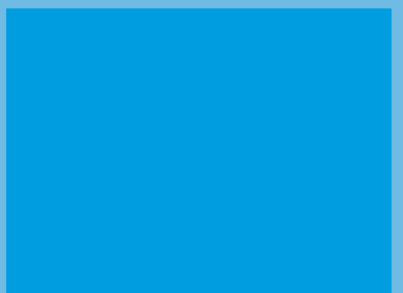
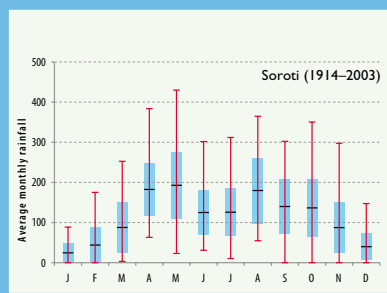
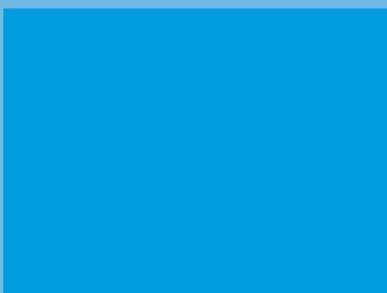
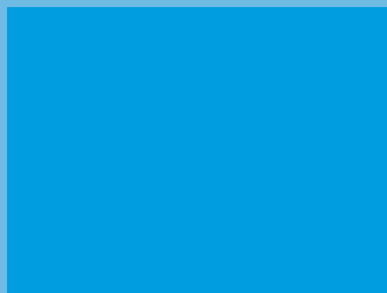
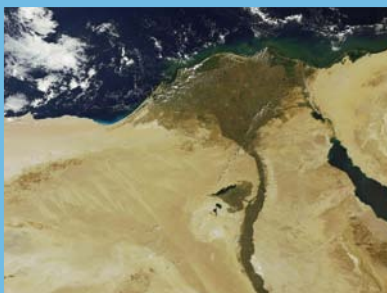


## The Water Resources of the Nile Basin



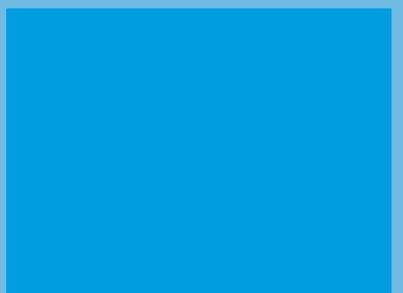
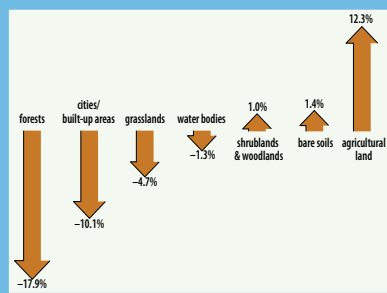
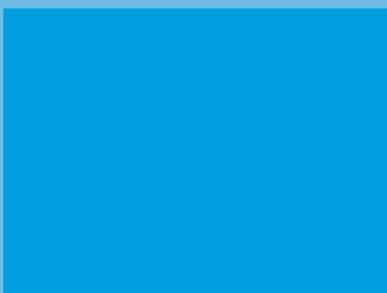
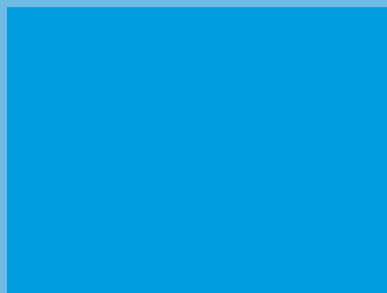
# KEY MESSAGES

