Forests of Mount Kulal, Kenya: source of water and support to local livelihoods

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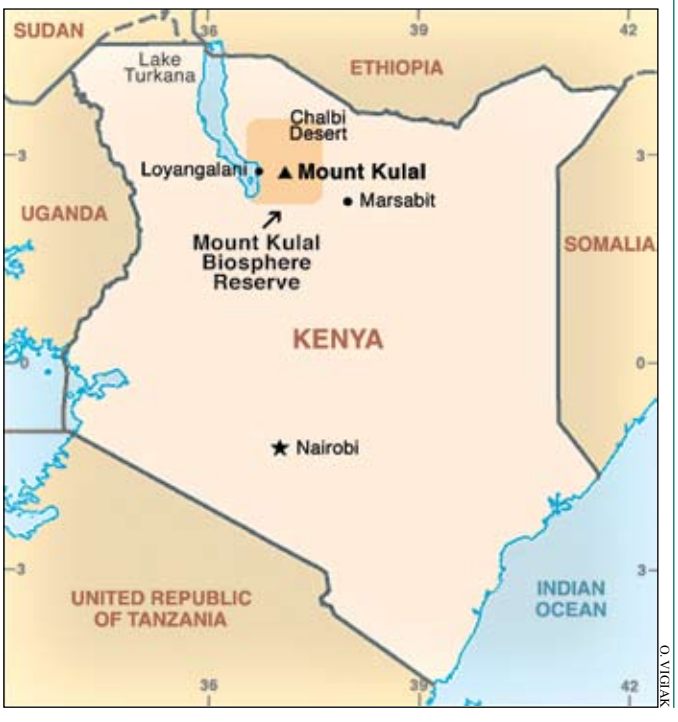
Mist-capped Mount Kulal, rising in the middle of one of the driest regions of East Africa, provides vital hydrological services for the entire region.

Mount Kulal is an eroded volcanic peak covered with mist forest at its summit and varying vegetation types below. It is among the highest peaks in northern Kenya and represents a unique ecosystem surrounded by arid and semi-arid lands on all sides. The mountain ecosystem captures moisture in the forms of mist and rain and provides important hydrological services for the entire region.

Mount Kulal is the centrepiece of the Man and the Biosphere (MAB) reserve of the same name, which is one of six MAB reserves in Kenya. The United Nations Educational, Scientific and Cultural Organization (UNESCO) designated it as a MAB reserve in 1979. Located in northern Kenya in the Marsabit District, the reserve covers about 7 000 km^2 extending from the eastern side of Lake Turkana through ragged lava flows to the top of Mount Kulal, where the core zone measuring 11 km^2 is located. In the eastern and northeastern part of the core zone, the reserve drops down through semi-desert ecosystems to the hot lowlands of the Chalbi Desert (see Map).

The Turkana, Samburu, Rendille, El Molo and Gabbra people who inhabit this varied landscape rely on the environment for their herding, fishing and farming livelihoods while in turn having an undeniable impact on it. These primarily pastoralist cultures have adapted their subsistence practices to incorporate and increasingly rely on both montane forests

Mount Kulal biosphere reserve



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and semi-arid vegetation for many forest products and services, including fuelwood, raw material for charcoal, timber for construction, food, medicines and socio-cultural and spiritual services. A few individuals on Mount Kulal and along Lake Turkana have begun businesses or cooperatives capitalizing on ecotourism interest in the region.

The Integrated Project in Arid Lands (IPAL), a collaborative effort of the United Nations Environment Programme (UNEP) and the MAB Programme of UNESCO, carried out research in this region from the mid-1970s to the mid-1980s and deepened understanding of the biotic systems supported by the mountain in the midst of arid lands. The Government of Kenya gazetted the forests during this period. The Kenya Forestry Research Institute (KEFRI) assumed programme management from UNESCO, but it has not had active programmes for over a decade. Since cessation of these programmes, conservation and management activities in Mount Kulal forests as well as the entire reserve have come to a halt. The forests may be at risk of severe degradation.

