ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT FOR THE PROPOSED 21KM BUFFER EXPANSION PROJECT IN SOUTH WEST MAU FOREST ZONES.

GPS Coordinates: 0°18'51.8"S 35°28'47.4"E - 0°27'44.7"S 35°30'40.9"E

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I, the undersigned, submit this Environmental & Social Impact Assessment Study Report for the Proposed 21km Buffer Expansion Project in South West Mau Forest Zones located between Kericho and Kuresoi North. The Environmental & Social Impact Assessment Study Report has been carried out in accordance with the Environmental Management and Coordination Act (Amendment) 2015 and Environmental (Impact Assessment and Audit) Regulations, 2003.

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Acronyms and Abbreviations

NEMA	National Environmental Management Authority
EIA	Environmental Impact Assessment
ESIA	Environmental & Social Impact Assessment Study Report
EA	Environmental Audit
EMCA	Environmental Management and Co-ordination (Amendment) Act (No. 5 of 2015)
ESMP	Environmental and Social Management Plan
EHS	Environmental, Health and Safety
GOK	Government of Kenya
Ha	Hectares
SERC	Standards and Enforcement Review Committee
ISO	International Standard Organization
ITCZ	Inter-Tropical Convergence Zone
km	Kilometres
m	metres
MFC	Mau Forest Complex
NTZDC	Nyayo Tea Zones Development Corporation
CGK	County Government of Kericho
CGN	County Government of Nakuru
DOHSS	Directorate of Occupational Health and Safety Services
CO	Carbon Monoxide
CO_2	Carbon Dioxide
NO_x	Nitrogen oxide
PPEs	Personal Protective Equipments
Masl	Metre above sea level
WRA	Water Resources Authority
KFS	Kenya Forest Services
KWS	Kenya Wildlife Services
KWTA	Kenya Water Tower Agency
CFA	Community forest association

EXECUTIVE SUMMARY

Introduction

The Environmental Management and Co-ordination (Amendment) Act (No. 5 of 2015), is the legislation that governs approval of project requiring ESIA studies. The second schedule of the Act lists the projects that are require Environmental & Social Impact Assessment Study Report studies in accordance with section 58 (1-4) of the Act. It makes it mandatory for any proponent of a project, to; before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the second schedule in the Act, submit a project report to the National Environment Management Authority (NEMA), in the prescribed form and giving the prescribed information.

Over the last decades degradation on the Mau Forest Complex (MFC), have reached crisis level as a result of encroachment, excisions and illegal forest resources extraction. This degradation is a major threat to water resources, biodiversity and livelihoods of forest dependent comm unities. If allowed to continue it will lead to conflicts over these resources and land. Political interference, weak law enforcement, limited management capacities of mandat ed institutions, and inadequate governance systems account, in part, for this wanton degradati on. Presently, the riparian communities and the Kenya government through key economic sectors that directly depend on goods and services of the region are paying the price of over three decades of negligence and improper land use management. The ongoing forest restoration efforts, including demarcation, installation of buffer zone, educating the general public about the need for sustainable environmental conservation in such areas is highly essential and should be sustained. In addition it is imperative that the restoration and rehabilitation efforts are fortified through integration with potential socio-economic activities that can support the survival of the riparian rural communities. This will minimize encroachment, poaching, charcoal burning and deforestation among other vices which are currently experienced.

The entire South West Mau forest buffer stretch is estimated at 440Ha (44Km at 100m width) and lies between Kericho and Kuresoi North. More than half of the total stretch 222Ha (23km at 100m width) have already been established with tea buffer while the balance of 21km is not established.

The proponent intends to extend the existing buffer on the remaining stretch of 210Ha (21Km long at 100m width) between Kericho and Kuresoi North. (GPS coordinates: 0°18'51.8"S 35°28'47.4"E and 0°27'44.7"S 35°30'40.9"E). The buffer will consist of 70% tea plantation and 30% conservation area (under natural/indigenous vegetation) and riparian area (grass and Bamboo vegetation).