- The Nile Basin is characterized by high climatic diversity and variability, a low percentage of rainfall reaching the main river, and an uneven distribution of its water resources. Potential evaporation rates in the Nile region are high, making the basin particularly vulnerable to drought.
- White Nile flows only contribute up to 15 per cent of the annual Nile discharge, but are fairly stable throughout the year. The Eastern Nile region supplies up to 90 per cent of annual Nile flows, but its contribution is highly seasonal.
- Extensive regional aquifer systems holding substantial quantities of groundwater underlie the Nile region. Some of the aquifers hold fossil water, but others are recharged from precipitation over the basin, or from irrigation areas and the baseflow of the Nile. Groundwater is the dominant source of domestic water supply in rural communities across the basin.
- The quality of the Nile waters has generally deteriorated because of population growth, intensification of agriculture, and industrial development. Across the basin, environmental sanitation is poor, resulting in bacteriological contamination and nutrient enrichment of the Nile waters. While the quality of large parts of the Nile system – in particular in the sparsely populated areas – remains acceptable, localized high pollution is experienced mainly around urban centres. Groundwater in isolated locations also has naturally occurring high levels of dissolved minerals.
- The headwater regions of the Nile are subject to widespread soil erosion. Sediment yields are particularly high in the Eastern Nile sub-basin, which contributes 97 per cent of the total sediment load. Most sediment is captured in reservoirs in The Sudan and Egypt, which leads to a rapid loss of reservoir storage capacity.
- The finite Nile flows are now fully utilized for agricultural, domestic, industrial, and environmental purposes, while water demand continues to rise steadily due to population growth and economic development.
- Irrigated agriculture in Egypt and The Sudan represents the single most important consumer of the waters of the Nile, but the upper riparians are planning investments that will use the river's renewable discharge and present challenges concerning the equitable appropriation of the Nile water resources amongst the Nile riparian countries.
- Recommended regional-level actions for consideration by the Nile riparian countries include the restoration of degraded water catchments that are critical for sustaining the flow of the major Nile tributaries, restoring badly degraded lands that export large quantities of sediments and cause serious siltation in the Nile tributaries, and establishing a regional hydrometric and environmental monitoring system.



The River Nile, Egypt.

## The Environmental Resources of the Nile Basin





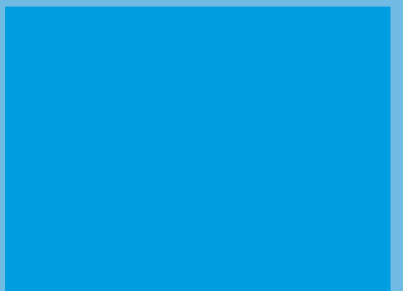
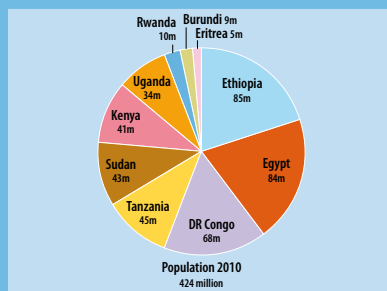
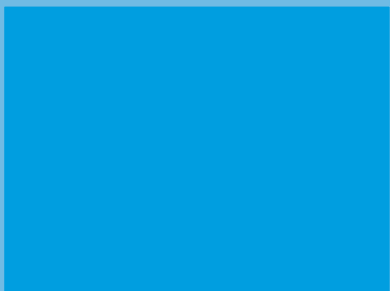
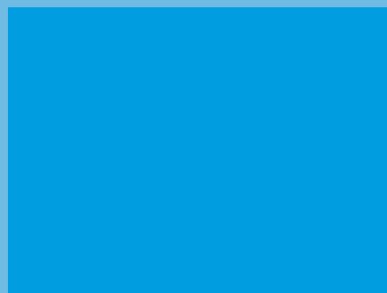
# KEY MESSAGES

