

BIODIVERSITY, LOCAL RESOURCE, NATIONAL HERITAGE, REGIONAL CONCERN, AND GLOBAL IMPACT: THE CASE OF MAU FOREST, KENYA

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Abstract

The Mau Forest situated in western Kenya is the largest remaining near continuous block of indigenous forest in East Africa. It is a biodiversity haven with a wide range of fauna and flora some of which are endangered. The Mau is important as a water tower feeding rivers and lakes thus supporting livelihoods of millions of people in Kenya and the region. Over the last 20 years an estimated 2000 Km² of forest was destroyed in the Mau resulting in environmental, social and economic loss. As a major water tower, the impact of this loss is evident lowered water levels in the rivers that emanate from this forest and increased temperatures. In addition are economic losses in agriculture, tourism and energy sectors that affect the livelihoods of people not just in areas adjacent to the Mau but also in neighbouring counties. The unobstructed destruction of the Mau forest continues to deprive the country of a national heritage and is of regional and global concern. Attempts to rehabilitate the Mau have had limited success and they require multidisciplinary local and international support.

Keywords: Biodiversity, genetic diversity, forest, ecosystem, natural resources

Introduction

Biodiversity is Africa's richest asset with knowledge of medicinal, agricultural and other properties of the biological resources developed over centuries harbored by the local people. To these people, biodiversity is a means of livelihoods, a basic resource that fulfills their nutritional and health care needs and thus its destruction through loss of genes, species, habitats and ecosystems impoverishes them. It is predicted that if present trends

continue, 25% of the world's species will be lost in the next 20 to 50 years (Winpenny, 1990).

Other than exploitation of the fauna and flora by logging, charcoal banning and poaching, biodiversity is threatened by attempts to pirate and control it through bio prospecting and bio piracy; searching and appropriating of life- micro-organisms, plants, animals and the traditional cultural knowledge that go with it without legal rights. This is the violation international conventions on biological diversity (UNCTAD, 1996).

Biodiversity is under siege, threatened by the compounded effects of carbon-dioxide emissions, unregulated industrial logging, desertification, natural resource extraction (through activities such as hydroelectric power generation and mining), genetic contamination (through the use of Genetically Modified Organisms), commercial exploitation of endangered species and the disappearance of traditional cultures (O'Riordan and Stoll-Kleemann, 2002; Cunningham et al., 2005).

The exploitation of local natural resources, such as found in a forest like Mau, has happened since time immemorial. Despite being local, such resources are a national heritage with an impact far beyond the country's borders. The Mau Forest in Western Kenya, one of the Kenya's water towers, has been systematically destroyed in the last 15 years with the resultant upsetting of a delicate ecological equilibrium as bio diverse fauna and flora is destroyed. Attempts to rehabilitate the forest through eviction of illegal settlers, reforestation and resettlement programs have had limited success.

The immediate reaction is to view the Mau Forest crisis as a local and at most a national situation. However, the impact of destruction is of regional and global concern and it requires collective, national, regional and international effort to fully address the Mau Forest crisis.

This paper investigates the situation of the Mau as a multidisciplinary challenge that requires concerted international effort.

I.

According to the United Nations Environment Program (UNEP), biodiversity is the totality of genes, species, and ecosystems. Thus biodiversity is a concept that captures both variety in respect to organisms and ecosystems and refers to all life forms, including plants, animals, and micro-organisms, whether naturally occurring or modified, wild, cultivated or domesticated in a particular geographic area (O'Riordan and Stoll-Kleemann, 2002).

The Mau is a biodiversity sanctuary in the largest indigenous forest in East Africa that lies across the Equator between 00 1' 0" N and 00 55' 0" S and between the latitudes of 350 15' 0" and 360 15' 0" E. The Mau forest

complex is the largest water catchment area in Kenya where many rivers originate such as the Nzoia, Yala, Nyando, Sondu, Mara, Ewaso Nyiro (south), Naishi, Makalia, Nderit, Njoro, Molo and Kerio. These rivers feed important lakes such as Lake Victoria, L. Turkana, L. Natron, L. Nakuru and L. Baringo; the first three of which are cross-boundary between Kenya-Uganda-Tanzania; Kenya-Ethiopia and Kenya- Tanzania respectfully. Because Lake Victoria, (Africa's largest lake, world's largest tropical lake and world's second largest freshwater lake) is mainly fed by the Mau, we can extrapolate that the Mau Forest Complex affects the livelihoods of the over 130 million people in countries of East and Central Africa (fig 1)