The project's primary objective is to protect and conserve South West Mau Forest Zones through establishment and management of tea plantation belt as physical buffer zone between forests designated for protection and local populations. The project activities are also expected to provide alternative employment and income sources for the rural population within the project areas. The project will also enhanced natural forests protection to the benefit of agriculture through soil and water conservation.

ESIA Methodology

The ESIA was carried out through physical examination, literature review and interviews. It encompassed all aspects pertaining to the physical, ecological, socio-cultural, health and safety

conditions at the site and its environs during and after implementation. The study was based on laid down scientific qualitative procedures with the most recent methodologies and analysis required in ESIA and, strictly adheres to the relevant legislative framework. The study examined implementation approach and design considerations, as well as institutional aspects (the tea industry, forestry and agricultural institutions) before highlighting relevant issues in the following areas: (a) forestry and conservation; (b) agro-ecological practices: and (c) tea production. The study then proposed an action plan for the proposed project, with detailed conclusions and recommendations for establishment of tea buffer zone.

An overview of the key environmental, health & safety legislation and regulations of relevance to each project component were taken into account during the ESIA exercise. The environmental regulatory context for tea industry, forestry and agricultural sector has been described in the legal section. In addition, the international conventions and treaties governing the conservation of biodiversity and control of greenhouse gases emissions have been considered, and their relevance to each of the components assessed.

Potential Environmental Impacts

Potential impacts during implementation and/or operation include: impact on biodiversity, soil resources, impact on water resources, occupational and public health hazards, traffic impacts, noise, dust, exhaust emissions and impacts from waste generated. Positive impacts of the proposed project include improved forest conservation and improved economy.

Mitigation of Significant Environmental Impacts

A comprehensive Environmental and Social Management Plan has been prepared to assist the proponent address the identified adverse environmental impacts of the project. The ESMP outlines the monitoring frequency, cost measurable and verifiable indicators as well as the parties to undertake the required actions. Strict adherence to the Environmental and Social Management Plan provided is recommended to ensure environmental sustainability of the project.

Conclusions and recommendations

In summary the proposed project has been assessed with an objective to determine the possible socio- economic and environmental impacts (both positive and negative) it is likely to have on environment and to propose appropriate mitigation measures. The proposed project will have numerous positive impacts some of which include improved forest conservation, creation of employment, improved infrastructure and increased revenue among others. The negative impacts of the project are largely on potential soil erosion/pollution, water contamination and occupation health and safety. However measures to mitigate these impacts has been proposed and presented largely in the report and summarized in the EMP. It is recommended that, the proponent should focus on implementing the measures outlined in the ESMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern the establishment and management of the proposed buffer. It is also recommended that the positive impacts that emanate from such activities should be enhanced.

Given the foregoing considerations ranging from environmental and socio-economic as well as policy considerations, it's expected that the project will contribute immensely to forest conservation and local economy. This EIA is hereby submitted for scrutiny and possible approval to facilitate the inception of the project.

Advert Summary

The entire South West Mau forest buffer stretch is estimated at 440Ha (44Km at 100m width) and lies between Kericho and Kuresoi North. More than half of the total stretch 222Ha (23km at 100m width) have already been established with tea buffer while the balance of 21km is not established.

The proponent intends to extend the existing buffer on the remaining stretch of 210Ha (21Km long at 100m width) between Kericho and Kuresoi North. (GPS coordinates: 0°18'51.8"S 35°28'47.4"E and 0°27'44.7"S 35°30'40.9"E). The buffer will consist of 70% tea plantation and 30% conservation areas.

The project's primary objective is to protect and conserve South West Mau Forest Zones through establishment of a tea belt as physical buffer zone. Other benefit of the project include: soil and water conservation, creation of employment and income sources.

