



Politics of Land Excisions and Climate Change in the Mau Forest Complex: A Case Study of the South-Western Mau Forest

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ABSTRACT

Kenya is blessed with numerous natural forests, which play vital roles in national development. The Mau Forest Complex is Kenya's biggest water tower and unlimited source of ecological, aesthetic and socio-economic benefits to millions living around the area. However, the complex faces critical threats due to anthropogenic activities. The key objective of the study is to critically examine the causes, key impacts, and intersections between large scale land excisions, local climate change and human security of the adjacent communities. Both secondary and primary data were employed to study the links between land excisions and climate changes around the complex. The study findings reveal that large scale land excisions are mainly led by human actions such as political motives influencing contested land ownership regimes, population pressure, growth of subsistence agriculture, logging, charcoal making, and rural-urban development. The study concludes that the areas around the forests are experiencing rapid climate changes, including recurrent and persistent drought periods and rainfall variability. These changes in the local climate pose unprecedented implications to human security and well-being of the local people. The study recommends that while dealing with climate change issues, national policies be guided by taking consideration of addressing political dimensions of land excisions as a major threat to Kenya's forest lands.

1. Introduction

The Mau Forest Complex (MFC) is the most important water tower in Kenya. It is a natural asset, which provides strategic ecological and economic goods and services at local, national, and regional scales. Its rich vegetation includes the acacia trees, coniferous plantations, wooded grasslands teaming with great variety of wildlife. Over the years, and especially in the last few decades, profound changes have taken place in the Mau, leaving behind a trail of destruction of one of the country's key natural resources. As a result of these activities, more than one quarter of the original forested area of the MFC has disappeared (Kinyanjui et al, 2014, also KEFRI, 2013).

Against this background, this paper takes account of the history of land excisions in the MFC. It further delves into the impacts of anthropogenic activities and the resultant environmental crises causing climatic changes in and around the Mau complex. Additionally, the paper examines the continued degradation of the Mau's

ecosystem and the overarching situation of human security and socio-economic effects on the local population. The paper focuses on the Southwest forest reserve, which is one of the most degraded parts of the MFC.

1.2 The study Site

The MFC is located in the West of the Great Rift Valley, and situated at approximately 250 kilometres from Nairobi. Originally, the Complex covered massive land area of 405,000 ha, however, presently land cover of the MFC has been reduced to 273,300 ha (Kenya Forest Services, 2014). The Mau Forest Complex is the biggest of the five key water towers in Kenya and serves as an upper catchment for several streams and twelve rivers including Nzoia, Yala, Nyando, Sondu, Mara, Kerio, Molo, EwasoNgiro South, Njoro, Nderit, Mkalia and Naishi. At the same time, these rivers drain into five major lakes of the region; Victoria, Nakuru, Natron, Turkana and Baringo.

The Mau Forest Complex comprises 22 units of forests contained within ten major forest blocks; Mau Narok, Maasai Mau, East Mau, Western Mau, Southern Mau, South West Mau, Londiani, Tinderet, Lembus and Trans Mara.

These forest blocks are situated in the heart of some important counties like Narok, Nakuru, Baringo and Kericho. Vegetation cover of the MFC vary erratically from grasslands to thick bamboo forest formation in the Eastern slopes, whereas the lower slopes of West and Southwest have a mixture of bamboo with various kinds of trees forming a closed canopy montane forest (KEFRI, 2013) Based on this information, the Mau Complex is one of the biggest closed canopy montane ecosystems in the East African region (ibid).

The Mau Forest Complex has five main forest reserves, including the Eastern, Western, South-West, Transmara Ol-Posimoru and the Maasai Mau. All of these reserves are gazetted except the Maasai Mau, which is classified as trust land, managed by the County government of Narok. Gazetted forests are directly under the government's authority and managed by the Kenya Forest Service, which is the state agency mandated to take care of national forests. The national government manages gazetted forests on behalf of the people whereby the revenues collected from the forest are utilised to strengthen national economy as well as for the common welfare of the citizens. Topographical features of the Mau Forest Complex include the changing landscape, comprising a multitude of hills, rolling land, plains, and escarpments. Its slopes range from 2 per cent where the forest lies in the plains to 30 per cent along the foothills (Olnag & Kundu, 2011)

The MFC lies at an altitude between 2000 to 3000 meters above the sea level. The Mau Forest Complex lacks a definite dry or wet precipitation regime and receives rainfall throughout the year, especially in the eastern parts. Studies indicate that during 1986-2005, the Complex had a bimodal rainfall pattern, with continuous rains having two peaks; long rains, and short rains (Kenya National Museums, 2009). Long rains extend from March to June while short rains are experienced during the period between Octobers to December.

Since 2006, trimodal precipitation pattern has also been observed in certain areas having long rainy season from April to May while short rains occurring during November to December, with an extra small peak during August (Baldyga, et al., 2007). Average annual rainfall is about 2000 mm in the areas around Kericho and 800-1000 mm in areas adjacent to Narok, Nakuru, Molo, Lembus and Trans Mara. The normal temperature inside the Mau fluctuates between 12°C to 16°C (Kenya Meteorological Department, October 2013). During the months of summer, maximum temperature rises above 19°C. The soil of the Mau Forest region is volcanic and layered with fertile soil, thus, making it attractive for agriculturalists.

The Mau Forest provides a habitat for variety of flora and fauna. Its flora changes as the altitude varies. Some parts of these forests consist of shrubs with numerous varieties of indigenous and exotic trees such as cedar, African olive, and Cypress, contrasting with grasslands in other parts. Its bamboo forest is of great economic and ecological significance and plays key role in the regional hydrological cycle. Bamboo conserves moisture, seeps rainwater and through this process, helps recharge the underground aquifers. In addition, it

protects the soil and keeps it intact from erosion and water runoff.