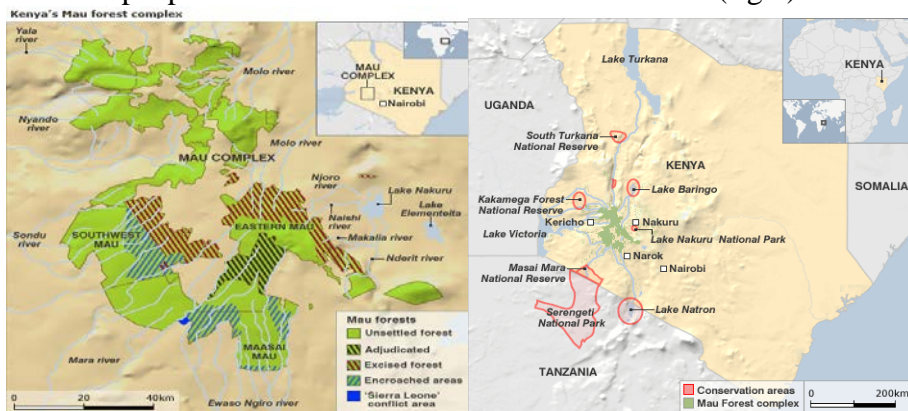


Fig 1 Geographic position of Mau forest complex (GOK, 2009),

The Mau is the largest remaining near continuous blocks of mountain of indigenous forest in East Africa. It is classified as a montane forest with mountain ecosystems that form life zones characterized by dense forests at moderate elevations which transit to grasslands or tundra as the altitude increases (Prance, 1984). It has moist forest vegetation types in the windward and the leeward sides of Lake Victoria respectively occurring at 2100 - 3300 m above sea level, with rainfall above 1500 mm, and dry forest vegetation occurring at 1800 - 2900 m above sea level where the annual rainfall is 700 -1350 mm (Beentje, 1994).

This forest is a classic example of biodiversity with flora and fauna with wide genetic, species and ecosystem diversity (fig 2). This unique genetic diversity includes rare and endangered animals such as the Bongo antelope, the Colobus monkey and the forest elephant making it a haven for scientists as well as tourists visiting eight conservation areas namely South Turkana, Kerio Valley and Kamnarok National Reserves; Lakes Baringo, Magadi, Nakuru, Natron National Parks. These lakes are famous for over 500 bird species including the flamingoes; Maasai Mara and Serengeti National parks famous for wildebeest migration and the Kakamega National

Reserve the only remnant Guinco Congolian forest ecosystem famous for its unique birds and butterflies.



Fig 2 The Bio diverse Intact Mau Forest (GOK 2009)

The economic importance of the Mau forest is evidenced by the fact that in 2007, the Maasai Mara Reserve and Nakuru Park generated revenue of over USD 10 million from Park entry fees alone (UNEP, 2008).

The rivers originating from the Mau produce hydro electric power with an estimated potential hydropower generation of approx. 535 megawatts, representing 57% of the total electricity generation capacity in Kenya in 2009 (GOK, 2009). Such an increase in hydroelectric power generation can reduce use of non renewable fossil fuel with accompanying benefit in environmental conservation . A further benefit of the forest is its role in climate regulation as a reservoir and sink of carbon dioxide, the main greenhouse gas (GHG) contributing to global warming and climate change (Hesslerová and Pokorný 2010).

Furthermore, the Mau complex is of importance to Kenya's key agricultural economic sector in supplying water for cash crops such as tea and rice; subsistence crops and livestock. Tea production and tourism are among the country's largest foreign currency earners (CIA, 2014). Considering its genetic, ecological and economic value, inarguably the Mau forest is not only a local resource and a national heritage but an important natural resource with regional and global impact.

Traditionally, the forest was inhabited by the Ogiek, one of the very few remaining forest dwelling communities in Kenya who consider biodiversity of the forest as sacred and practice a hunter-gatherer lifestyle that conserves and sustains biodiversity (Nabutola, 2010). The delicate bio diverse equilibrium maintained for decades was however upset when other

groups migrated into the forest leading to destruction of the forest with the area shrinking with time from the original gazetted area of 452,007 hectares to the an area estimated area of 273,300 hectares (Kimaiyo, 2004). Although the actual area covered by the forest may be contentious, it is estimated that over the last decades, approximately 25% of Mau forest has been lost to excisions and encroachment (UNEP 2008; GOK 2009).

The destruction of the Mau is a classic example of varying local, national, regional and international interests. Locally, the population of the Ogiek people decreased drastically. Those remaining have either been assimilated by other ethnic groups or adopted agricultural lifestyles incompatible with conserving the forest (Kimaiyo 2004).