Table 0-1: Summary of potential environmental impacts and mitigation measures

Environmental Impact	Proposed Mitigation measures
Loss of biodiversity	▪ Reserve at least 30% of the buffer as conservation zones preferable through indigenous species. ▪ Provide riparian vegetation (grass/bamboo) along the river riparian ▪ Provide clear demarcation of boundaries- (maximum width of 100m) ▪ Restrict any disturbance of vegetation on the actual project area and avoid spill over effects.
Soil erosion and pollution	▪ Provided soil erosion measures/structures within the buffers. ▪ Practice low-impact tillage methods to reduce disturbances to soil; ▪ Use green manure to produce organic fertilizers ▪ Minimize grease and oil leakages from machinery. ▪ Re-vegetate all open or disturbed area. ▪ Avoid tillage on steep slopes;
Impacts of agro-chemicals and fertilizers on soil	▪ Improve organic content of the soil so as to improve the fertilizer use efficiency while reducing their extensive use. ▪ Conduct regular soil nutrient/fertility tests to determine nutrients level of the soil before establishment.
Water contamination	▪ Avoid stockpiling excavated materials within area prone to flooding. ▪ Hazardous materials should not be stored above flood level and at least 40 meters from any water course ▪ Where possible, tillage/ploughing should be done during dry season.
Impact on animals/wildlife	▪ Erect barriers to all open excavations to keep off wildlife and workers.
Dust and exhaust emissions	▪ Provide and enforce speed limits. ▪ Provide adequate PPEs for workers
Noise and vibration pollution	▪ Instruct drivers to avoid gunning of vehicle engines or hooting especially when passing through sensitive areas. ▪ Maintain machineries in good condition in order to reduce noise.
Waste generation	▪ Provide and maintain adequate sanitary facilities. ▪ Encourage use of compost from plant waste
Occupational Health and Safety	▪ Provide all workers with PPEs and enforce their use. ▪ Train workers on fire safety and basic first aid procedures. ▪ Provide workmen's compensation insurance cover for workers. ▪ Provide properly stocked first aid boxes and a trained first aider.

Environmental Impact	Proposed Mitigation measures
	▪ Create EHS awareness among the workers ▪ All access to the hazardous areas should be secured. ▪ Store chemicals according to MSDS. ▪ Support implementation of HIV/AIDS prevention programmes
Traffic impacts	▪ Minimize damage to existing road and drainage system. ▪ Avoid spillages of materials on the roads ▪ Provide adequate warnings on use of heavy vehicles/machinery ▪ Ensure strict enforcement of on and off -site speed limits
Socio-economic	▪ Consider local community for employment opportunities.

1.0 INTRODUCTION

1.1 Background

Kenya is an agricultural country with a slow growing manufacturing sector. About 80% of the population is dependent on the agricultural sector for survival means. The sector accounts for at least 70% of the national employment and contributes up to 27% of the GDP. It is the single most important sector of the economy. However, sustainability of agricultural production depends among others, on the ability of the country to protect the natural forests that are important to soil and soil water conservation.

With a fast growing human population, currently at 48 million, farm sizes and land productivity have been on the decrease due to population pressure and environmental degradation. While the farming communities are aware of the role of forests in their agricultural ecosystem and the need to plant trees and protect existing natural forests; diminishing farm sizes, charcoal burning, poaching and the encroachment on the forest reserves are great constraints. Kenya's closed canopy natural forests are currently estimated to cover only 2% of country land area. With the current wood demand and forest utilisation scenario, that is not likely to change in the near future, it calls for more efforts at protecting existing natural forests and the afforestation of degraded lands nation-wide. Protecting natural vegetation also remain important to the wildlife sub-sector that forms the backbone of the country's eco-tourism industry.

The need to protect forests in Kenya goes beyond the easily recognizable environmental functions of forests. In spite of the importance of forests to the survival of rural communities in Kenya, the demand for land by the growing population pose serious danger to forest conservation. Nevertheless, the Kenyan Government has taken decision at highest level to give priority to environmental protection in general and to forest conservation in particular. Government's policy has emphasized the need to conserve and protect forests for the benefit of future generations while acknowledging the immediate benefits to the present generation in terms of the protection of water catchments' areas and the preservation of the fertility of agricultural soils. It is in this context that the Nyayo Tea Zones Development was originally introduced, with a view to providing not only a physical buffer between forests designated for protection and local populations but also alternative employment and income sources for these populations.