Other roles of bamboo is to help in carbon dioxide sequestration by storing excessive amount of carbon which otherwise would be released into the atmosphere and add to global warming and climate change. Bamboo is also a good source of handicrafts. Since 2013, the government of Kenya introduced the enterprise development programmes based on sustainable use of bamboo, especially aimed at the well fare of the internally displaced persons (IDPs) of the Mau Forest. Such programmes help to generate livelihoods by making handicrafts like baskets (J. M. Mbinga, personal communication, 13 February, 2014). Other types of forest trees provide wood for multiple usages from furniture to construction, mainly due to durability, strength, and flexibility (Ben-zhi et al., 2005).

Although MFC is not a tourist attraction as such, the forests sustains more than 450 bird species and a huge variety of wild animals, including some rare and endangered species such as the bongo, yellow backed duiker and the African golden cat. Other commonly found animals found in the Mau forests include elephant, buffalo, gazelle, leopard, antelope, hyena, forest hog, colobus, blue and red-tailed monkeys, and many small species such as the African genet and hyrax. Each species of the flora and fauna is an asset of the forest and plays a unique role to enhance its socio-economic and ecological values.

There are wide range of goods and services that are linked to the Mau's biodiversity. For instance, the Complex provides water, food, shelter, clothing, firewood, and grazing areas for the communities living in and around its proximity (Ben-zhi et al., 2005). Forest animals and plants are source of food for the locals. Many of these contain medicinal properties and are used to cure day-to-day ailments (The Mixed community Focus Group Discussions, 2014). The biodiversity also provides endless opportunities to researchers of various fields of study. The Mau Forests have been home to indigenous forest dwelling communities such as the Ogiek, meaning 'the caretaker of all plants and wild animals' (Joseph, 2001).

Traditionally, the Ogieks have had an intrinsic relationship with their environment, which made them conscious about the ecosystem of the MFC. In the process, they sustainably used and protected the forests with their indigenous practices and knowledge. For decades, these communities have entirely relied upon the forest resources. For instance, in the economic, food, and health perspectives, the Ogieks relied upon bee keeping, game hunting, and other forest supplies such as roots of trees and wild berries. Honey is the most important item as they use it as food and trade it to make livelihoods. For the Ogiek women, the white pupa of the bees (found in the honeycombs) is a delicacy and a natural medicine to cure many diseases. Traditionally, skin or hide of the hyrax provided their clothing called ender. As such, the forest has been a typical life sustainer for their routinely up keep (Ogiek community Focus Group Discussion, 2014).

The Ogieks settled in the East African forests before 1800 AD and held land through elders, selected on customary rules, based on clans and families. These indigenous communities treated land as an asset and an element of spiritual identity as well as a significant part of their cultural heritage. During the early 1900s, colonial rulers partly demolished their land ownership rules as the introduction of the Native Land Trust specifically disowned the natives from their traditional land. Despite the huge demand for an Ogiek reserve, the British administration dismissed the issue and never recognised their right, being a minority community to own land. During the 1930s, the colonial government harassed the Ogieks by confiscating their livestock, beehives, and the stocks of honey barrels (Kimaiyo, 2013).

Lack of access to education has led to high level of illiteracy among the Ogiek community. Therefore, most of the time they have been sidelined from active political participation. Consequently, their voice has never been heard for their rights and socio-political development (Ogiek Community Focus Group Discussion, 2014). After independence, the Government of Kenya also refused to recognise the Ogieks' rights to own land, although the community leaders have been fighting for their land ownership rights for decades. Similarly, the new constitution of Kenya recognises the indigenous community rights and accepts them as the equal citizens of the country, however, the issue of their land ownership is yet to be resolved. Therefore, due to environmental and political factors, land conflicts have continued to erupt in the Rift Valley areas and around the MFC.

1.3 Economic and Ecological Benefits of the Mau Forest Complex

Among a number of others major forests of Kenya, the Mau Forest Complex plays critical role to sustain natural and human environments. The complex provides fundamental environmental resources necessary for Kenya's sustainable development and achievement of the Vision 2030, which is a blueprint for Kenya's future socio-economic growth. Economic and ecological values of the Mau forests are the tangible and non-tangible benefits, crucial to attain human security. The rivers and lakes of the Mau Forest Complex are of tremendous economic and ecological values for the local, national, and regional human security needs. For instance, Mara River is a source of survival for the humans and animals both in Kenyan and Tanzania's game reserves such as the Maasai Mara and the Serengeti.

Lake Victoria is a great source of East Africa's fish industry; 75 per cent of its water comes from Mau's rivers (though Kenya has only 6 per cent of the lake's border). The lake produces more than 500, 000 tons of fish annually, which is exported to Europe, Asia and the Middle East, valued approximately US\$400 million annually. Other trans-boundary rivers and lakes are also key sources of water supply to the adjacent rural and urban areas. This water, thus, has been supporting numerous sectors such as housing, tourism, energy, agriculture, and industry.

Compared to other water towers in the region, another special significance of the Mau is that its waters flow to

trans-boundary lakes including the White Nile. This implies that the Mau complex not only supplies water to the eastern Africa, but also it is an important water resource for the entire Nile Basin, covering the Horn and parts of Northern Africa (E. Chebelyow, personal communication, 14 February 2014). The Mau forests, therefore, provide crucial social and ecological services at national, regional, and international levels. For instance, it helps in water regulation, underground water purification and waste treatment, water storage and ground water recharge (Ibid).

Secondly, the vegetation cover of the forest controls soil siltation and erosion, and protects against landslides and floods. Thirdly, the forest helps in the biodiversity conservation. The forest also regulates disease control as changes in the land cover can enhance the growth and multiplication of bacteria and viruses causing diseases, like cholera and malaria. Lastly, the ecosystem of the Mau Forest helps to regulate the local and regional climate and mitigates natural disasters. It is estimated that the Mau Complex generates goods and services equal to US\$ 1.3 billion annually, which is 2 per cent of Kenya's Gross Domestic Product (GDP). Nearly 5 million Kenyans depend on the forest for their daily provisions (UNEP, 2012).