- The Nile Basin has many unique aquatic and terrestrial ecosystems, and is home to thousands of species of plants and animals, many of them endemic to the basin.
- The basin's water and related environmental resources provide a wide range of societal goods and services, contributing between 40 and 60 per cent of the gross domestic product of the Nile riparian countries.
- The Nile's system of waterways and wetlands constitutes an important flight path for migratory birds and also a destination for migratory birds from other regions of Africa. Seventeen aquatic and wetland ecosystems within the basin have been designated as international Ramsar sites.
- Natural resources of the Nile Basin are under increasing pressure from a multiplicity of sources, mainly agriculture, livestock, invasive species, bushfires, mining, urbanization, climate change, and natural disasters.
- Many protected areas (national parks and game, wildlife, and forest reserves) have been established to conserve the basin's unique ecosystems, with mixed conservation success.
- The root causes of the rapid degradation of the basin's environmental resources are population growth, poverty, civil insecurity, and weak policy, legal, and institutional frameworks in the Nile riparian countries.
- The Lake Victoria Basin Commission (LVBC), the Intergovernmental Authority on Development (IGAD), and the Nile Basin Initiative (NBI) are examples of a growing number of regional frameworks established in recent years to address environmental degradation within the Nile Basin.
- Key recommendations for regional-level actions by the Nile riparian countries include the restoration of degraded water catchments critical for sustaining the flow of the major Nile tributaries, restoring badly degraded lands that export large quantities of sediments and cause serious siltation of reservoirs, and establishing a regional network for monitoring changes in water quality and land-use within the basin.



Clearing water hyacinth, an invasive species that has had an adverse impact on many parts of the Nile Basin, including parts of Lake Victoria.

## Opportunities and Challenges of the Growing Nile Population





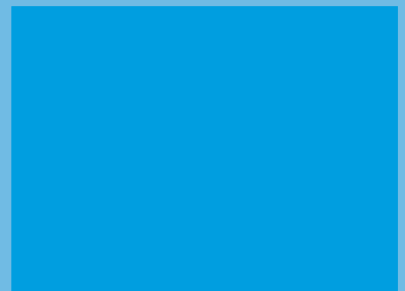
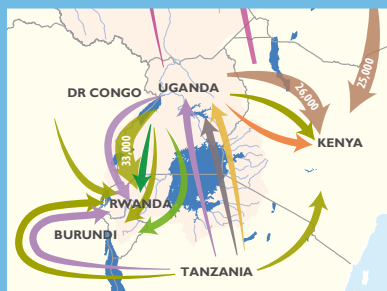
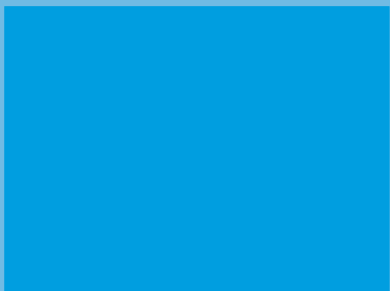
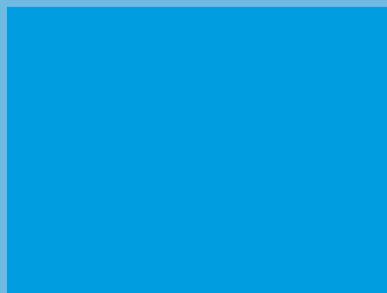
# KEY MESSAGES