Nyayo Tea Zones Development Corporation

Nyayo Tea Zones Development Corporation (NTZDC) was established through a Legal Gazette Notice No. 265 of 1986, which was later amended by Legal Gazette Notice No. 30 of 2002, as a State Corporation with the aim of promoting forest conservation by providing buffer zones of tea and assorted tree species to check against human encroachment into the forestland.

The corporation is mandated to protect the gazetted forests from human encroachment by establishing continuous belts of tea bushes and assorted tree species which acts as a buffer between forests and communities living adjacent to the forests. The tea zones not only help to protect the forests but also in the rehabilitation of ecologically fragile areas.

The corporation has established tea buffer belts in the five water towers of Mt. Kenya Forest, Aberdare Forest, Mau Forest Complex, the Nandi, Kaptagat and Kakamega Forests, Mt. Elgon

Forest and Cheranganyig Hills. Two additional new tea buffer zones are to be expanded in South West Mau and Masai Ol Posimoru.

Forest Conservation

Since inception, the Corporation has established 5,235 hectares of forest cover in form of assorted tree species. The Corporation has played a leading role in the preservation of biological diversity of Kenya's highland forests. The tea zones have acted as 'live' fences against human intrusion. In the areas where the Corporation is situated, illegal logging has been greatly reduced and encroachment stopped. In fact, since the buffer was established, there has been a resurgence of some of the seasonal rivers that had dried up in the conserved areas.

In order to be more effective in achieving its overall mandate, the Corporation continues to employ new strategies in the conservation, protection and expansion of Kenya's natural forest cover. This is achieved by enhancing consolidation of physical buffer zones along the gazetted forests through the establishment and management of fuel wood, indigenous trees and tea plantations. In addition, the Corporation continue to support the development of agro-forestry for buffer zone communities and engage their participation in forest planning and management.

The forest expansions are expected to promote environmental conservation and economic prosperity for the local communities in line with the Kenya Vision 2030. Ultimately, however, forest conservation efforts cannot succeed without the participation of various stakeholders. Therefore the Corporation works closely with local communities, donors and other government agencies like the Kenya Forest Service to ensure not just the planting of new forests, but protection of the existing ones.

It's noteworthy that the Corporation's conservation efforts, which have successfully stopped human encroachment into the gazetted forests, have also tremendously mitigated the negative impact of deforestation on agriculture and the environment in Kenya such as soil erosion and desertification.

Tea Production

Production of tea by Nyayo Tea Zones Development Corporation has registered steady growth since the first bushes matured in 1989. The Corporation has since its inception established 3,488 hectares of tea in the 17 zones across the country.

Over the years, green leaf production has increased from 3 million kilogrammes in the 1990's to 26 million kilogrammes produced in the 2014/15 financial year. The increased green leaf production has correspondingly increased the Corporation's revenue and enabled it become financially self-reliant.

The present management team at the Corporation has tremendously expanded and improved the quality of tea it produces, including planting an additional 1,500 hectares of tea and infilling which is ongoing. The tea expansion is expected to increase green leaf production to 30 million kilogrammes in the next few years.

Nyayo Tea Zones has also constructed its own factory, Kipchabo Tea Factory located in Nandi County. This has helped minimize losses of unprocessed green leaf during flush periods in the factory catchment's area.

1.2 Rationale and objective of ESIA

The ESIA has been undertaken to fulfill the legal requirements as outlined in Sections 58-69 of the Environmental Management and Co-ordination (Amendment) Act (No. 5 of 2015) and Part II of the Environmental (Impact Assessment and Audit) Regulations 2003.

