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# International Day for Biological Diversity

Karura Forest and its Ecosystem Services

– an introductory Reader

a joint project of



Federal Ministry  
for Economic Cooperation  
and Development



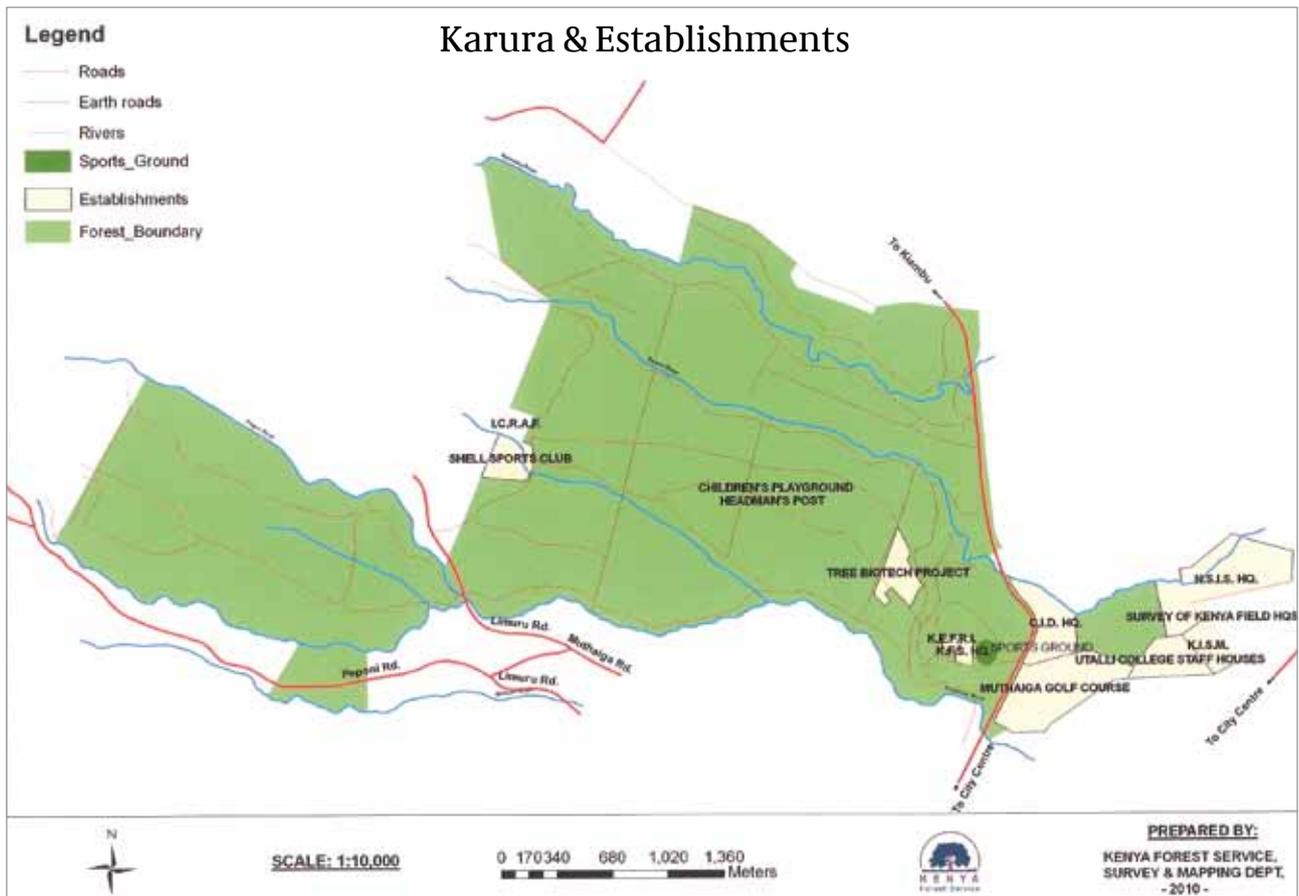
Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety

in cooperation with



Convention on  
Biological Diversity





### Karura forest

Karura forest (Karura Forest Reserve) was gazetted in 1932 as a government forest and covers 1041.3 ha. The area was previously larger, but land was given out by the government for the construction of various buildings, including UNEP, National Youth Service (NYS), National Security Intelligence Service (NSIS), and Criminal Investigative Department (CID) headquarters. The forest is partly-natural (759.6 ha) and partly-plantation (281.7 ha) and contains both indigenous and exotic trees. The forest has over 20 local tree species, including the *Alia africana*, *Croton megalocarpus*, *Neutonia buchanani*, *Makamia otea*, Podo and Cedar. In addition, there are 15 species of exotic trees, including the Cypress, *Grevillia robusta*, *Araucaria spp*, *Casuarinas spp*, *Jacaranda* and *Eucalyptus spp*. Besides the large number of tree species, Karura forest is also of great importance ecologically, economically and culturally.