- The Nile countries have a combined population of 437 million, 54 per cent of which (238 million) resides in the Nile Basin.
- Water availability appears to be the chief determinant of population distribution in the basin. In Egypt and Sudan, population is largely concentrated along the course of the River Nile, while in the upstream countries it follows the pattern of rainfall distribution.
- The population in the region is rising rapidly, presenting governments with both opportunities and challenges. The rising population increases availability of labour for economic production, and ensures a large market for food produce, manufactured goods, and services.
- But the rising population also increases degradation of natural resources, puts pressure on economic infrastructure (transport, education, health, water, and power and telecommunication facilities), increases food security concerns, and leads to rural–urban migration, with the attendant problems of rapid urbanization.
- The factors maintaining high population growth rates are numerous, including widespread poverty, illiteracy, cultural norms, low access to reproductive health services, lack of empowerment, and civil war.
- Concerted efforts by the riparian governments at addressing high population growth rates in the 1980s and 1990s produced sharp reductions in fertility rates. Fertility rates have continued to decline in the region but more slowly.
- About 72 per cent of the basin population resides in rural areas. The dominance of rural populations is predicted to persist to 2030 and beyond in most Nile countries.
- Considering that the factors that enabled a large population to make a positive contribution to economic development are not well established in most of the Nile countries, the challenges posed by the rising population far outweigh its benefits, and threaten to prevent these countries from becoming middle-income economies by 2025 or 2030.
- To achieve the ultimate goal of slowing the rate of population growth, the basin states need to increase funding for activities aimed at managing the population growth, and to intensify efforts at holistic rural development.

Women and children in Rwanda queue to collect tablets during the Mother and Child Health Week, held in April 2010. Improving the health of women and children is seen as an incentive to have smaller families.



## Agriculture, Food Security, and Livelihoods in the Nile Basin





# KEY MESSAGES

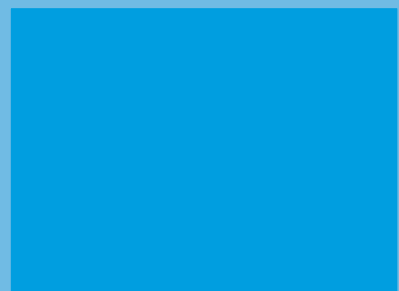
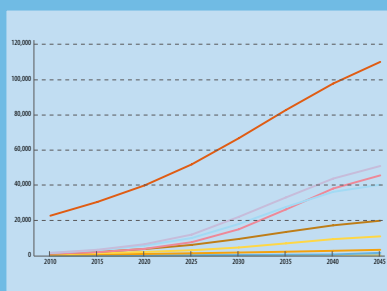
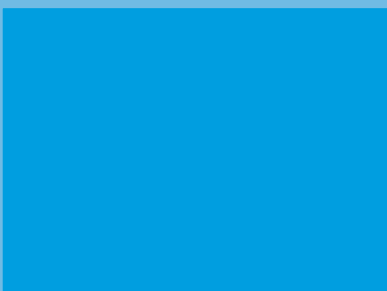
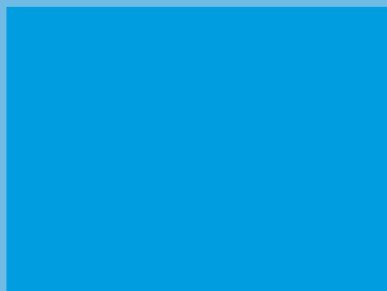
- The agricultural sector is of great importance to the Nile Basin countries as it is a major contributor to GDP, employment, and food security. Agriculture is also the largest water-consuming sector: irrigated agriculture alone uses the equivalent of about 78 per cent of the peak flow of the Nile at Aswan.
- Close to 90 per cent of the land currently used for agriculture is under rainfed farming systems. These systems are characterized by subsistence-level production and low yields of crops and livestock.
- There is about 5.6 million hectares of land under irrigation or equipped with irrigation facilities in the Nile Basin. A large proportion – 97 per cent – of the land is located in Egypt and The Sudan, with the remaining 3 per cent distributed among the upper riparian states. Productivity and water-use efficiency is high in the irrigation schemes in Egypt, and on commercial irrigation schemes in the rest of the basin, but generally low in the large smallholder irrigation schemes in The Sudan.
- Three countries – Egypt, Tanzania, and Uganda – produce large quantities of fish, but the freshwater fisheries resources of the basin are showing signs of being overfished.
- The potential of the agricultural sector is large, but it is held back by constraints in both the natural resource base and the policy, institutional, and economic environment.
- The agro-processing sector in the region – except for that in Egypt – is poorly developed.
- Production levels for food crops have been rising over the years, but food production in the Nile countries falls short of local demands, and all countries are net food importers.
- Trade volumes between Nile Basin countries are low, as none of them generates sufficient surpluses to support high-volume trade. Trade links between the downstream countries (Egypt and Sudan) and the rest of the basin states are very weak.
- To produce sufficient food to feed the basin population and generate surplus for regional trade, the basin countries need to concurrently implement a wide range of measures targeting the multiple constraints affecting the agricultural sector.
- The present situation of dominance of smallholder rainfed subsistence farming in the upper riparian countries is likely to persist to 2030 and beyond. To improve rural livelihoods and enhance food security in the region, it will be necessary, therefore, to improve the productivity of this farming system through, for example, introducing water and soil conservation techniques, providing quality seeds, and encouraging use of fertilizers.
- From the perspective of water management, interventions to increase agricultural productivity should include programmes to increase rainwater harvesting, expand irrigated areas, improve the water-retention properties of soil in the upstream countries, and improve productivity and water-use efficiency in the downstream countries.