The specific objectives of the ESIA are to:

- Collect and analyse baseline information for physical, biological and socio-economic environments in the project area;
- Discuss the legal and regulatory issues associated with the proposed project;
- Predict and assess the potential impacts of the project;
- Propose appropriate mitigation measures for any negative impacts and enhancement measures for the positive impacts resulting from implementing the project;
- Conduct public participation so as to incorporate their views in project implementation;
- Prepare an Environmental and Social Management Plan;
- Prepare an ESIA Study Report for submission to NEMA.

1.3 Methodology of ESIA

The environmental assessment is based upon desk studies, field assessments, discussions with the proponent and stakeholders; and has been carried out in the following key steps:

- Site visit- information data collection, desktop studies (associated documentation)
- Physical assessment of the project site and activities including the surrounding areas
- Public consultation and participation.
- Evaluation and verification of findings
- Draft ESIA report
- Preparation of final ESIA report

1.4 Report Structure

The scope of the study complied with Part IV of the EMCA and the Environmental (Impact Assessment and Audit) Regulations 2003. It is structured as follows:

Preface	The executive summary which highlights the main results of the ESIA
Section 1	Provides an introduction to the project and sets out the contents of the report
Section 2	Outlines the relevant environmental policy, institutional and legislative framework
Section 3	Describes the baseline environmental conditions.
Section 4	Provides the project description and activities.
Section 5	Provides the public consultation process.
Section 6	Describes the alternative options for the project.
Section 7	Describes the potential environmental impacts of the buffer zone
Section 8	Presents an Environmental and Social Management Plan
Section 9	Presents the conclusion and recommendations.

2.0 POLICY, LEGAL AND REGULATORY FRAMEWORK

2.1 National Policy Framework

Several policies have been developed over the years to guide the development and management of proposed projects to ensure both economic and social sustainability these policies are discussed below.

The Kenya Government's environmental policy aims at integrating environmental aspects into national development plans. The broad objectives of the national environmental policy include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations, while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigation effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.1.1 The National Environmental Action Plan Framework, 2009 - 2013

The National Environmental Action Plan Framework is the second national environmental policy after the 1994 National Environmental Action Plan (NEAP). The development of NEAP is provided for by EMCA, 2015 which requires preparation of Environmental Action Plan at different levels; County, Sub-County and national levels. The framework recognizes the intertwined linkages between economic growth and environment in Kenya. It highlights priority themes and activities for the country towards achieving sustainable environment.

The policy framework among others, proposes integration of environmental concerns into regional and local development plans, promotion of appropriate land uses and enforcement of EMCA, 2015 Amendment Act and its subsidiary and other relevant legislations. The policy framework also advocates for efficient water harvesting, storage and usage. On human settlements and infrastructure, this policy framework recognizes the associated environmental issues. These include waste management, sanitation, diseases, land use changes in conservation areas, demand for water, energy, construction materials, pollution, land degradation, biodiversity loss etc. In managing operations of the proposed project, consideration of the highlighted issues is vital towards contribution to the national sustainable development goals.

Multiple stakeholders' involvement inclusive of the private sector is advocated for within the implementation of this framework towards achievement of sustainable development goals. Finally, the framework also advocates for monitoring and evaluation to ensure effective and efficient environmental policy implementation.

The NEAP for Kenya was prepared in mid 1990s. It was a deliberate policy effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of the societal decision-making.

2.1.2 Policy Paper on Environment and Development (Sessional Paper No. 6 of 1999)

The key objectives of the policy include:

- To ensure that from the onset, all the development policies, programmes and projects take environmental considerations into account;
- To ensure that an independent EIA report is prepared for any industrial venture or other development before implementation; and
- To come with effluent standards that will conform to acceptable health guidelines.

Under this paper, broad categories of development issues have been covered that require a sustainable development approach. These issues relate to waste management and human settlement. The policy recommends the need for enhanced reuse/recycling of the residues including waste water, use of raw or non-waste technologies, increased public awareness rising and appreciation of the clean environment. It also encourages participation of the stakeholders in the management of the waste within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others.

