# **KIBWEZI FOREST AND UMANI SPRINGS:** PIPE DREAM OR INNOVATIVE CONSERVATION?

Canopy of the groundwater forest around Umani Springs with the Chyulu Hills in the background

ALL PHOTOS BY: OMARI MBONDE

# **BY OMARI MBONDE & QUENTIN LUKE**

etween the Chyulus, one of the world's youngest mountain ranges, and the dangerous chaos called the Nairobi-Mombasa highway, lies a small and fragile green pearl around the Umani Springs, the Kibwezi forest. It has been naturally protected from vehicle access by the recent lava flows, some probably only a few hundred years old, which have created jumbled and sharp-edged ridges that form barriers to vehicles. In spite of having been designated a forest reserve in 1936 and covering just under 60 km<sup>2</sup>, it is relatively little studied but it accommodates considerable biodiversity values and provides renewable resources to a large number of users. Initially woodcarvers, charcoal-makers and hunters operated at sustainable levels and provided mainly local markets but increasingly their intensity and scale started eating into the natural capital, heavily

degrading the most accessible parts by, for example, providing truckloads of charcoal as far as Nairobi.

Most of this area of Kenya, roughly between Machakos and the thin high rainfall coastal strip is semi-arid and covered by Acacia-Commiphora woodland of varying density. Though the soils can be quite fertile, the low rainfall and the absence of rivers are obstacles to agricultural development. A very large proportion has therefore been allocated to extensive livestock keeping or to wildlife in the 64,000 km<sup>2</sup> Tsavo Conservation Area, best known for the Tsavo East and West National Parks and Amboseli National Park. Within this vast rangeland there are very few permanent water sources as the volcanic rock is highly permeable and rainfall quickly infiltrates. They exist only where there is a combination of a high rainfall area (higher altitudes) and a layer of Precambrian metamorphic rock that is

impermeable, creating a contact zone where the infiltrated water resurges. The link between Mount Kilimanjaro and the marshes of Amboseli is well known, as are the Mzima Springs in Tsavo linked to the southern reaches of the Chyulu Hills (peak of over 2000 m).

The much smaller Umani "springs" that are at the origin of the existence of the Kibwezi forest are dependent on the rainfall on the northern part of Chyulu Hills where forest cover is relatively intact and which was incorporated into the Chyulu Hills National Park. Such groundwater flows are also highly sensitive and a small tectonic event can close off a route and open up another. This happened in the positive sense in Amboseli in late 1957 when resurgence suddenly increased and created the main marshes.

In contrast to most of the other "springs" in the area (Kiboko, Kibwezi, Mtito Andei) where a small river originates directly from the springs, the water from the Umani springs first fills a series of clear water pools, then disappears underground again and supplies a series of marshy wetlands between the springs and a very large recent lava flow that acts as a kind of embankment. The water then flows underground again towards Kibwezi town, some 80 m lower than the springs.

Where the groundwater is close to the surface the land is covered by a magnificent groundwater forest of over 25 m height with splendid fig trees (12 species have been recorded), a large number of centuries old Newtonia hildebrandtii, and several hundred other plant species including a number of vulnerable (Drypetes natalensis var. leiogyna) and endangered subspecies (Craibia brevicaudata ssp. burttii). This list of threatened species is expected to expand as the Red List for eastern Africa, currently under revision, will soon be published. Likely candidates are the restricted range species Euphorbia friesiorum, Cyphostemna kibweziense, Commiphora ovalifolia, Secamone attenuifolia, Anisotes ukambensis, Thunbergia reticulata and Asparagus denudatus. Not only is the forest highly diverse but it is also characterised by an unexpectedly large number of "typical" coastal species, having perhaps moved there along a much larger river connecting to the coastal forest strip, including Combretum schumannii, the woodcarver's dream. The forests are home to Sykes and Vervet monkeys



Groundwater resurging at the top of the pools in Umani Springs.

that come under attack from the African Crowned eagle, congregations of Trumpeter and Crowned Hornbill feasting on figs are the target of African Hawk Eagle. Other predatory residents are Tawny and Long-crested Eagle, while large flocks of Crested Guineafowl roost there.

The wetlands attract a colourful variety of waterbirds and also large mammals, especially elephant and buffalo, of which a substantial proportion are thought to be dry season migrants from the Chyulu East National Park (NP). The need for the animals to drink also made them vulnerable to poachers. Before the fence and the anti-poaching patrols were put in



The "Dancing Jewel" damselfly (Platycypha caligata) at Umani Springs.

place, shooting platforms from which poisoned spears and arrows could be planted in their backs abounded along the paths leading to the springs. Snares and poisoned "footnails" were also used in abundance. The wetlands are such an ideal habitat for waterbuck that their absence is conspicuous. This probably indicates that they were hunted into local extinction.