Smallholder rainfed fields in Uganda.

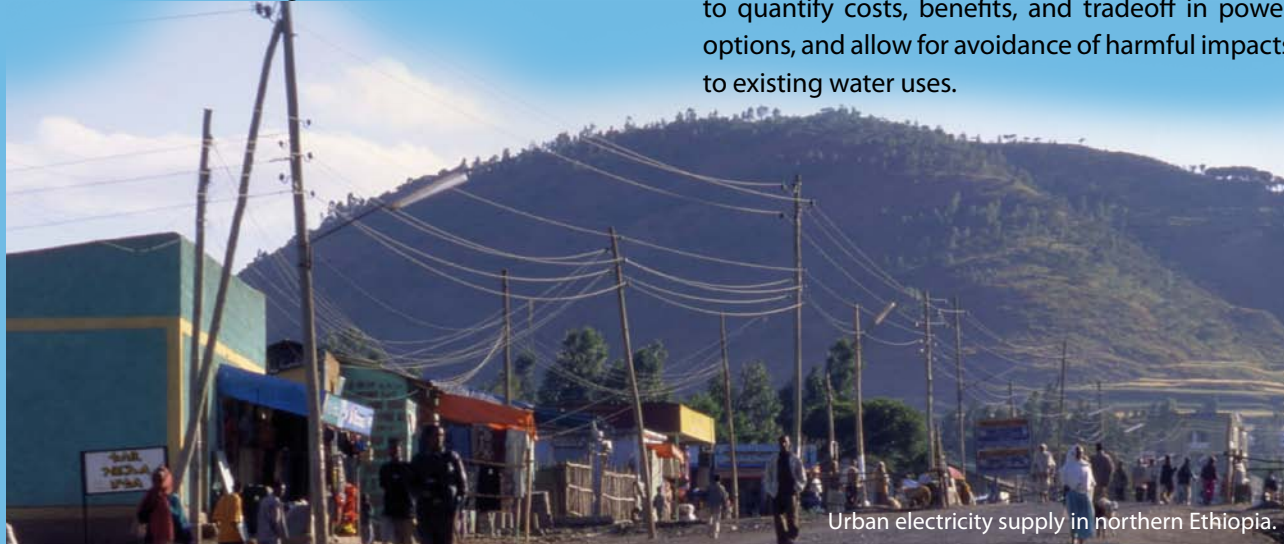


## Hydropower Potential and the Region's Rising Energy Demand



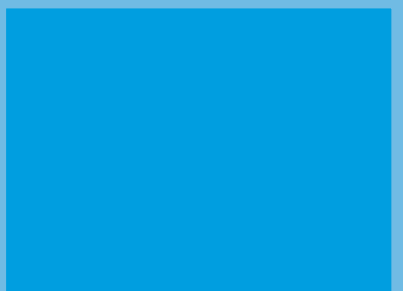
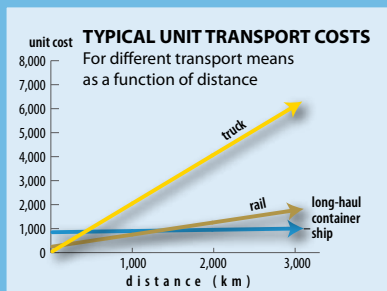
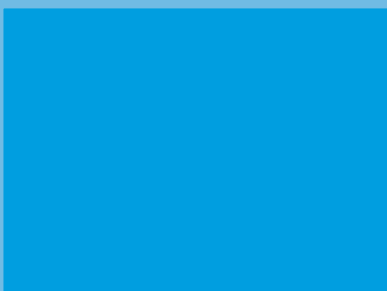
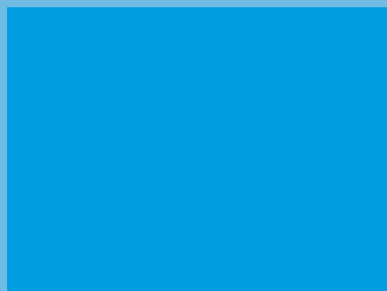
# KEY MESSAGES

- Power/electricity is a critical requirement for growth and economic production in the Nile countries. In particular, it is important for attracting new investments to the region, supporting expansion of the industrial and service sectors, creating employment and improving living standards.
- The Nile riparian countries are endowed with substantial energy resources that include hydropower potential, natural gas, oil, geothermal energy, coal, peat, biomass, solar, and wind. Among the various energy options, hydropower is the most attractive to the Nile countries because of its long economic life and low per unit energy costs.
- The hydropower potential in the Nile Basin exceeds 20 GW. Existing facilities only represent about 26 per cent of potential capacity. The Nile countries depend on hydropower to varying degrees, with Burundi, DR Congo, Ethiopia, and Uganda reliant on it for 80 per cent or more of their power.
- Electricity supply in the Nile countries (with the exception of Egypt) is inadequate, unreliable, and expensive. Accordingly, electricity consumption in the region is among the lowest in the world. Urban areas are significantly better served than rural areas, where the bulk of the population remains dependent on biomass energy sources, with associated negative impacts on the environment.