2.1.3 Kenya Vision 2030

Kenya Vision 2030 is an overarching, long-term development programme, with the objective to transform Kenya into a "newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment". Its three economic pillars (economic, social and political) aim to achieve an average economic growth rate of 10 percent per annum, and the agricultural industry is recognized among the key contributors to assist in the delivery of objectives. Kenya Vision 2030, in terms of the agricultural industry, intends to reach the status of "a food-secure and prosperous nation", through "an innovative, commercially oriented and competitive agriculture". The ambitions of this blueprint, however, may increase GHG emissions.

The transformations that are required to take place under the economic pillar of Kenya Vision 2030 are as follows:

- Restructure the key institutions relating to agriculture, livestock, forestry and wildlife, in order to promote agricultural growth;
- Increase the productivity of crops, livestock and tree cover;
- Introduce land-use policies to improve output;
- Develop more irrigated areas in arid and semi-arid lands for crops and livestock;
- Improve market access for smallholders through improved supply chain management; and
- Provide added value to farm crops, livestock and forestry products to enable their access to local, regional and international markets.

Despite the central role of tea in the Kenyan economy, the threat of climate change and the factors necessary to adopt relevant measures have not been adequately highlighted in the key strategies of the economic pillar. There is, however, a commitment to improve research and development, strengthen the human and financial capacities of research institutions and strengthen collaboration between research, policy and public-private partnerships.

2.1.4 Agriculture sector development strategy

The Agriculture Sector Development Strategy (ASDS) is the overarching policy framework for agriculture development in Kenya. Its goal is "to achieve a progressive reduction in unemployment and poverty, the two major challenges of poverty and food security that Kenya continues to face".

It is aligned to Kenya Vision 2030 and guides the sector's medium-term plans. ASDS places the principles of the Comprehensive Africa Agriculture Development Program on a national platform, under the New Partnership for Africa's Development. Through this strategy, it is anticipated that the tea industry will grow at an annual rate of 7 percent for the period 2010-2020. The programme takes into account the impact of climate change and the associated risks to Kenya's climate-sensitive agriculture sector - especially in terms of its leading industrial crop - in relation to its foreign exchange revenue and GDP. In addition, the strategy outlines the policies and institutional adjustments that are necessary to create a vibrant and productive industry, recognizing at the same time the importance of public-private partnerships within the industry.

ASDS proposes a consolidation of numerous agriculture sector reforms to streamline the legislative framework that governs the agriculture sector in Kenya. It aims to foster agricultural and land-use best practices and align the sector to the Constitution of Kenya (2010).

Some of the reforms and pilot projects being implemented in the sector that could benefit the tea industry are the following Consolidated Agricultural Policy Reform Legislation: The Agriculture, Livestock, Fisheries and Food Authority Act 2012; Kenya Agricultural and Livestock Research Act 2012; Pyrethrum Act 2012; and Crop Act 2012. The Fertilizer Cost-Reduction Initiative: To make fertilizer more affordable and easily accessible to farmers in order to increase agricultural production. In this regard, the Kenyan Government has been procuring and distributing fertilizer at a subsidized rate to farmers across the country in order to stabilize its price. In addition, the Government has carried out a feasibility study for locally manufactured fertilizer. Improvement of weather and climate forecasts: To improve the issuance of timely and accurate weather and climate forecasts and provide early warning system information by:

- Ensuring the continued operation of rainfall stations, especially those in the tea growing areas;
- Strengthening existing networks of agro-meteorological stations to cover the tea growing areas; and
- Incentivizing relevant institutions (e.g. TRFK, TBK and the Kenya Meteorological Society) to jointly research extreme weather events that may affect the tea sector.

Although the ASDS does not explicitly identify the challenges specific to the tea industry, it does recognize the potential of value addition to increase its competitiveness in the global market. It should be noted that despite the importance of tea in the country's economy, it so far has been operating without a policy framework.