In the energy sector, the complex has the capacity to generate hydropower of 535 Mega Watts, which is 41 per cent of Kenya's total power generation (Government of Kenya, 2007). In addition, having catchments on the South West Mau, the power plants of the Sondu, Ewaso Ngiro Rivers, and the Kericho tea estates have potential to produce more than 440 MW of energy (UNEP, 2012). Thus, economic value of Mau's total energy generation amounts to US\$ 131.6 million (Elliot, 2012). Among other agricultural and horticultural commodities produced in the area, tea is Kenya's major cash crop that is ranked third highest foreign exchange earner for the country. Tea production needs particular microclimate with well-distributed rain to provide constant moisture, air and soil temperature and long sunny days. Most of Kenya's tea is cultivated around the southwest Mau as it provides an ideal environment for tea production.

Being in the neighborhood of Mau forest, Kericho is world's leader in terms of tea yields per hectare. More than 100 small (these are less than 10 acres) scale tea farms contribute towards 65 per cent of Kenya's total tea production (H. A. M. Ole Kamwaro, personal communication, 25 June 2014). The tea sector provides nearly 35,000 jobs and around 50,000 small-scale farmers' livelihoods entirely rely on the ecological services of the Mau Forest Complex (Owino, 2007). It is estimated that Kenya's tea earnings are nearly US\$ 163 million annually (Elliot, 2012). Many large multinationals such as Unilever Kenya, James Finlay, and Williamson also found in Kericho County. Studies reveal that compared to other tea producing areas of Kenya, there are 8 to 20 percent higher yields in the proximity of the Mau Forests. Therefore, more than two third of the tea produced in the western Kenya benefits from the ecological functioning of the Mau forests. Rice, wheat, and maize are other major cash crops, which are produced around the Mau's favorable climatic conditions (B. Cheserek, personal communication, 14 February 2014).

During the past few years, production of grain has considerably increased in and around the MFC. In the Narok County, for instance, total wheat production during 2011 and 2012 accounted for 2,983,130 and 4,908,400 bags of 90 kilograms respectively, which is significantly higher than the previous year's yields in the Narok County area. For the production of above-mentioned commodities, areas around the MFC are well established with smallholder (approximately 2.5 acres) agriculturalists found along the Bomet County, adjacent to West and Southwestern parts of the Mau Complex. The Olenguruone Enclave lies towards the Nakuru County, which is concentrated with groupings of settlements since 1940s. This area is known for the production of vegetables, pyrethrum, and tea (Jackson & McCarter, 1994).

Molo Farms in Nakuru produce abundant quantity of oats, barley, and wheat. Other commercial farming activities include ranching, sheep rearing and dairying. However, these are gradually turning to smallholders with mixed agro-pastoral practices. The lower Northern part of the Mau Forest lies next to the Narok County, most of which is arid and semi-arid and has more pocketed population relying on mixed agro-pastoral economy. Socio-economic surveys reveal that thousands of the forest dwellers and local communities living next to the forests used the forest wood for making poles, spears, bows and arrows, fuel and furniture making. Bamboo is used in building, construction and fencing. Grass of the forest makes good material for thatching. Forest vines provide basket-making material. Various plants of the Mau are used as herbal medicines for both humans and animals. Historically, forest animals provided meat by hunting, though it has currently decreased due to banning and shifts in the agro-pastoral economy (Ibid).

Thus, the complex has been a key source for the national economic growth, for it directly provides means of livelihood, water, food, medicines, and housing material for the local and regional population. However, since the colonial era, due to its affluence with innumerable environmental and ecological resources, the Mau Forests have been a battleground between the politicians, ruling elites, and the local communities of the country. The following section provides a detailed account of some of these issues, which over the years have led to significant destruction of the Mau Complex.

2. Methodology

For the purpose of this study, both qualitative and quantitative data was collected using the case study method, which provided thorough observation and investigation of the social unit to identify causation. Therefore, to explore the inter-linkage between land excisions and climate change impacts, I concentrated on Eastern, Southwestern and Maasai Mau forests. However, this paper will only focus on the southwestern part where issues of illegal land excisions and deforestation have led to increased greenhouse gas emissions with annual and diurnal temperature rise, severe frost spells, changes in the river flows, and rainfall variability. At the same time, resource scarcity,

growing poverty level, loss of livelihoods and decreased crop yields, threaten various aspects of the human security of the local population.

Primary data was derived from semi-structured and unstructured interviews. Based on the non-probability criterion, judgmental/purposive sampling guided to select the interviewees. Thus, for the purpose of primary data collection, cases of subjects were picked because they possessed the required information based on their skills and expertise. In addition, they had phenomenal role in environmental conservation, natural resource conservation/management, and Kenya's climate change policy making affairs. These interviews helped to do the in-depth investigation of the underlying causal factors and impacts of anthropogenic climate change, scarcity of key resources, and posed threats to the local population.

The sample of more than twenty five interviewees included various experts from the Kenya's Ministry of Water, Environment, and Natural Resources, Kenya Wildlife Services, Kenya Forest Services, Kenya Forestry Research Institute Londiani, civil society activists, various government offices, the forest communities (the Ogieks and the Maasai), tea producers, scholars, researchers, and environment related civil society organizations. Kenya Meteorological Department provided quantitative data on temperature and rainfall, which guided to assess the climate changes in and around the Mau Forest Complex during the study period (1963-2014).

Focus Group Discussions (FGDs) were also part of qualitative data collection. The focus groups consisted of various community members and evictees living near the Mau forest. The members of these groups were selected on the basis of age, gender and skills to share their experiences and opinions on the given topics of discussion. Questions asked during the discussions were semi structured and open-ended. Record taking consisted of both note taking and audio recording. In addition, during the fieldwork, the researcher made use of day to day accounts in the form of a 'diary of observations'. This provided additional primary information based on researcher's personal experience and observations during the field trips to the study site. Government documents were an important part of primary data collection. The nature of the data analysis for this study was qualitative. Thematic analysis method has been used where key themes of the study were identified and major subjects and associations between them were discussed.