According to Kenyan law, the forests and other areas not occupied by homesteads belong to the government, but according to local traditions the land is held collectively by the community. Landownership has not yet been put to the test legally at Mount Kulal, nor elsewhere in northern Kenya (except at the Samburu Game Reserve, where conservation measures barred nomadic pastoralists from their traditional pastures). The uncertain land tenure situation represents a challenge for conservation management planning and for sustainable forest management.

This article is based on the work of IPAL and the findings of a UNESCO-Kenya multidisciplinary working group that visited the Mount Kulal reserve in December 2006 to explore the current status of the reserve and its inhabitants.

GEOLOGY, TOPOGRAPHY AND HYDROLOGY

As Mount Kulal is of volcanic origin, lava fields define the landscape in the surrounding area (Herlocker, 1979) and the mountain's sides are steep and often slashed by deep canyons, especially on the eastern and western flanks. To the west, Lake Turkana lies at 410 m elevation while the floor of the Chalbi Desert to the north is between 435 and 500 m. The highest point of Mount Kulal is 2 335 m. This peak is one wall of the remains of a volcanic crater located at the centre of the mountain ridge, but the eastern rim has been eroded over millennia to form the magnificent El Kajarta Gorge, which splits Kulal into two parts (Herlocker, 1979). The lower slopes give way to alluvial plains at 500 to 700 m. To the south, these plains are bounded by the even higher mountain ranges of the Ndotos and Nyiru (2 752 m).

The location of a peak as high as Mount Kulal in the middle of one of the driest regions of East Africa not only makes it unique topographically, but also contributes to the particular ecosystem services the mountain and its forests provide to the region. The climate of the region is driven by the northeast and southeast monsoon systems. The northeast monsoon provides hot, dry air masses that bring high winds from the north or northeast and a short rainy season in October and November. The southeast monsoon, originating in the Indian Ocean, is more favourable for rainfall. The long rainy season is highly variable but usually peaks during April. The topography of Mount Kulal creates what is known as orographic lifting: air masses are forced from lower to higher elevation, where they cool down and thus can no longer hold as much moisture, so that clouds and precipitation form. This phenomenon, along with the convergence of the conflicting monsoon systems, results in cooling and rainfall (Herlocker, 1979). Mist forests at the core zone of the MAB reserve aid in trapping moisture derived from the evapotranspiration occurring in the lowlands, and may increase local rainfall, although this has not been adequately studied.

ECOSYSTEM SERVICES

The Mount Kulal forests aid in holding water and delivering it to the villages on and around the mountain. Water is delivered by springs in the forest and on the shoulders of the mountain, as well as by seasonal and constant springs at the base of the mountain. Up to a dozen springs and water holes are known on the mountain alone (Synott, 1979). Intact forests at all levels, from the mist and cloud forests at the summit, through the villages of Gatab, Oltorop, Larashi and Arabal, to the *Acacia* forests on the shoulders of the mountain, aid in retention and absorption of the often short and intense rains and in preventing rapid runoff. Rapid runoff can cause not only soil erosion and loss of vegetative cover, but also loss of livestock and human life through serious flooding downstream.

The rich volcanic soils that are increasingly used for agriculture to complement traditional herding practices are not the only important geological feature of

Springs on Mount Kulal currently flow year round and maintain stream ecologies rich in plant diversity

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Construction of houses from wood is the most common use of forest products in the villages of Mount Kulal

Mount Kulal. The ancient lava flows filter and conduct water to springs throughout the region. Loyangalani Spring provides year-round freshwater on the eastern shore of the salty Lake Turkana and has become the key to the largest settlement in the region (Fuchs *et al.*, 1935). Loyangalani was originally established as a trading and administrative centre based on proximity to the spring and remains reliant on it for all its freshwater (Fratkin and Roth, 2005). It now serves as a base for the small amount of ecotourism in the reserve. The Oasis Lodge, outside the centre of Loyangalani but close to the origin of Loyangalani Spring, was the first business established purely for tourism in the region and has first access to water from the springs. Although there are now many camps and lodges in the region, the Oasis Lodge remains the premier ecotourism lodge. In addition, numerous other seasonal springs rise near lava-strewn streambeds or in the middle of lava fields. These are important watering holes for humans and for the animals on which they depend for their livelihoods.