2.1.5 National climate change response strategy, 2010

The National Climate Change Response Strategy (NCCRS) was developed by the previous Ministry of Environment and Mineral Resources in response to the United Nations Framework Convention on Climate Change. The NCCRS is founded on the principle of mainstreaming climate proofing and climate change adaptation in the planning process of the agriculture sector. The strategy recognizes the impact of climate change and the risk of crop failure on rainfed agriculture, as well as the differences between the production and market share of small- and large-scale farming.

Furthermore, it calls for an increased capacity for research in the industry to enhance productivity; adaptability and mitigation; product quality and safety; and the competitiveness of agricultural products in domestic and global markets.

A key outcome of the NCCRS is the National Climate Change Action Plan, which calls for measures to enable Kenya to transition into a low-carbon, climate resilient position to improve people's livelihoods, while taking into account its Vision 2030 goals. The plan acknowledges that Kenya's growing population and urbanization have the potential to increase GHG emissions and, therefore, intensify climate-change risk and vulnerability

The NCCRS comprises eight components to guide the country towards a low-carbon, climate-resilient course, thus acknowledging the sensitivity of the agricultural industry in relation to climate change. It recommends adaptation by agricultural systems and outlines the priorities to expand climate resilience. It also advocates the mainstreaming of such considerations in all sector programmes. The NCCRS indicates that the agriculture industry is a growing source of GHG emissions, responsible for approximately 30 percent of Kenya's GHG emissions in 2010. The strategy includes a warning that industry emissions could increase from 20 million metric tonnes of carbon dioxide equivalent (MtCO MtCO) in 2010 to 27 by 2030. In response, the Ministry of Agriculture, Livestock and Fisheries (MALF) has established a climate change unit that coordinates the implementation of climate-related programmes and projects in the industry. It has outlined priority adaptation actions to increase climate resilience of the industry.

2.1.6 The National Biodiversity Strategy and Action Plan, 2007

The overall objective of the National Biodiversity Strategy and Action Plan (NBSAP) is to address the national and international undertakings elaborated in Article 6 of the Convention on Biological Diversity. It is a national framework of action to ensure that the present rate of biodiversity loss is reversed and the present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation.

2.1.7 National Policy on Water Resources Management and Development

While the National policy on water resources management and development (1999) seeks to enhance systematic development of facilities in all sectors for promotion of the country's socio-economic progress, it also recognizes the by-products of this process as wastewater. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution.

Industrial and business development activities therefore should be accompanied by corresponding waste management systems to handle the wastewater and other waste emanating there from. The same project requires that such projects should also undergo comprehensive ESIA studies that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighborhood and further downstream are not negatively impacted by the emissions. As a follow-up to this, EMCA, 1999 requires annual environmental audits to be conducted in order to ensure that mitigation measures and other improvements identified during ESIA study are implemented.

In addition, the policy provides for charging levies on waste on the basis of quantity and quality. The "polluter-pays-principle" applies in which case parties contaminating water are required to meet the appropriate cost of remediation. The policy provides for establishment of standards to protect water bodies receiving waste water, a process that culminated in the enactment of the Environmental Management and Coordination (Waste management) Regulations 2006.

Water is at the heart of all development, because it is the key resource for health, food and cash crops, hydropower and the ecosystems. Safe, adequate, reliable water supplies, good sanitation and sound hygiene are therefore essential to achieving the Millennium Development Goals including those on poverty, hunger and the HIV/Aids epidemic

The Kenya government recognizes that the current arrangement are inappropriate and a bottleneck to achieving the set poverty reduction objectives. The government therefore started a process of comprehensive policy and institutional reform that will facilitate pro-poverty water and sanitation services programs. As a first step, a national water policy on water resources management and development was created in 1999. It has four broad objectives:

- To preserve, conserve and protect available water resources and allocate them in a sustainable, rational and economic way;
- To supply water of good quality and in sufficient quantities to the various water needs, while ensuring safe disposal of waste water and environmental protection;
- To establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector promoting and supporting participation of users;
- To develop a sound and sustainable financing mechanism for effective water supply and sanitation development

2.2 Legal Framework

2.2.1 Environment Management and Coordination (Amendment) Act (No. 5 of 2015)

The Environmental Management and Co-ordination (Amendment) Act (No. 5 of 2015) is an act of parliament to provide for the establishment of an appropriate legal and institutional framework for the management of the environment and for related matters.