#### **INNOVATIVE CONSERVATION**

The forest reserves of Kenya have so far attracted much less attention or investment than the more "touristy' wildlife parks but in 2010 the Kenya Forest Service and the David Sheldrick Wildlife Trust entered into a joint management agreement, a first in Kenya, since then followed by the Ngare Ndare forest in Laikipia. The core areas of the Kibwezi FR south of the highway were enclosed on three sides by an electric fence, maintaining the connection to the Chyulu East NP but considerably reducing animal damage to the surrounding farmland. The regeneration of the highly degraded charcoaling areas is already obvious.

Traditional access rights are guaranteed and the collection of firewood by legitimate users has increased substantially. Animals are slowly becoming less jittery as the hammering by poachers has been brought to a halt. The Umani Springs Lodge was upgraded and beautified

### CONSERVATION



**RIGHT:** Mass mortality of Yellow Fevertree just downstream of the dried out wetlands. This is an early warning signal and the phenomenon is expected to affect other tree species and will soon expand upstream towards the overexploited springs as well as affect forest productivity in all downstream areas to Kibwezi town. **INSERT:** Forest dominated by centuries old Newtonia hildebrandtii that is the be sacrificed for the 400 kV powerline if the project goes ahead as planned.

at considerable cost. This should in principle be able to generate enough funds to maintain the fence and the anti-poaching brigades. So all seemed at last on track for the preservation of the pearl.

However, the fence has failed to stop another type of destructive folly, namely the over-abstraction of the water that is the engine that sustains this productive ecosystem. The first abstractions were done to supply the steam engines of the railway. A metal pipe was laid above ground on a crushed lava rock bed but the take-off was limited and did not affect the ecosystem as a sufficient reserve flow was left to maintain the functions that depend on the underground flows. With population growth, three additional pipes were

laid in and still the ecosystems were able to cope. But since the addition of the Kisayani water project in 2005 the groundwater levels seem to have been falling, the wetlands started to recede and some tree mortality was noted. This was attributed to the general drought that hit Kenya at the time. However, from 2011, as trenches to accommodate the pipe for a much larger planned abstraction, the Mtito Andei water project, were starting to be dug, the wetlands dried out completely and the mortality of groundwater dependent Yellow Fever Tree (Acacia xanthophloea) just downstream from the wetlands has reached dramatic proportions.

This is the kind of damage that could be avoided by professionally conducted and carefully audited ESIAs, technically correct regular flow measurements as well as by conscientious management of the scarce water resource. Sadly none of these conditions have been fulfilled. The ESIA for the Mtito Andei water project, conducted in 2009 and revised in 2011, ignored the obvious tree mortality and took an absurdly high flow as the base flow from the springs, namely 954 litres per second, about six times higher than the average flow of 163 liters/sec based on monthly flow measurements between 1984 and 1987. Obviously, the reserve flow, i.e. the flow that has to remain in the ecosystem to maintain its functions, should not be based on the maximum or even the average flow but on the minimum flow, probably of the order of 110 litres/sec. This is especially true as none of the off-takes

## CONSERVATION



TOP: For the first time in living memory the Umani wetlands, a vital dry season refuge for wildlife over a wide area including the Chyulu Hills NP, have dried out. Increased abstraction for settlements along the Nairobi-Mombasa highway is the cause and worse is expected. TOP RIGHT: Traditional Kamba rainmaker Mutweya has been visiting the wetlands for over 50 years and have never before seen them dry out.

ACCORDING TO KAMBA RAINMAKER MZEE MWANZIA MUTWEYA, BORN SOMETIME AROUND WORLD WAR ONE, AND WHO HAS BEEN COMING TO THE AREA SEVERAL TIMES A YEAR FOR ABOUT FIFTY YEARS TO PERFORM THE RITUALS TO APPEASE THE TRADITIONAL SNAKE SPIRITS THAT PROTECT THE SPRINGS AND ALSO REQUEST FOR RAIN, THE WETLANDS HAVE NEVER BEEN DRY.

has any mechanism for limitation when flows in the spring decline. According to the Kisayani water project ESIA, the total off-take after implementation will be 102 litres/sec, leaving less than 10% as reserve flow ,while the report states that it should be at least 25%, preferably 30%. So, according to their own figures, this project should not have been implemented. Even the Mtito Andei water project ESIA agrees that a reserve flow of 46 litres/sec should be maintained but at the same time proposes an additional off-take of 76 litres/sec bringing the total off-take to 178, higher than the average flow and almost twice the minimum flow.