FORESTS AND LIVELIHOODS

Mount Kulal forest provides many resources to communities living on the mountain as well as those living at lower altitudes. The forest is the main source of building material, fuelwood and medicine for local inhabitants. The deep gorges are used by *morans*, young Samburu warriors, as training and hiding grounds. Samburu villagers report the historical use of numerous caves, gorges and even cavernous fig-tree trunks as refuges during raids and prolonged battles with neighbouring pastoralists.

The forest products used most often are poles for construction of local houses. Samburu houses in the villages of Mount Kulal take one of two forms. Mud and pole structures built with tree trunks can last decades, especially with regular maintenance of mud walls and metal roofs. More traditional homes use smaller branches that are buried in the ground and bent into a dome to form the main structure of the house. This structure is then thatched with grass and brush and now preferably roofed with plastic. These homes may last only a few years and it is not unusual for a compound to have several constructions of varying ages. Smaller twigs (e.g. of *Lippia* sp. and *Lantana* sp.) for reinforcing the mud walls may be obtained from bushland near the village rather than from the forest.

Probably used at an equal rate is deadwood for fuelwood. Local administrative officials attempt to enforce conservation laws established during more active management of the reserve, which limit cutting of living trees for fuelwood in the forests on the mountain. However, cutting of brush or trees in the forested areas outside the core zone and the lowlands of the reserve seems to be unregulated. Fuelwood here is vital most of the year because of the cool climate and high humidity. Woodfuel (fuelwood and charcoal) is the main energy source, but charcoal is made on a small scale, mainly for local consumption. According to one resident of Gatab, some households collect as much as 40 to 50 kg of fuelwood daily, although this is probably an extreme upper limit.

On a smaller scale, minerals are quite important to Samburu culture. Local people collect red ochre from *lorian lolkaria* or "a place of red ochre" in the forest. The ochre is mixed with sheep-tail fat and smeared on the hair to make it beautiful and grow long. It is mainly used by *moran*, although young women may also use small amounts. Harvesters sell the ochre at 10 shillings (US$0.15) per tablespoon in local villages.

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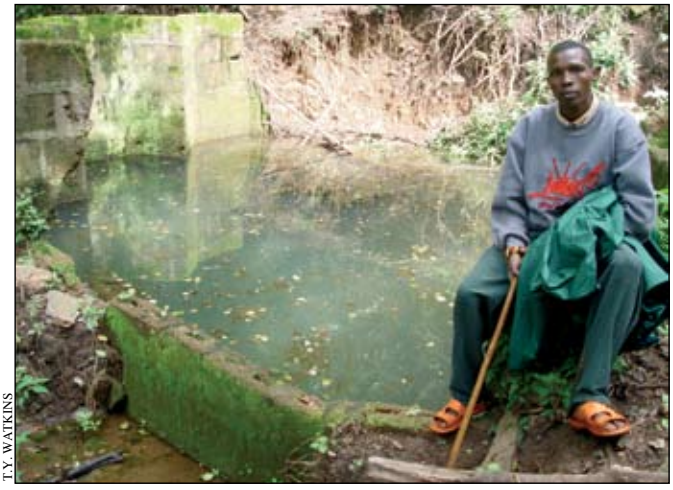
Most surveyed residents verified that the forest is a rich source of local and traditional medicines, although it is difficult to quantify the amounts collected. As this information was received from non-specialists, it is safe to assume that many if not most households collect these products periodically. Since they are available to all in the nearby forest, they are not actively traded or exchanged in markets. Some plants are used in soup, mainly by *moran*, to prevent diseases, while women add certain plants to the milk given to children to fortify them. Both *Clerodendrum myricoides* and *Boerhavia coccinea* are planted in homesteads for their medicinal value.