3. Results and Discussion

The results and discussions are divided into pre and post independent land excisions of the Mau Complex, with a detailed analysis of other anthropogenic activities and the consequent climate change impacts around the area.

3.1 Pre-Independence Land Excisions in Kenya

Before the British rule in Kenya, most land was under communal ownership, which allowed the clan or community members to practice their occupations in a secure milieu based on the principle of reciprocity.

Abiding by local customary laws, people used land for agriculture and pastoral activities including hunting, livestock keeping and fishing. The management and the use of natural resources were based on the indigenous knowledge of the clan or community members. Traditional rules and ethics helped to resolve major disputes regarding the land rights and transfer of ownership (Okoth-Ogendo, 1976). Thus, these communities lived in harmony, enjoyed their lives free from all kinds of fear and want, and led honorable lifestyle as the local laws provided necessary conditions for security and economic development.

In early June 1895, among other British colonies, Kenya was also targeted as a favorite destination and was declared as British Protectorate; however, the land ownership remained with the locals. In 1901, Europeans began to settle in Elburgon and moved towards Molo South and Keringet. From 1902, the colonial settlers began to amend the existing land ownership laws and introduced new land policies. For instance, under the Outlying District Ordinance, the Maasai agreements of 1904 and 1911 were substantially changed. The Colonials also used the local administration to move thousands of the Maasai and their herds to Laikipia (Okoth-Ogendo, 1991). Following the new land allocation policies, the European settlers seized land in Central and Rift Valley Provinces of Kenya (Kimaiyo, 2013) where main use of land was ranching, farming, hunting, and plantation, depending on the type of labor available in the area (Boone, 2012).

During this time, the new land policies that helped to transfer huge portions of the Mau Forests were through the Crown Land Ordinance. In addition, with these distorted policies, the colonials displaced thousands of Kenyans of various ethnic identities such as the Kikuyus, the Luos, the Luhyas and the Kisiies. Most of them migrated to the Highlands and settled as squatters, laborers, and peasants. However, some of them succeeded as farmers and gradually through the legal organisation of colonial settlements continued to occupy land in this area. As such, the Colonials empowered the Commissioners to grant 999 years leases (Section 34 of the Crown Land Ordinance), especially through the provisions of the Crown Land Ordinance of 1915, which specifically played a major role to disown the natives from their ancestral land (Mosley, 2009).

According to the Residents Native Laborers Ordinances in 1918, these squatters were left with fewer tenancy rights. The situation further deteriorated during 1934-1939, when the Ordinance entirely disqualified the natives to own any piece of land, especially in the so-called White Highlands (Okoth-Ogendo, 1991). By 1940, there were thousands of squatters (majority being the Kikuyu) in the area who worked as laborers for the white settlers. With the population growth, the white settlers saw them as threat in the areas and used coercive means for evictions. This was due to their increased interest in the highly fertile land in the Highlands that the Europeans wanted to own exclusively.

Secondly, it was due to the new settler's growing need of labor force to work on these farms. Therefore, to deal

with the shortage of labor, the colonial government used forced labor policies whereby even the local administration such as the chiefs helped to recruit the squatters. Thus, most of the squatters were bound to work as low cost contractors or casual laborers with minimum wages or no wages at all (Van Zwanenberg, 1975, also Carey Jones, 1965). As a result, the displaced pastoral and agricultural communities were severely affected with hunger as well as growing incidents of human and livestock diseases. Furthermore, the white settlers used every barbaric tactic to keep away the local communities from farming and owning land in the Rift Valley. For example, they imposed various forms of taxes on the ordinary Africans, enshrined in the colonial laws. For instance, they imposed the Hut Tax of 1901, the natives of East Africa had to pay to own a hut. Initially, it was the tax of one Rupee; however, it increased with time as the locals resisted paying.

By 1910, the Native Hut and Poll Tax provisions included severe punishments for non-payment and were imprisoned for three months or would be disowned from the property. Likewise, the Kipande laws restricted the movement of locals, even within their own homeland. In addition, these taxes and laws provided a weapon of capitalistic economy to force the locals in the labor market and to work for the settlers (Waris, 2007). In 1941, to resettle the displaced squatters from previous year's eviction plans, the colonial government established their initial schemes in Olenguruone part of the Mau, situated in the Narok Forest. By 1942, there were still more than 200,000 squatters in the area.

During 1945 and 1952, more than 100,000 squatters were maliciously forced to move to Central Kenya. During the late 1940s, these were among the fundamental factors that significantly fueled the formation of the Mau Mau movement (Kanongo, 1987). The pattern of cyclic evictions continued when the colonials evicted most of these squatters in 1954, especially from the Kikuyu origin, from Olenguruone. However, it was one of the Colonial rule's strategies to contain the Mau Mau movement against their oppressive rule. Simultaneously, they wanted to allocate some of this land to the local Kenyans. Nevertheless, this was clearly for their self-interest as the colonials wanted to gain the loyalties of the local cronies who were pro-government and were against the Mau Mau revolt (Carey Jones, 1965).

3.2 Post-Independence Forest Land Excisions in Kenya

Kenya won its independence in December 1963. According to the Kenya Constitution of 1963, section 205, all land previously owned by the British Crown was automatically transferred to the government of Kenya (under the care of the President). This incorporated all kind of forestland, game parks, and reserves, including the white settler's land and the unoccupied land left for future development purposes. Immediately after independence, the government of Kenya planned to dispose half of this land on behalf of small-scale farmers. In this process, Kenya's first President Jomo Kenyatta introduced some 123 land settlement schemes, ranging from five thousand to ten thousand acres of land pieces (Von Haugwitz, 1972).

Many of these included the low density schemes were especially intended for commercial farming where the division of land was from 8-16 hectares (Odingo, 1971).

