FACT SHEET

FEBRUARY 2018

CLIMATE CHANGE VULNERABILITY AND ADAPTATION IN EAST AFRICA

AQUATIC ECOSYSTEMS AND WATER

PHOTO: PREPARED/ TEDDY CHENYA

BACKGROUND

The East Africa vulnerability, impacts, and adaptation assessment (VIA) was undertaken by the East African Community (EAC) with support from the USAID/Kenya and East Africa Planning for Resilience in East Africa through Policy, Adaptation, Research, and Economic Development (PREPARED) Project. The study adopted the Intergovernmental Panel on Climate Change (IPCC) assessment framework and used locally observed climate data and socioeconomic information for a 30-year period (1981–2010). Detailed analysis for the VIA focused on the Lake Victoria Basin (LVB), the largest water body in the region, which is important to farming, fisheries, transportation, and water supply in the five EAC Partner States included in the VIA (Burundi, Kenya, Rwanda, Tanzania, and Uganda).

The VIA developed and demonstrated an approach to integrating adaptive strategies that respond to the risks due to climate change. The assessment contributed to development of the EAC Climate Change Master Plan (2011–2031), which links the EAC's Climate Change Policy, Climate Change Strategy, and Climate Change Master Plan into a vision for a resilient future for East Africa.

This brief captures the major findings related to water resources, aquatic ecosystems, and related infrastructure, one of five thematic sectors covered by the analysis in the VIA. It also presents detailed policy actions that were developed based on the findings. The foundational work for the VIA, the current climate baseline and future projections, are presented in the first brief in this series and summarized here.

CLIMATE BASELINE

Data from 1981–2010 indicate a large variance in average annual rainfall variability across the region, with higher variability in the long rains of March-June (MAMJ). In aggregate, the patterns in monthly rainfall suggest that the short rains of October–December (OND) have increased, and the long rains have decreased in the LVB over most of the past century. Overall, rainfall has been declining 20–100 millimeters every 10 years and drier periods are getting longer and more pronounced during the long rains. Wet and dry periods have occurred in distinct 10-year cycles. With regard to surface temperatures, data for 1930–2016 indicate that the average monthly maximum temperature over the LVB has increased +0.7°C to +1.2°C and the average monthly minimum has increased +1.0°C to +1.1°C.

CLIMATE PROJECTIONS

The VIA projections for changes in rainfall and mean surface temperature for 2030, 2050, and 2070 are based on historical and downscaled future scenarios for maximum and minimum temperature data for scenarios representing low, mid, and high levels of emissions and concentrations (RCP2.6, RCP4.5, and RCP8.5). Generally, rainfall is projected to increase over East Africa under all future scenarios except for the June–September (JJAS) period in 2020. Mean annual maximum surface temperature projections increase 1.0°C to 2.0°C over most of the EAC by 2030. The projected warming will be greatest in March–May (MAM) and JJAS and least in October–December (OND). If no mitigating actions are taken, maximum daily temperatures are expected to increase 2.5°C to 3.5°C by 2050. Projections also indicate that East Africa can expect that rainfall and temperature events will become more extreme, episodic, and intense.

KEY FINDINGS

East Africa is endowed with significant freshwater resources, including major rivers and lakes, one of which is Lake Victoria, the largest shared water resource in the region. The region has a total renewable water volume of 187 cubic kilometers per year. Other water resources include groundwater, riverine flows, and lacustrine swamps. These resources support most of the productive sectors in the EAC, including agriculture (both irrigated and rain-fed), livestock, and fisheries; they also provide water for domestic and commercial uses as well as supporting wildlife and a wealth of aquatic and terrestrial biodiversity.

Climate change, climate variability, and socioeconomic conditions have combined to impose significant pressures on water availability, water accessibility, and water demand in the EAC. It is projected that this will aggravate the water stress currently faced by Burundi, Kenya, and Rwanda, while Tanzania and Uganda, which are not water stressed now will become so in the future.

POPULATION PRESSURE

While water resources are finite, its use has continued to increase exponentially in the region. In part this is due to population pressure: over the last century populations in the EAC have increased rapidly (3.0–3.5 percent annually). This is most evident in the LVB, where population more than doubled between 1980 and 2015 (Figure 1). Meanwhile the water resource has remained largely unchanged. Kenya, for example, is in a precarious situation, having about 681 cubic meters of water per capita per year, which compares poorly with the globally recommended 1,000 cubic meters per capita per year. Population projections indicate that per capita water availability will decline to 235 cubic meters by 2025. Rwanda and Burundi face similarly severe water scarcity now and in the future.