### Recreation / Tourism

Karura forest contains many amenities for recreation to suit everybody's taste. Such as a 50-foot waterfall, the Mau-Mau caves (where the Mau Mau fighters hid during the colonial war. The caves are now used by churches and other people for fasting and praying), many kilometers of nature trails, a marshland perfect for bird-watching, three rivers to explore and many pleasant picnic sites. Near the caves stands a huge tree *Craibea brownii* – commonly known as »father of trees« as it is the oldest in the forest, estimated to be two centuries old. It also holds nearly all of Nairobi's 605 bird species, three types of Antelope, Monkeys, Water bucks, Bush pigs and dif-



ferent species of reptiles, amphibians, fish and small mammals. It is an invaluable natural treasure for all Kenyans.

Economically, Karura forest is a tourist attraction because of its unique trees, nature trails for residents to jog, cycle or stroll, as well as pathways to explore the three rivers and caves, accompanied by rangers from the Kenya Forestry Service. There are plans by Friends of Karura forest to erect an electric fence around the forest to make it more secure for visitors.

The entry fee: Non resident: Adult 200 ksh, Child 50 ksh.  
Resident: Adult 50 ksh, Child 20 ksh.

## Water

Karura forest has three permanent rivers flowing through the forest i.e Ruaka, Karura and Gitathuru, providing water to many Nairobi residents. These rivers are utilized directly by people neighbouring the forest (such as residents of Muthaiga, Runda, whispers estates and UNEP as well as Mji wa Huruma, Githongoro and deep sea villages) for domestic use, irrigating tree nurseries and flower gardens. Karura forest also helps in regulating the water cycle when tree roots soak up rainfall, stems, trunks and roots slow runoff; and tree leaves release water back into the atmosphere. In addition, plant and animal biodiversity depends on forests for survival.



Ecosystems play a major role in the global hydrological cycle contributing to water regulation, provision and purification. Global water use is dominated by agriculture and livestock production, followed by industrial and domestic use. Forests significantly influence the quality of water circulating in a watershed. They promote higher rates of evapotranspiration leading to increased atmospheric humidity thus higher probabilities of cloud formation and rainfall. For example, the amount of rainfall received annually in Karura is 943.9 mm while its environs receive 728.4 mm. Forests increase water infiltration thus reduced surface runoff. This consequently means that there is increased time in which water purification occurs thus improving water quality. The passage of water through the soils has an impact through dilution of inorganic (nitrate and phosphates) matter and organic (pesticides) compounds.

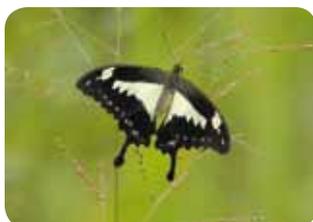


The amount of rain in Karura forest on an area of 1041.3 ha translates to 9.83 Million cubic Meters per year of water generated by the forest. A well conserved forest retains about 85 % of the water in its sub-surface storage while with human interference the retention can be as low as 50 % depending on the level of interference which is a loss of

about 35 % in form of surface runoff. Therefore, if well conserved, Karura forest can retain about 8.35 Million Cubic Meters of water per year. This water is slowly released by the forest into the streams originating from the forest and the slow flow ensures that the rivers do not drying up. This ensures that the rivers flow throughout the year thus ensuring adequate availability of water for the ecosystem and basic human needs. According to Human Development Report of 2006, each person is entitled to a minimum 20 litres of water per day and if a figure of 40 litres per day is allowed for, then the water from Karura forest alone can serve about 600,000 people which is about 20 % percent of the population of Nairobi. This means that if the forest area around Nairobi is increased 5 times, then it can serve the domestic water needs of the entire population of Nairobi. To realize this dream, the Water Resources management Authority (WRMA) in collaboration with community based Water Resources Users Associations (WRUAs) and other stakeholders has embarked on catchment protection and rehabilitation as well as monitoring of water resources to ensure adequate availability of water for all by in accordance with Vision 2030.