According to satellite image assessment, it is estimated there was a decrease of 180,000 ha of forest land from 520 000 ha in 1986 to 340 000 ha in 2009 and by 2010 over 2000 Km² had been destroyed. (Hesslerová and Pokorný 2010). Between 1998 and 2004, the Government of Kenya announced intentions to excise 10% of the gazetted forests. The initial excision of 1,812 ha was earmarked to resettle the Ogiek. At the end of the exercise however, 2,588 ha was mostly allocated to businessmen, politicians, professionals and bureaucrats with political and economic power (Ndungu Report, 2004). Further excisions continued and by 2001, 61,586.5 ha of forest had been excised and 41,122 ha encroached in by about 4,647 households with settlements, the forest destroyed and plots used for subsistence farming (Fig 3). In total, the forest excision and widespread human encroachments led to a total loss of about 25% of the more than 107,000 ha the Mau between 1989 and 2009 (GOK, 2009).

Maasai Mau: forest destruction



Fig 3 From forest to agricultural land (Nabutola, 2010, NEMA 2013)

In classic forest transition of a developing nation at the periphery of a globalized system, forest degradation started and continued unabated with loss of flora and fauna. Indiscriminate felling of trees for timber and charcoal led to destruction of the diverse forest plant life. In addition, the wildlife including elephant and buffalo, that were abundant in the Mau were reduced to a fraction of the original due to human-wildlife conflict and loss of habitat (UNEP et al 2008c). The cleared forest land was then used for settlement, agricultural and livestock farming purposes. Of particular importance was the excision/encroachment of land that is currently under tea production that makes the Mau Catchment area the largest tea growing area in Kenya undertaken both by large scale local and foreign firms as well as local small holder farmers (NEMA 2013).

The direct impact of this destruction is decreased water volumes and lowered levels in rivers and lakes that depend on the Mau water tower (Fig 4). Between 1996 and 2001, many streams in the Mau Forests Complex had their flows changed significantly or altogether dried up (NEMA 2011). For instance, the four perennial rivers feeding the Lake Nakuru are now (specify the ‘now’) seasonal leading to lowering of the Lake’s area by 100 metres in 10 years (NEMA 2013). This has had adverse effects on the ecosystem resulting in reduced flamingo populations among other wildlife (UNEP et al 2008). In addition, are the low levels of the Mara River that feeds the famous Maasai Mara and the Serengeti ecosystems. A change in the water levels have resulted in a disturbed ecosystem, increased temperatures and disrupted rainfall patterns leading to decreased wildlife populations and thus lowered tourism revenues for the Kenya and Tanzania (GoK, 2009; Hesslerová and Pokorný 2010). Other than national revenue from tourism, considering that the tourism industry supports many local households, the changes in the Mau also have a local impact due to loss of livelihoods of persons directly and indirectly dependent on the tourism industry (citation needed).

Another example is the Sondu River on which the Sondu-Miriu hydropower plant is constructed. With destruction of Mau Forest, the river had such low water levels that the inauguration of this hydro power plant in 2008 was postponed (Daily Nation, 2008). With reduced water volumes in the river, this plant operates below its maximum capacity. The economic impact of decreased hydro power generation and reduced input into the national grid is that the country is forced to utilize more import-dependent nonrenewable fossil fuel energy. This does not only have a national impact on foreign currency reserves but also a global impact on depletion of a nonrenewable resource with accompanying pollution effects.

The excision, encroachment and subsequent Mau forest destruction has had environmental changes with severe consequences (Fig 4). The biodiversity of plants previously at equilibrium (this equilibrium state is a theory yet to be proved) has been disrupted and the Mau can now be classified as a biodiversity hotspot, a region with a high level of endemic species under threat from humans (Myers 1988; Mwangi et al 2014. Other than physical destruction of forest, the changes in weather patterns, failed rainy seasons and long spells of drought further contribute to a loss of biodiversity. This loss is associated with many changes such as decreased wood production of existing trees (Piotto, 2008); increased diseases and pests (Levine et al 2004; Philpott et al 2009) and decreased carbon uptake as well as reduced soil organic matter and nutrient re mineralization (Quijas et al 2010; Cardinale *et al* 2011). Other than reduction of biodiversity in respect to fauna and flora varieties and species, there is also a change in dominance of species in which can be associated with stress factors like fires and over that further interfere with the delicate equilibrium of the Mau ecosystem (Kinyanjui, 2009): statement unclear- please clarify.

Implications of a destroyed Mau is also potentially a food and civil security issue. With decreased and unpredictable rainfall, lower water volumes in rivers and lakes, farmers face decreased crop and livestock yields that threaten their very survival. According to the NEMA report (2013) this has led to people's squabbling over dwindling resources and caused civil conflict. In addition, the people who encroached into the forest resist eviction and appeal for protection from leaders keen on getting their political support.



Fig 4 Sections of the heavily deforested Mau (NEMA 2013)

In respect to human health, biodiversity provides critical support for drug discovery due to available medicinal resources derived directly or indirectly from biological sources. It is a fact that half of pharmaceutical compounds in the market are derived from plants, animals, and micro-organisms and 80% of the world population depend on either modern or traditional medicines from nature for their health care (Mendelsohn and

Balick, 1995). Most of these medicines are from uncultivated biodiversity sources in the wild (Correa, 2002).