But the project is going ahead regardless. It will be impossible

for the groundwater forest and the wetland ecosystems to survive if water abstraction from the springs is not brought down to pre-Kisayani project levels.

According to Kamba rainmaker Mzee Mwanzia Mutweya, born sometime around World War one, and who has been coming to the area several times a year for about fifty years to perform the rituals to appease the traditional snake spirits that protect the springs and also request for rain, the wetlands have never been dry. He and fellow rainmaker Francis Mwambua Ngeke, who has been frequenting the area since the 1970s, have occasionally seen the water levels much higher, actually flowing over the railway pipe before the



others pipes were put in. A traditional well in the lava flows downstream from the wetland has also dried out for the first time. The situation is therefore critical and immediate action should be taken to limit the current offtake, re-establish a sufficient reserve flow (initially even a higher one to refill the underground aquifer and the wetlands) and especially stop all additional off-take projects until a thorough environmental audit has been conducted. It is clearly essential to put a system in place to continuously monitor the reserve flow and the groundwater levels and to install control valves that allow limitation of the off-takes as a function of these monitoring results.

Worse still, the laying of the Mtito Andei pipe, which is put in deeper than the previous ones, possibly to avoid vandalism, includes drilling through the thick slab of mixed volcanic ash and travertine that underlies the forest floor. This layer possibly prevented the groundwater from disappearing before having supplied the forest and the wetlands. This entails the risk that the reserve flow, even if restored, will simply go underground.

In any case, as population figures along the Nairobi-Mombasa highway are set to continue increasing, there is no way a limited and fragile water source such as Umani Springs, that in addition has many other ecosystem functions to fulfill to sustainably supply benefits to the local communities and the country, can be the solution. Water will simply have to be brought from elsewhere!



The laying of the new pipeline involved breaking the rock layer that is possibly a key feature of the functioning of the system.

As if the attacks on the forest from ground level and below were not enough there is now an aerial attack on the way. For over a hundred years new linear elements in the landscape, the railway line, the highway, the KPL pipeline and a powerline have all taken a path that, to a large extent, avoided fragmentation of the forest block, even though a few slices were separated from the rest at the northern end. The proposed 400 kV powerline that is to link up Mombasa with Nairobi is scheduled to simply bisect the forest reserve and even go straight through the middle of one of the most pristine groundwater forests with immense Newtonia and fig trees.

As usual the ESIA is below par, it has not evaluated the presence of threatened species, biodiversity, aesthetic and carbon storage values along the wayleave. It can hardly be judged as an independent ESIA as some of the "consultants" are employees of the powerline company. It does not consider any alternative routes (taking it along the northern edge like all the previous linear elements would certainly only add a very marginal amount to the total cost of the 500 km line), and even states that the project is not in a forest reserve or protected area (and therefore the forest act does not even apply). Fortunately the Director of Forests is adamant that will not be allowed to happen. In addition, the obligatory consultation of the local stakeholders seems to have been a pure formality as these have been made to believe that the project will provide reliable power locally while it is intended to just pass over their heads. The risk of passing a 400 kV powerline over an electric fence (an investment of over \$200,000) and inducing some ground-level current surges, has not been evaluated.

The argument that the powerline was allowed to go through Tsavo NP unopposed does not hold as there is a fundamental difference between a sparse Acacia-Commiphora woodland and a dense primary forest that supplies an immense range of ecosystem services. The gung-ho fashion in which the green pearl is being handled by the various companies and national institutions involved in both the water and power projects, the lackadaisical execution of the ESIAs and the absence of thorough evaluation and auditing violates both the spirit and the letter of the environmental laws and of the new constitution. Those days should have been behind us by now.

**OMARI MBONDE** is an ecologist with 20 years' experience in various African countries. His main interest is in the maintenance and enhancement of water-related ecosystem service delivery for human well-being. The equitable sharing of the benefits, derived from these services, with vulnerable social groups is his near-obsession.

QUENTIN LUKE has worked with the East African Herbarium, National Museums of Kenya for over 25 years. He worked towards the gazettement of the Mjikenda Kaya forests as National Monuments, published several new plant species, and carried out many plant surveys in West, Central and East Africa. He is Chair of the East African Plant Red List Authority, an Honorary Associate of Royal Botanic Gardens, Kew and an Alternate Member for Africa on the CITES Plants Committee.