### **Pollination**

Pollination is a very important process in the sustenance of a forest. Karura forest is endowed with a large population of pollinators such as bees, birds, bats and butterflies. The forest has a butterfly hotspot which is not only a tourist attraction but also of ecological value. Pollinator species often depend on natural or semi natural habitats for the provision of nesting and other floral resources. Therefore, the availability of natural habitats has a significant influence on pollinator species richness and abundance (Heard *et a.,* 2007).



## Climate change

In the recent years, the climate has been changing. The earth is becoming warmer and patterns of precipitation have changed. The change is driven by increases in concentration of trace gases such as Carbon Dioxide, Methane, etc known as »green house gases« in the atmosphere due to changes in land use and rapidly rising rates of fossil fuels. Carbon dioxide which is the major green house gas is absorbed from the atmosphere by water and through photosynthesis by vegetation leading to storage in biomass in soils as organic matter.

Karura forest helps stabilize the temperature in Nairobi city and its environs and also attract rainfall. Urban forests and parks are known to assimilate about 41% of the carbon dioxide generated by traffic and about 17% of total anthropogenic Carbon dioxide (Jansson & Nohrstedt, 2001). They also help in coping with anxiety and stress, concentration in both children and office workers among other health indicators and also in noise reduction within cities (Ozer *et al.*, 2008). The forest structure acts as natural barrier to disasters such as flooding downstream.

## Community benefits

Nairobi was founded in the late 1890s as a British railway road camp on the Mombasa-Uganda railroad. Nairobi is a maasai word meaning a place of »cool waters« and the British put a city there to have water for the steam engines/locomotives for a refill, when going from Mombasa to Kampala. In 1905 the city became the capital of the British East Africa Protectorate and later in 1963 it became the capital of independent Kenya. Nairobi lies at the southern end of Kenya's agricultural heartland, 1.19° South of the Equator and 36.59° East of Meridian. It covers about 684 km<sup>2</sup>, altitude varies between 1,600 M and 1,850 M asl. The climate is generally a temperate tropical climate, with cool evenings and mornings becoming distinctly cold during the rainy seasons. Nairobi has approximately 4 million inhabitants. Karura forest which is a breath taking forest reserve is located north of Nairobi. It acts a water catchment area as well as temperature regulator for the city and its surrounding.



Nairobi has been experiencing an upsurge in development of uncontrolled urban settlements such as Mathare Valley to the east of the city and Kibera to the west. The same scenario is also observed within Karura forest reserve. Mji wa Huruma village (located inside Karura forest) has a population of between 3000–4000 people. The village covers approximately 160 M wide and up to 170 M long. The forest provides a source of livelihoods this community. The provision of raw materials such as timber, fibre, fuel etc is one of the most important forest ecosystem services. Other products include medicinal plants, topsoil and tree seedlings. Bee keeping project is another income generating activity. At the moment the Huruma Vison self help group has 80 beehives. One hive produces between 18 kg – 24 kg of pure processed honey. They sell a jar of 250 ml at 200ksh to residents of the forest and communities living around the forest. This activity is seasonal depending on rainfall pattern.

### Soils

Soil organisms' activity has a direct impact on soil structure and hence on water infiltration and retention rates. Forests and wetlands with intact ground cover and root systems are considered very effective at regulating water flow and improving water quality. Vegetation microbes and soils remove pollutants from overland flow and from ground water through physical trapping water and sediments, adhering to contaminants, reducing water speed to enhance infiltration, biochemical transformation of nutrients, absorbing water and nutrients from the root zone, stabilizing eroding banks, and by diluting contaminated water. All soils store carbon in varying extent with the largest stores being in peat soils. Forests are the only major ecosystems where the amount of carbon stored in biomass of plants exceeds that in soils. Forest soils are further enriched by deposition of plant remains. In Karura forest, the topsoil is used by villages and residents living around the forest for planting tree seedlings in nurseries, ad gardening. The Huruma vision self help group sells a seedling between 60–100 Ksh depending on size of the seedling which is one source of income for the group.



Photos: Dr Fabian Haas

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For further information

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