A loss of biodiversity such as found in the Mau has an impact on human health: the wildlife not only provides drugs but also influences dietary health, nutrition security, social and psychological health. Diverse biological resources are also known to have an important role in reducing disaster risk, through psychological wellbeing associated with flora and fauna species diversity (Fuller et al, 2007). It is noted that with an increase in the loss of biodiversity, there are anticipated health risks of the resultant climate change. These are changes in the epidemiology of disease vectors, public health concerns due to scarcity of fresh water and impacts on agricultural biodiversity and adequate food resources. There is a relationship between biodiversity and infectious diseases in respect to various pathogens and their hosts for in a “hot spot”, the species that are threatened most are those that buffer against infectious disease transmission, while those that survive are those that increase disease transmission (Ramanujan, 2010).

Recognizing that the destruction of the Mau has catastrophic social, economic and environmental effects the government of Kenya has had attempts to rehabilitate the Mau. Rehabilitation of the Mau is two pronged: eviction of those settled within the forest and reforestation. Attempts to this effect have had limited successes due to several challenges one being differentiating and resettling the original Ogiek and other settlers and those that have illegally encroached. In 2005, about 10,000 people were evicted from the forest. In 2009, a taskforce on this matter (clarify the matter) produced a report that was endorsed by Cabinet that clearly stated that the government of Kenya was committed to restoring and maintaining the Mau to achieve environmental, social and economic stability for sustainable development.

Attempts to evict them have met a backlash on political leadership. The main challenge however is the politically and economically powerful people who were allocated the land. To date, there has been limited reforestation for evictions have not been successful.

The Mau forest provides a classic case of environmental apartheid where resources are exploited by a small minority (local and international large scale farmers) to the exclusion of the majority (the Ogiek and other small scale subsistence farmers) who require such resources for their very wellbeing and survival. It is also an example of bio prospecting and bio piracy where biological resources and indigenous knowledge have been used without due benefit and credit to the local owners. In this regard, there is a risk that the resources in the Mau and knowledge that the Ogiek and other indigenous people have regarding use of the fauna and flora may be exploited and commercialized without their due recognition and benefit.

Conclusion

As the source of primary material and active ingredients for many commercial products- foods, pharmaceuticals, cosmetics, biotechnology, veterinary science, seeds and agro-chemicals- biodiversity is recognized as a highly strategic resource with commercial potential comparable to that of petroleum or uranium (Global Exchange, 2007). Approximately 90% of the world's remaining biodiversity is concentrated in tropical and sub-tropical regions within developing countries such as the Mau Forest (Winpenny, 1990).

The Mau forest is an example of how exploitation of a local natural resource can have a large undesirable effect on the national heritage of a people escalating into a net negative impact to the regional and global community. The impact of biodiversity depletion in the Mau is most dramatically felt by indigenous and rural communities whose livelihoods and local economies depend on it. Other than loss of genetic diversity, these communities also lose indigenous cultures which are part of national and global heritage. With the drying up of rivers and lakes that depend on the Mau, the impact of low water levels is manifest beyond Kenya into Tanzania's Serengeti as well as Lake Victoria's fishermen in Uganda and Tanzania. Considering Lake Victoria is the source of the Nile the impact of Mau's destruction is evident as far as Egypt. The issue of Mau forest is now not just about loss of a local resource or a national heritage but of loss of livelihoods and economies of millions of Africans who directly and indirectly depend on the ecosystem. Thus, when the rains stop falling and rivers which stem from the Mau forest dry up affecting the livelihoods of over 10 million people, then it ceases to be an issue of loss of genetic diversity, disruption of the ecological balance or climate change becoming an economic and political issue of global concern.

Saving the Mau requires a multidisciplinary approach. To start with, experts in conservation, biodiversity, climate change, botany and zoology need to determine the health of the Mau forest in respect to disturbance using available techniques (Mutiso *et al* 2015). A comprehensive plan of removal of people should then be implemented with the input of sociologists, psychologists, anthropologists, political scientists as well as public policy professionals. It is only then that effective reforestation and rehabilitation of the Mau can commence with special programs by experts in forestry, wildlife ecology and natural resource management. Action on the Mau is urgently required not just as at local, national or regional levels, but concerted international effort. This effort will culminate in local sustainable land use, restoration of a national heritage, efficient regional natural resource management and a global impact on climate change by carbon sinking and reduction of greenhouse emission gases.

The University of Kabianga naturally endowed by being strategically located on the South West edge of the Mau is committed and endowed with multidisciplinary capacity to undertake scholarly and extension pursuits in saving the Mau. To this end, this University is seeking collaborators.

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