- The Nile Basin remains the only region on the African continent without a functional regional power grid. The volumes of power traded amongst Nile countries are insignificant.
- Demand for power in the region is high, rising rapidly, and will exceed supply for many years. The rise in demand is driven by, among other things, improving economic conditions and rising population in the basin. Projections of power demand for 2035 in the Nile countries indicate an increase of 300 percent and higher over present demand.
- Very large investments in power generation and transmission – in the range of tens of billions of dollars – are required for a sustained period to meet the region's power demand.
- Hydropower is the preferred energy source for most Nile countries. To tap and sustainably exploit the vast hydropower potential of the region, the countries need to plan and develop the water resources cooperatively, and mainstream environmental and social considerations in all aspects of power development. Balancing the interests of competing sectors and different countries while optimizing hydropower production will require coordinated reservoir operation across the basin. Total power demand will eventually exceed hydropower potential, and alternative power sources will need to be developed.
- The NBI is contributing to the transformation of the region's power sector by providing a forum for joint planning and cooperative development of hydropower generation and transmission options, and promoting power pooling amongst the Nile countries. The NBI has developed analytical tools such as the Nile-DSS that make it possible to quantify costs, benefits, and tradeoff in power options, and allow for avoidance of harmful impacts to existing water uses.



Urban electricity supply in northern Ethiopia.