During the late 1960s and 1970s, many politicians and government dignitaries being heads of private land companies introduced the Settlement Trustees Fund schemes to buy or lease estates and farms. However, the companies later sub-divided these chunks of land among their families by holding shares. Through this politicised process, many Kenyans of Luo and Kikuyu origin gained control of land in the Rift Valley (Berman & Lonsdale, 1992). During this period, land parcels of 4-6 hectares were distributed among the subsistence farmers, based on the high-density schemes (Odingo, 1971). The willing-buyer-willing-seller policy was the focus of diverse ethnic classes, including the affluent middle class people, corporate societies, and the investor companies who were generally keen on agricultural production (Oyugi, 2000). Thus, through this process 20 per cent of the White settlers' land was divided among the local farmers while the rest remained with the government.

By 1970, these schemes gained a lot of momentum and helped to settle approximately half a million landless locals (Leys, 1975). Under Kenya's first constitution, all forestland is under the possession of the government as was the case with the Mau Forest. Nevertheless, forestlands can be used for multiple purposes through degazettement process. From 1970s to 1990s, through various informal schemes, Kenya's forests were continuously degazetted and divided among the influential political leaders and their party members. The beneficiaries mainly included the politicians, high status civil servants and the business community. The Kenyan government, for instance, established the Lake Nakuru and Mauche settlement schemes for the landless Kenyans and the squatters, especially from the Kikuyu tribe whereby many of these settlements were established near the forests including the Mau. These settlement areas therefore, continuously expanded as the population grew with time, and grabbed more land from the surrounding areas (Ibid).

The Kalenjins who believed that it was their ancestral land, however, opposed these schemes. In 1978, President Daniel Arap Moi came to power and progressively used the forestland allocation policies to advance his political motives. Specifically, from 1986 onwards, among other forests and state properties, the Mau forests Complex became more of a fund, used to award and influence the party friends to strengthen the regime (Southall, 2005). For instance, some leading members of the ruling tribe and party associates were among the 'land grabbers' especially in Nandi and Kericho Districts, being the most promising areas for agricultural development as well as social-multiplicity (Boone, 2012). Simultaneously, the President was reaching out to help the aggrieved who had been disowned or could not possess land during the 1960s and 70s, under President Kenyatta's land allocation schemes. However, the new president's land allocation process was questionable and highly sensitive to the political environment of the country.

During 1991-92, Kenya established the multi-party system, which stirred uncertainty for President Moi's

future rule. However, once again the ruling party members triggered violence and ethnic clashes to clear the Rift Valley area. They used local militia groups who fiercely attacked the villages and burned houses, destroyed property, and brutally killed and raped hundreds of women. As a result, more than three hundred thousand were displaced whom since Presidents Kenyatta's times had lived in small settlements and owned land (E. Chebelyow, personal communication 14 February 2014). Following these incidents, the South-West Mau Forest was opened up for new settlements, especially from Kericho and Bomet areas and led to further occupation of the forestland (Bateson, 1994).

Over the years, Kenya's political elites have targeted the Rift Valley and the surrounding areas for electoral campaigns. Therefore, before and after every election period, there have been widespread and recurring episodic clashes in the area, in particular during 1991-92 followed by 1997, 2002, and 2007-2008 electoral periods. These bloody clashes and killings of thousands of innocent citizens are the attribute of continued evictions and resettlements by the Kenyan politicians, who have been using the Mau forests for their political gains (H. A. M. Ole Kamwaro, personal communication, 25 June 2014). In 2001, the most critical issue that caught the attention of the international community was the destruction of the Kenyan forests and the controversy over the forestland ownership.

In 2003, due to the growing publicity of the forestland excisions and severe degradation of the Kenyan forests, a land commission was set up to investigate cases of land grabbing. The commission reported that during the last two decades, huge chunks of protected parts of the Mau Forest Complex were cleared to award the political elites, including some prominent multi-national companies. The Ndungu Report identifies serious incidents where political factions, public officers and provincial administrators used various illegal means for their personal benefits. The report also argues about various accounts of wide spread corruption, leading to human rights violations and land grabbing (The Ndungu Report, 2003).

Additionally, the Ndungu Report identified that the Kenyan presidents who were the trustees of the public land, used their powers to lease hold and free hold public land to some individuals and corporations while the deserving individuals and communities, including the Ogieks, did not receive any land. According to the legislations provided in the Kenya Forest Act, degazetted forest can be used for genuine public interest (Ibid). However, according to the Kenya land commission's report, in this case, most of the land was allocated for political gains and mobilisation of the elections. At this point, it can be argued that throughout the twentieth Century, neither the colonial rulers nor the Kenya's independent governments had any environmental security concerns. In addition, Kenya's political leaders did not attempt to use the natural resources sustainably, while keeping in mind the future implications in terms of environmental degradation, climate change, resource scarcity, and the human security repercussions.

During 2004, former President Kibaki's government undertook various measures to restore the complex and ordered to evict thousands of forest dwellers to protect the forest from further destruction. These evictees were issued with 12,000 title deeds as compensation (Kagwanja et al, 2010). In addition, the Kenya government sponsored many restoration programmes with huge sum of finances that were exclusively meant to rehabilitate the Mau Forests. For example, one such programme was setup with the help of the Council of Elders' in Narok. This was an initiative to grow seedlings and establish nurseries. However, the plan was abandoned midway and the allocated funds were diverted towards unknown projects (P. Ole Lemain, personal communication 25 June 2014).

In June 2005, thousands of more squatters were evicted, however, the forest encroachment was never fully controlled and by 2007, the rapid destruction of the forest reached a crisis state. In the aftermath, the office of the Prime Minister established the Mau task force, specifically mandated to conserve the Mau Forest Complex. In July 2008, the task force held a forum whereby more than 300 participants, comprising members of the government and civil society were present. The forum produced a status report highlighting several themes including; governance, capacity building, climate change, and environmental sustainability. The report recommended restoration measures with the eviction of 200,000 people residing in the forest. As a result, the government ordered further eviction from the Mau forest. Until 2013, for more than three years, the evictees lived in the Internally Displaced People's (IDP) camps, and later in 2014 were compensated and relocated (Focused Group Discussion, April 2014).