Across the region, 75 percent of the rural population already lacks access to safe drinking water. The Lake Victoria Basin contains about 30 million rural inhabitants, the majority of whom are very poor. Projections indicate that this population will more than double by 2020 (68 million) and by 2050 it could increase to about 165 million people, creating great competition for water resources.

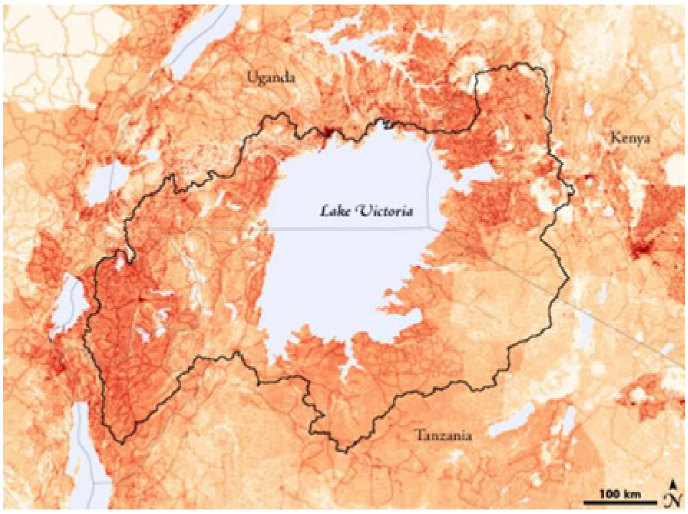

Figure 1. Population density in the Lake Victoria Basin is high and increasing 3–4 percent per year

One consequence of increased population pressure has been changes in the physical, chemical, and biological properties of water sources within the Lake Victoria Basin over the past 50 years. The changes are due to increasing and considerable pressure from a variety of interlinked human activities in the catchment. These include industrial and municipal activities within urban centers, wetlands degradation, and deforestation. Major urban centers are hotspots for point and nonpoint sources of pollution within the basin, with pollutants originating from manufacturing industries, inefficient wastewater treatment facilities, and dumping of solid wastes.

CLIMATE CHANGE PRESSURE

East Africa's is renowned for very its aquatic biodiversity and its wetlands provide water and productive environs for numerous species of plants and animals, including migratory birds. Lake Victoria's natural resources alone support more than 100,000 artisanal fishermen and the lake is a major source of protein to approximately 8 million people. The state of the region's fisheries is of a major concern to the riparian states and there has been a general view that fish catches are declining and that the fishery may be in danger of collapse.

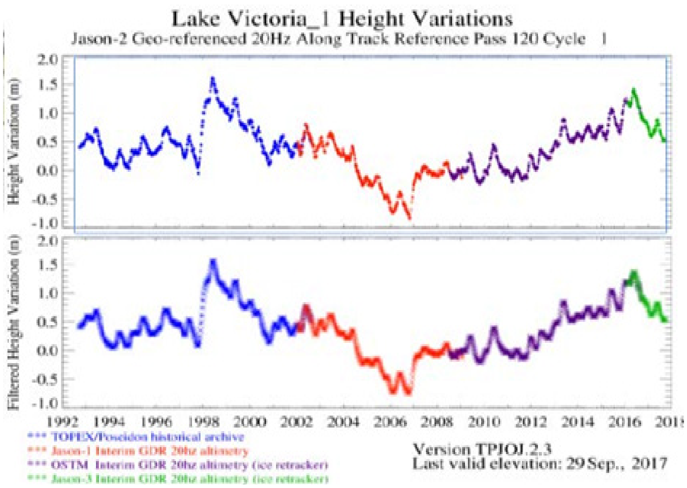

Figure 2. Lake Victoria water levels are highly variable and sensitive to prevailing climatic trends

Changes in climate patterns, variability, and trends will have serious consequences. Lake Victoria is highly sensitive to such changes (Figure 2). Higher surface temperatures affect fish reproductive patterns and the distribution of macro-invertebrates and amphibians. Changes in precipitation levels affect water levels in surface water and groundwater recharge and extreme rains can increase sediment loads in rivers and lakes, affecting water quality. Overall changes in weather patterns can also affect the migration patterns of water birds. Some of these effects have already been observed in East Africa.

FUTURE PROJECTIONS

Rainfall is one of the climatic variables that will be most affected by climate change and variability in the EAC region. Arid and semi-arid areas will experience annual rainfall of below 300 millimeters under the best case scenario of RCP2.6. With an unprecedented increase in temperature of about 2.50°C to 3.50°C, both the quantity and quality of water will be affected. Over-extraction of groundwater resources, increased competition, and conflicts over water may become common in parts of East Africa where per capita water storage is already low, particularly Burundi, Rwanda, and Uganda, which have the least groundwater storage. Under such warming trends, the existing differences in water availability across the region could become more pronounced, causing serious threat to economic growth, social cohesion, and political stability. The IPCC projects that 90 to 220 million people in Africa would be exposed to increased water stress due to climate change.

