES, PLANS, AND INSTITUTIONS RELEVANT TO CLIMATE CHANGE

### National Strategies and Plans

- Initial National Communication (2002): Covers both mitigation and adaptation, and includes information on greenhouse gas emissions, mitigation options, vulnerability assessments of key sectors, potential adaptation measures, and the policy and institutional context for responding to climate change.
- National Climate Change Response Strategy (NCCRS) (2010): Seeks to promote the mainstreaming of adaptation and mitigation measures into all government objectives and planning by highlighting key impacts, vulnerabilities, and potential response measures. The NCCRS also offers an action plan.
- Climate Change Bill: Currently in draft form; draws attention to the necessity of mainstreaming climate change, including into government budgets, and reviews progress on the implementation of both adaptation and mitigation programs. Kenya does not yet have a Climate Change Policy.

## Institutional Framework

- The National Environmental Management Authority in the Ministry of Environment and Mineral Resources (MEMR) is the focal point for all national environmental issues and is responsible for day-to-day coordination of climate change policies and projects.
- The National Climate Change Activities Coordinating Committee coordinates the climate change activities of the Government of Kenya (GOK).
- The Kenya Meteorological Department within the Ministry of Transport operates a network of meteorological stations, which enable it to supply meteorological and early warning information for sectors such as agriculture, energy, and marine resources both regionally and nationally.

## Adaptation Priorities

The NCCRS identifies the GOK's priority sectors for adaptation, adaptation measures by sector, and cross-cutting capacity building needs to improve individual and institutional ability to reduce climate change risks and vulnerabilities. The NCCRS also highlights data-related needs of collecting and systematizing existing weather, climate, and sectoral data. It draws attention to the lack of robust vulnerability assessments to address inadequate national and local information on how changes in climate may manifest and affect the vulnerability of specific sectors and resources.

## Key Players and Initiatives

Donor-funded, adaptation-specific activities have tended to focus on assessments, strengthening capacity to integrate adaptation into development policy- and decision-making processes, and initiatives to improve prediction models and enhance the ability to respond to malaria. As a result, a number of important sectors such as agriculture, water resources, and energy remain under-examined both in terms of understanding vulnerability and piloting adaptation measures.

- United Nations Development Programme (UNDP) supports a number of initiatives, including Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa – Kenya (funded by the Government of Japan); Adaptation to Climate Change in Arid and Semi-Arid Lands (funded by Global Environment Facility (GEF)); and Piloting Climate Change Adaptation to Protect Human Health in Kenya (funded by GEF).
- International Development Research Centre (IDRC) supports the Transferring the Malaria Epidemic Prediction Model to Users in East Africa initiative (funded by Climate Change Adaptation in Africa, United Kingdom Department for International Development, and IDRC).
- UN Refugee Agency supports the mitigation of short-term effects and development of long-term strategies to cope with climate change in the Dadaab refugee camp in northern Kenya.

## Priority Challenges and Constraints for Addressing Vulnerability and Increasing Resilience

Data, research, and capacity needs include:

- Increasing the availability of sector-specific information and data on the costs of climate impacts as well as quantitative information in general.
- Increasing capacity to conduct analyses of regional and local circulation models.
- Improving communication among relevant stakeholders both within the government as well as with NGO, scientific, research, private sector, and community groups for effective disaster risk reduction and adaptation at national and subnational levels.

Addressing these constraints and needs will contribute to Kenya's ability to move beyond assessments, strategies, and pilots to the implementation of adaptation that supports long-term climate-resilient development.

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