The MFC surfaced as an issue of global political discourse in the 2009 Copenhagen World Summit on Climate Change where it caught the attention of the international community. Following this, in collaboration with the United Nations Environmental Programme, the Kenya Wildlife Services, Kenya Forest Services and various environmental NGOs, numerous programmes have been placed to control the situation of illegal settlements. For instance, with the help of the government of the United States and the European Union, huge funds have been poured for the restoration of Kenya's vital water towers. However, the situation is still uncontrolled as most forests of the Mau Complex are still under constant degradation.

3.3 Anthropogenic activities and Climate Change in the Mau Forest Complex

Land use and land cover changes in the Mau Forest have gradually influenced many changes in and around the MFC. Data reveals that before the mid 1980s, nearly 75 per cent of Mau's land cover consisted of unchanged forest, with 12 per cent woodland while 13 per cent was under farming (Olang & Kundu, 2011). However, since the late 1980s, large-scale deforestation and conversion of the forestland into cultivation and subsistence agriculture has substantially decreased Mau's forest cover.

Figure 1 indicates the encroached, adjudicated, and excised areas of the Mau Forest Complex as have been marked with red, black, and blue shaded parts of the

Eastern, Southwest, and the Maasai Mau forest blocks. As discussed earlier, parts of the Mau forest have been occupied through legal and illegal encroachment, specifically which were previously under the forest management or conservation. In the case of Mau, the so-called legal way of forest encroachment is where the owners hold title deeds through the settlement schemes. However, if the claim of ownership is without any such documents, these parts of forests are under illegal ownership. In the adjudicated forest, land ownership right exists through an authorized registration process.

Excised forests are the part of forest reserves cut out for a particular purpose such as for human settlements. Interview data reveals that over the time, many interacting factors have led to Mau's destruction. For instance, lack of management logistics and poor infrastructure to act efficiently against the encroachers has been a key factor. Most of the forest stations are ill equipped to monitor and control the illegal activities. Frequent clashes and ethnic violence in the area has left many stations of the forest unmanned, which further led to severe encroachment and allowed the raiders to steal wood (E. O. Omollo, op cit). In the policy area, there is weakness of policy implementation especially concerning the Mau Forests.

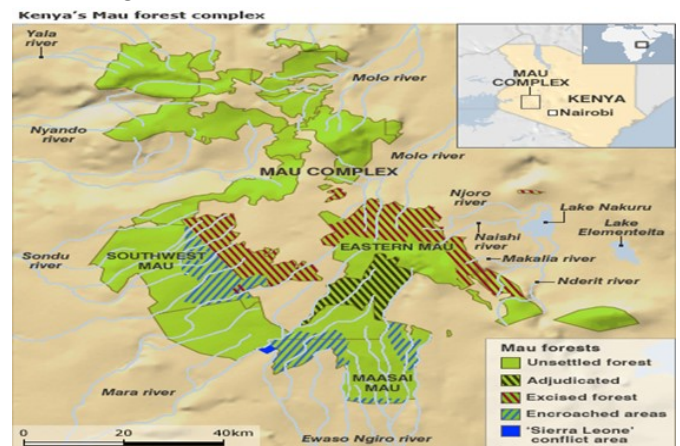


Figure 1. Encroachments in the Mau Forest Complex (Source: Kenya Forest Service, 2014)

These activities are additionally the potential causes of climatic changes such as warmer temperatures, irregular rain patterns, frosts, and droughts, influencing profound threats to peace, security, and adequate development in the area as discussed below.

3.4 Climate Change impacts in the South-West Mau

Originally comprising an area of 84,140 ha, the South-West Mau was the largest block of the Mau Forest Complex. South-West (SW) Mau consists of steep valleys beautifying it with crisscrossing rivers and streams. The SW part of the Mau Forest Complex lies in the Western Highland of Kenya. In 1960, it was established as a Nature Reserve due to the presence of large populations of rare species such as Bongo, leopard, elephants, and many bird varieties. The SW Mau has been under threat since 1932 when it was gazetted under the Legal notice No. 44. In 1934, 589 ha were excised for the boundary plan. Nearly 4000 ha were excised during 1951-1957, meant to establish settlements around Kuresoi area. Again, during 1968, an area comprising 9,386 ha was cut-off for more settlements in Embomos area (Government of Kenya, 2009).

During the 1970s and 1980s, more than 6000 ha were additionally excised for Olenguruone settlements including the tea farms. All of these excisions were made under various legal notices (Ibid).

A part of the SW Mau touches the Kericho County, which is Kenya's major tea producing area. In 1924, Kenya started its commercial tea production and the Kericho area provided the most favorable climate to cultivate the premier quality tea. Therefore, over various phases, huge chunks of the SW Mau were converted into tea plantations (E. Chebelyow, op cit). Although tea production brings huge wealth and foreign exchange for country's better economy, however, at the same time tea farms were developed at the cost of natural forests of the country.

For instance, in 1984, a government led Nyayo Tea Zone programme required to clear 100 meters wide bands along the gazetted forest boundaries, meant to buffer encroachments of the forests. Additionally, these tea plantations were established to generate national wealth and employment creation. Over the period, these plantations have occupied massive areas along the SW Mau and Transmara, nevertheless, at the cost of indigenous forest exceeding up to 150-200 meters, particularly in Kiptagich and the Nairovia areas. These schemes did not pursue the strict forest boundary, and lacked ecological impact assessment studies. In a number of places, open gaps left plenty of room for human encroachment into the forest, causing further deterioration to the forest (Jama, 1991).