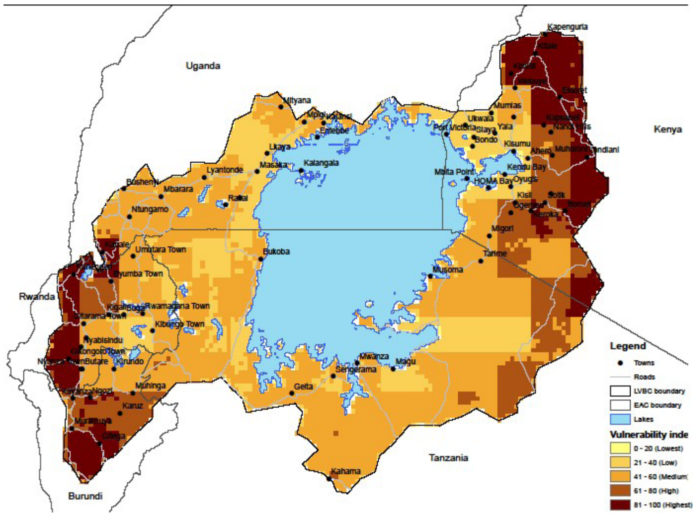

Figure 3: Water stress vulnerability in the Lake Victoria Basin for 2050, RCP4.5

Results of a water stress vulnerability assessment, conducted for the three potential future emission scenarios for the Lake Victoria Basin for the years 2030, 2050, and 2070 indicate spatial variations on the magnitude of the impacts, showing higher vulnerability in Kenya for 2030 and Tanzania for 2050. In 2050, the threats will affect the western sections of the LVB and will be severe across the entire basin (Figure 3). In 2070, vulnerability will be higher in Kenya, especially the Mau water tower; in Uganda; and parts of northern Rwanda and Tanzania.

Surface water resources are extremely vulnerable to climate change. Results from dynamical modelling predict that the LVB will experience more rainfall, but that 20 out of its 23 rivers will experience highly variable discharges. Continuous heavy rainfall may simultaneously increase risk by increasing flooding in some low-lying areas. The coefficient of variability in these predicted stream flows are high, in some cases above 70 percent. Groundwater recharge could increase, especially during the short rains. Where increases in heavy rainfall events are projected, floods could wash away sanitation facilities, spreading wastewater and potentially contaminating groundwater resources. This may lead to increased risk of diseases, especially in areas where pit latrines are used. Low levels of rainfall also carry risks as they can result in increased concentrations of sediment and pollutants in lakes and rivers.

With continuous climate variability, the region is at risk of biodiversity losses. Changes in the migratory routes (and timings) of species that use seasonal wetlands might lead to increasing human wildlife conflicts. Fish could be severely affected by climate change, as riverine species subjected to climate change and variability tend to react by restricting their range or by colonizing new climatically suitable habitats. A 1°C to 2°C increase may lead to the death of many tropical fish species. Eutrophication due to increased flooding and, consequently, nutrient inputs from catchments will undoubtedly lead to further pressure, increasing levels of water hyacinth, and cause loss of wetland vegetation. Already, the loss of the "spongy-like" effect of wetlands has led to increased flooding in Nyando, Kenya.

PROPOSED POLICY ACTIONS

Develop and implement community-based climate change resilience programs for water catchment management.

- Develop and implement climate change-resilient catchment management plans and promote Transboundary Water Resource User Associations.
- Promote cross-border experience sharing.

Develop a decision support system that integrates climate change and integrated water resources management (IWRM) information.

- Improve the availability and dissemination of climate change and IWRM information in the LVB.
- Develop a comprehensive hydrometeorological monitoring network.
- Develop best practices on water allocation plans that takes into account climate change and that can be scaled up to other sub-basins within the LVB.

Enhance technological advancement for water resources harvesting, storage, processing, and use.

- Opportunities exist to mainstream climate change into water resources management by (i) promoting, developing, and implementing water harvesting and storage facilities (e.g., dams and water pans); (ii) promoting groundwater assessment and management technologies to improve aquifer recharge; and (iii) promoting cleaner production technologies that improve water quality and efficiency.

Develop sustainable funding mechanisms and regional policy frameworks that support water security.

- Gain access to climate adaptation funds through EAC Secretariat accreditation to the Adaptation Fund and the Green Climate Fund.
- Capitalize the EAC Climate Change Fund.
- Harmonize regional policy frameworks on water security that mainstream climate change.

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