## The Role of Inland Water Transport in Support of Further Regional Integration





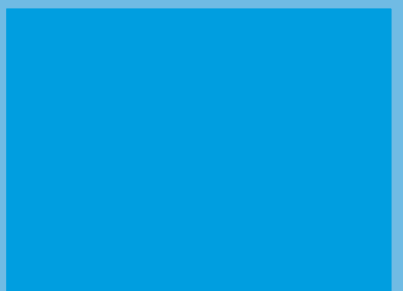
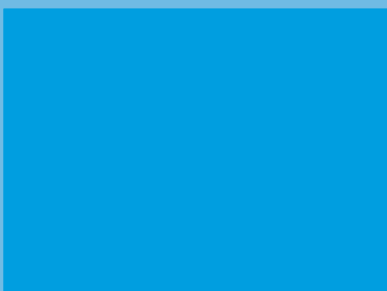
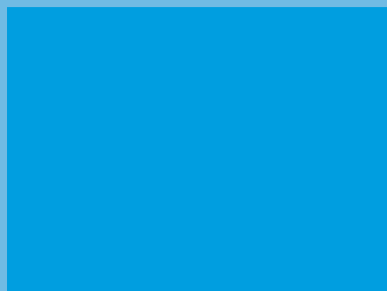
# KEY MESSAGES

- The land-locked economies of the upper Nile region are hampered by expensive road transportation and logistics that have generally reduced their economic opportunities.
- Efforts under the African Union and regional economic communities have resulted in (especially) improved road interconnections between the Nile countries. However, the transport and trade links between upstream and downstream riparians remain weak.
- The absence of a reliable and cost-effective north-south transportation link has constrained trade relations between the upstream and downstream riparians, and represents a lost opportunity for regional integration.
- Economic development in the Nile countries, combined with prospective mineral resources, fossil fuels, and agricultural potential, justify investment in bulk cargo transport infrastructure.
- Several reaches of the Nile could form elements of a comprehensive bulk cargo transportation system that could provide cost-effective access to internal and external markets.
- Developing the inland navigation potential of the river Nile – in particular the ‘southern reach’ from Kosti to Juba – may provide a low-cost transport route for bulk cargo from South Sudan and the Nile Equatorial Lakes region to The Sudan and Egypt; it could thus encourage north-south intra-basin trade and regional integration.
- Lake Victoria could provide a critical link between the Northern Corridor (Kigali-Kampala-Mombasa) and the Central Corridor (Dar es Salaam-Tabora-Mwanza), and enlarge the economic impact zone of the respective corridors; improved Lake Victoria navigation would also strengthen inter-regional transport connections and economic integration.

Trading vessel setting out from Jinja, Lake Victoria.



## Climate Change and its Implications for the Nile Region



# KEY MESSAGES

- There is overwhelming scientific evidence of a warming trend in the Earth's temperature, and consensus about the movement towards intensified extreme events such as floods and droughts.
- The Nile Basin is highly vulnerable to the impacts of global warming owing to a multiplicity of factors, and the basin communities have limited ability to cope with the negative impacts of climate variability.
- Nile flows are very sensitive to small changes in average basin rainfall, but the Nile Basin consists of a number of distinct sub-basins that each respond quite differently to possible climatic variations.
- Although the impacts of a global warming trend are not yet clear at regional and local level, the basin countries would do well to implement a number of 'no-regret' or proactive measures aimed at building resilience to current climate variability while enhancing adaptive capacity for future threats. A sensible approach for now would be to prepare for more variable conditions than currently recorded.
- A prioritized 'no-regret' measure is to expand water-storage infrastructure.
- The National Adaptation Plans of Action (NAPAs) and the early warning systems being developed in the Nile Basin countries represent a substantial effort but are insufficient to prepare effectively for a changing climate, given the scale of the threat.
- Climate-change adaptation measures will be most effective when undertaken in coordination with other riparians. Examples of joint measures to enhance the collective adaptive capacity include coordinated reservoir operation, promoting agricultural trade amongst the countries and between the basin and other regions, interconnecting power and transport systems, developing joint mechanisms for resource solicitation for climate-change programmes, and conducting joint research.

A farmer in Kobo district of Ethiopia surveys his drought-damaged crop.