Similarly, the Tea Research Foundation was also established on the Mau's land as it still meets the boundary of the SW block of the Mau Forest Complex. Although, Tea Research Foundation promotes research for the production, better quality and quantity and cloning of tea, its costly effects on the natural environment have never been estimated. During the 1970, World Bank financed a commercial tree plantation programme around Kericho, Saino and SW Mau that was intended to meet the growing needs for timber and industrial activities. Secondly, its major aim was to save the indigenous forests and control illegal logging. However, the programme was developed at the expense of indigenous forests, interfering with Mau's biological diversity and natural habitat (Ibid). By 2001, the government had excised further 22,797 ha from the SW Mau, representing additional 27.3 per cent loss of its total land area. The land was used for human settlements and small-scale cultivation (Kinyanjui, 2009).

The 2005-2006 UNEP survey indicates that most of the excised areas in the SW Mau were cleared to settle the indigenous people. Nonetheless, there were still around 2,300 illegal household covering 10 kilometers inside the gazetted forest. Traditionally, the Ogieks inhabited SW Mau, but over the time, the Kipsigis tribe also made it their home. Due to several eviction plans, many of these were forced to leave; however, a big population of forest dwellers and other communities stayed back and excised parts of forest land for illegal logging for firewood, charcoal making, and cultivation (UNEP, 2006). Over the time, these excisions have led to infinite impacts especially on the local climate. Various

studies indicate that mean air temperature in this area is increasing at the rate of 0.02°C per year since 1950s.

The air temperature for every ten years is also showing positive correlation with time data. For instance, during 1970s and mid-1980s, the average annual temperature in Kericho area remained within the range of 15.8°C to 16.5°C, though increasing gradually. After 1985, the temperature increased progressively, especially in 1987 average temperature jumped to a yearly mean of 17.8°C from the previous year's 16.0°C (Kenya Metrological Department, 2014). In 1998, once again there was an abrupt rise of temperature from 17.8°C in 1997 to 18.3°C. However, in later years mean annual temperatures remained relatively steady and within the range of 17.3°C-18.0°C. By 2005, Kericho's yearly mean temperature had reached the peak of 18.2°C. During the following years, average temperature remained more or less similar to the previous five years. Historically, Kericho county and the neighboring areas received throughout the year rains, with annual rainfall ranging between 1800 to 2200mm. With an abrupt rise in temperature during the late 1980s, the rainfall pattern dramatically changed, especially after 1985.

Metrological data indicates that with continuously rising temperatures, the amount of rainfall significantly declined throughout the 1990s, with fewer periods of normal average pattern of rains. For instance, in 1998, the area received more than 2000mm rainfall, triggered by El Nino phenomenon, which caused flash floods in most parts of Kenya. However, in the following years, average quantity of rainfall remained around 1800mm per year, which is again significantly less than the previous pattern of average yearly rainfall around SW Mau Forest (Ibid). Observations indicate that specifically since 2001, surrounding areas of the SW Mau especially Kericho and the neighboring areas have been experiencing severely dry or extremely wet seasons with an inconsistent and unpredictable patterns of rainfall. For instance, during 2004, the average yearly rainfall was 2,487 mm while during 2006, average rainfall in the area was 2504mm, which is much more than the average annual rain in the Kericho area.

However, year 2009 received only 1,415mm, which is the least amount of rain Kericho received during the past fifty years. During 2012, the area received more than an average yearly rainfall, causing severe spells of frost and hailstorms while following years have experienced relatively depressed rainfall. In the context of climate change implication, there are growing concerns as the area is already showing signs of fundamental changes in the local climate system. An analysis of the climate changes in the SW Mau forest indicates that deep rooted causes are grounded in the severe degradation and depletion of the forest cover, especially if both continue for a long period.

As discussed previously, forests are vital players in a hydrological system within and outside the forested areas. Secondly, water storage, movement, distribution, and quality is maintained by the forests. Therefore, good management mechanisms of the natural forests are necessary to keep them undisturbed and functioning. Most scholars of hydrological systems claim that droughts as well as floods are caused by land misuses/changes.

Forests also play critical role to form a steady rainfall system as they release water vapors into the atmosphere, which fall back to the ground in the form of rain.

In the forested areas, part of the rain stays on the leaves, which evaporates and has no role in the hydrological system of a forest. Thus, the amount of rain reaching the ground of the forest decreases compared to the non-forestlands. In the case of montane forests, approximately 75 to 86 per cent of the total rain reaches the ground. However, the remaining rainwater flows into the nearby streams and rivers. Studies carried out near the SW tea estates depict that during stormy weather of 75 mm rainfall, the flow rate in the naked land was 75 cusecs while it was less than 2 cusecs inside the forest where one cusec is one cubic foot of water flow per second (Pereira, 1973).

Therefore, clearing up of the SW Mau's forests has led to drought periods lasting for continuous three months whereas previously the area received constant rains with around two weeks disruption. At times, heavy rains cause floods, and destruction of roads and other infrastructure of the area, which is already poorly managed (Researcher's personal Observations, April 2012). Since the late 1990s, climate change in the SW Mau has led to significant changes in the local pattern of agricultural activities. Occasionally, the onset of rain is delayed which have particularly affected the planting season of maize from January/February to March/April. Additionally, unreliable/erratic rains have affected the usual farming cycle as the farmers prepare for sowing but there is insufficient rainfall in terms of average quantity necessary to provide required level of soil moisture.

Major consequences of these climatic changes include disrupted harvests and unpredictable crop yields. Other interrelated social effects include growing poverty, as many farm workers do not have work security, which destabilizes economic wellbeing in the area. With fewer incomes, local people have to compromise on other areas of life, such as health and children's education. However, in some area's government has sponsored programmes for alternative livelihoods. For example, in Olunguruoni area through alternative livelihood enterprise development, people are encouraged to utilise bamboo in the home craft industry and market the product to make living (J. M. Mbinga, op cit).