During prolonged droughts people bring their animals into the forests to forage. Branches, usually of olive trees (*Olea europaea* ssp. *cuspidata* and *Olea capensis* ssp. *macrocarpa*), are cut to feed the animals. During extreme droughts, animals also browse most other plants in the forest. The extent and effect of grazing in the forest is not yet known. Signs of cut branches and occasionally small trees are visible in the forest. Selective use of preferred species may warrant study to determine the effect of decreased biodiversity of forest species. Formerly, IPAL projects employed a guard to limit grazing inside the forest (Lewis, 1977), but this has since been replaced by the community's own surveillance team. In times of extreme drought when forest resources become more important to livestock, elders allow unsupervised grazing in the forest.



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An impoundment constructed about 30 years ago collects Mount Kulal spring water which is then piped to holding tanks that serve local communities

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Trees anchor the unstable volcanic soils of Mount Kulal; slip erosion is common in areas that have been cleared near many springs in the forest

Provision of water is the most important service provided by the forest for local villages. A number of springs now have impoundments to collect water for piping by gravity flow to holding tanks that serve local communities. Current construction, expansion and maintenance of this system are provided through the African Inland Church mission in Gatab. The water committee, a part of the local village council, is responsible for the management of the water system and any possible extension of it in the villages. Tampering with the water sources invites a fine of 1 000 shillings (about US$15) and other disciplinary measures by the local administration. In lowland areas three dams have been constructed and have proved useful to pastoral groups who mainly use them to water their livestock.

RECOMMENDATIONS FOR IMPROVED CONSERVATION

Mount Kulal's topography works in combination with regional weather patterns to trap condensation which gives rise to mist forests. The often lush highland forest cover holds rich volcanic soil in place during the seasonal rainfall. By slowing down runoff, forest cover not only prevents soil erosion that is evident in cleared areas, but also helps direct rainwater to the porous lava beds, in turn directing spring water to the edges of the Chalbi Desert and the rocky shores of Lake Turkana.

Diverse forest biological resources provide shelter, food, medicine and cultural and historical value to local people. Traditional pastoralist Samburu families are diversifying livelihoods and increasingly relying on agriculture for subsistence and trade. The newly established agriculture depends on water and soil, which both rely on the natural resources of Mount Kulal. People living inside the MAB reserve need to use and manage the resources sustainably so as not to endanger the very environment that supports them.

The UNESCO working group for the Mount Kulal biosphere reserve has grouped recommendations for the reserve's future into three broad categories: capacity building, conservation and development.

The Samburu communities living on Mount Kulal have a few usually species-specific traditional conservation practices. For example, *Ficus thonningii* is associated with rituals and is sacred to the Samburu people. *Juniperus procera*, although not ritually significant, is also protected. The cultural importance of some trees to the Samburu may explain why they have maintained some of the conservation practices aimed at forests introduced by UNESCO despite their limited financial resources. This strong foundation needs to be built upon and reinforced. Community administrators and leaders need to network and continue to build capacity for conservation and development.

In spite of individual awareness regarding conservation issues and community policing of blatant forest destruction, people living within the reserve tend to encroach on the forests of Mount Kulal. The continued selection of some trees for use and others for conservation will affect the biodiversity of the forests and have unknown consequences. In addition, several cultural groups live inside the reserve, not only the Samburu. Conservation efforts need to focus on the importance of maintaining ecosystem services for all inhabitants of the reserve and the region. Education in forest management and resource conservation that links livelihoods explicitly with ecosystem services will clarify the need to conserve biodiversity and manage forests in a sustainable way. Continuing participatory research will lead to better understanding of human/environment interactions and guide conservation with a focus on continuing access to forest products for sustainable livelihoods.

Trade and regional integration of communities and individuals may provide opportunities to improve livelihoods, food security and health. Villagers are already expanding herd diversity and introducing horticulture and market exchange into their livelihood portfolios. This can be done in a sustainable fashion, although it is not always done so now. Current and future development schemes must incorporate maintenance of biodiversity and conservation as necessary components. ◆

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