Additionally, longer periods of drought are drying up the perennial rivers that flow during the rainy season only (M. Kiga, personal communication, 14 February 2014). Other key impacts are ecological and hydrological changes including reduced water tables, increased siltation, and soil erosion in the surrounding area of the SW Mau Forest. Consequently, water tables and springs in the area have affected with reduced water levels. Some seasonal rivers, like River Kipchorian, which originates from River Nyando flows in rainy season, while its flow was on permanent basis especially during 1980s. However, due to the introduction of few reforestation programmes in 2012, water tables resurged in the area. With the severe changes in the local climate of the area, there are rising human security concerns. For instance, droughts primarily reduce water supply to households as well as

to the industrial sector, which can have direct implications on people's lives. Secondly, reduced water supply also means dwindling conditions of sanitation with poor health security. Data reveals that in Kericho area, unlike previously, water supply is inconsistent as most people receive water either in the mornings or in the evenings (J. Njuguna, personal communication, 20 February 2014). Due to reduced fodder and pasture, the dairy production has been affected negatively (County Stakeholders Consultative Workshop Report, 2012) that has further suppressed economic and food security, locally as well as within the region.

Climate change is also linked to the occurrence of excessive spells of frost and hailstorms in the highlands, which is particularly damaging to the top leaves of tea plantations and other crops. Especially, during January-April 2012, Kericho and Bureti areas experienced an unusually prolonged period of frost, severely affecting agricultural activities including the tea industry (Researcher's personal Observations, April 2012). Environmentalists state that frost is formed due to deviation in the day and night air temperatures, which is highly dependent on the surrounding environment. There is a complex relationship in forests and climate in the nearby areas. If extremely low temperature at night is followed by increased sun light and higher morning air temperature, this causes scorching of leaves, especially the top exposed layer.

Around SW Mau forest area, for the last few years nights have become significantly colder than the days, which is due to the fundamental changes in the local climate (B. Cheresek, op cit). Because of continued frost during January-April 2012 period, tea industry of the area lost production of continuous three months. Consequently, small-scale tea farmers lost 12.5 per cent of their annual yields while the losses for large-scale farms accounted for 28 per cent of their yearly production. Furthermore, due to the wide occurrence of frost, tea bushes could not survive and had to be uprooted and replanted which had enormous economic costs especially for the small-scale farmers whose livelihoods are entirely reliant on the tea productivity. Similarly, frequent hailstorms in the area cause havoc for tea farmers as these affect the tea production for up to four weeks, meaning disrupted plucking rounds with economic repercussions such as lost wages and lower crop yields (Ibid).

In relation to losses of biodiversity, due to extensive hunting and trapping activities of the white settlers and the forest dwelling communities, the number of large mammals is under stress while some animal species are on the edge of extinction. For instance, the most common antelope is rare in the forest and other animals like yellow back duikers have moved deep inside the forest due to natural habitat destruction, population of bongo is non-existent in the SW Mau (Davies et al, 1993). Large population of elephants has moved to other parks as the natural conditions of the forest changed. However, since 1995, there has not been any systematic data collection on the biodiversity in the SW Mau. Neither, Kenya Wildlife Services (KWS) has had any special mechanism to do census of animals in the forest (M. Salome, personal communication, 14 February 2014).

Human wildlife conflicts also threaten biodiversity as well as personal security of human beings. Very often, these conflicts cause injuries and loss of life, property, and livestock including crops. During 2007-09, there were 30 cases of human-wildlife conflicts in the area (Ibid). In addition, quality of air and water in Kericho has greatly polluted with the chemicals used in various industries, which are hazardous for the environment, humans, animals, and crop health. Investigations suggest that no environmental assessment measures were undertaken while establishing the land excisions for settlements or network of tea estates and processing factories.

There are justifications that tea plantations are environment friendly and act like forests. However, a small tea bush cannot hold as much quantity of water as a fully-grown indigenous tree does. In addition, natural forests have upper and under stories and both play unique functions in the hydrological and evapotranspiration cycles, which tea plantations cannot. Furthermore, there are fears that long-term negative impacts of plantations may threaten environmental security locally as well as regionally. This happens if natural forest is replaced with short rotation biomass such as crop cultivation, including the growth of industries and built environment.

Moreover, indigenous forests are known for biodiversity richness, which is not the case with tea farms. Nevertheless, as climate change is progressing, environmentalists unanimously agree on the critical role of forests in the protection of global, regional and local climate and the direct relevance to sustainable development and security of the local population.

4. Conclusion

The Mau forest Complex is adjacent to areas of high population density, and provide invaluable goods and services to millions of Kenyans. Due to increased human interference, the Mau forests are going through critical climatic changes such as rapid rise in the temperature, inconsistent rainfall, flashfloods and frost spells with significant threats including the loss of livelihoods, food crises, water scarcity, diseases, and loss of important biodiversity. For instance, the River Mara Basin and the Lake Nakuru National Park is experiencing dramatic changes in water supply and agricultural production.

In Conclusion, this chapter reveals that since Kenya's independence, throughout the 1960s and 1970s, with fewer changes in the forest cover, there was no significant change in the natural climate of the area. However, during 1980s, and 1990s, more than one quarter of the forestland was destroyed and degraded using legal and illegal means such as excisions, logging, clearing for subsistence farming, and human settlements. Since these times, changes in the local climate have led to rapid rise in the average temperatures of the areas in and around the Mau Forest Complex. Secondly, it has led to inconsistent rainfall pattern causing frequent and more intense droughts and flash floods. As a result, people are facing numerous socio-economic developmental and security challenges.

At large, deforestation and lack of adequate forest management policies are the main factors responsible for climatic changes and the accompanying negative impact on environmental sustainability. The study, therefore recommends that it is imperative for the Kenya government to address issue of land excisions to save Kenya's water towers from further destruction while dealing with climate change. The involvement of other stakeholders such as KFS, local communities, with county governments will potentially help improve the situation. In addition, improved awareness on forest conservation would significantly reduce continuing human encroachment. The study further recommends that while dealing with climate change issues, national policies be guided by taking consideration of addressing political dimensions of land excisions as a major anthropogenic factor.

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