National Environment Management Authority is a body established under the Act. NEMA has the legal authority to exercise general supervision and co-ordination over all matters relating to the environment, and is the principal instrument of the Government charged with the implementation of all policies relating to the environment.

Part II of the Act states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. It is worth noting that the entitlement to a clean and healthy environment carries a correlative duty. Hence, there is not only the entitlement to a clean and healthy environment, but also the duty to ensure that the environment is not degraded in order to facilitate one's own as well as other persons' enjoyment of the environment.

According to section 58 of the act, an environmental impact assessment study needs to be carried out on all projects specified in the second schedule of the act that are likely to have a significant impact on the environment. This proposed project is considered to fall under the second schedule of the Act.

2.2.2 The Water Act 2016

The Water Act 2016 is an Act of Parliament meant to provide for the management, conservation, use and control of water resources and for the acquisition and regulation or rights to use water. This Act is also meant to provide for the regulation and management of water supply and sewerage services; to repeal the Water Act 2002 and certain provisions of the Local Government Act; and for related purposes.

The purpose of the Water Act is to provide for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water, to provide for the regulation and management of water supply and sewerage services. Except for waters that are wholly situated in a private landowner's domain, the Act vests the rights over all surface and ground water in the state. This is only subject to the rights which users may acquire under license from time to time.

Part II, section 18 of the act provides for national monitoring and information systems on water resources. Following on this, sub-section 3 allows the Water Resource Management Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specified information, documents, samples or materials on water resources may be kept by a water user and the information thereof furnished to the authority.

Section 94 of the act makes it an offence to through or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing into or near to water resources in such a manner as to cause, or be likely to cause, pollution of the water resource.

2.2.3 The Forest Conservation and Management Act (No. 34 of 2016)

This act has introduced a Forest Board to be responsible for all forest resources in the country as opposed to the current status where the Chief Conservator of Forests is in charge. All activities within the forest reserves in this country that appear in the second schedule of EMCA 2015 have to undergo an ESIA process

2.2.4 The Wildlife Policy and Legislation

The Wildlife Policy Sessional Paper No.3 of 1975 governs conservation of wildlife within and outside protected areas. It also supports community initiatives towards conservation and plays an advisory role to the local communities by providing regulations that enable the generation of optimum returns from wildlife. The policy, however, does not allow consumptive utilization of wildlife resources within the parks, only non–consumptive uses such as recreation and tourism.

The Act and the corresponding policy are now under review, with a view to bringing them in line with the latest thinking and approaches to conservation. They will also provide for greater community/stakeholder participation in the planning and management of these resources countrywide. This should in particular address the conservation of resources outside protected areas.

2.2.5 Wildlife (Conservation and Management) Act, Cap 376

Wildlife (Conservation and management) Act Cap 376 was enacted in 1977 and revised in 1985. In 1989 the act was amended to establish KWS. This Act provides for the protection, management

and conservation of wildlife as a vital national and global heritage, which also makes great contribution to sustainable development. This is achieved through the maintenance of a system of National Parks, National reserves and sanctuaries. The Act specifically provides for the protection and regulation of protected animals, game animals and game birds as defined in three schedules.

KWS prime objective is to ensure that wildlife is managed and conserved so as to yield to the Nation in general and to individual areas in particular, optimum returns in terms of cultural, aesthetic and scientific gains as well as such economic gains as are incidental to proper wildlife management and conservation and which may be secured without prejudice to such proper management and conservation.

The gazettement of the national parks is presented in section 18, which state as follows:

18. (1) With the agreement of the competent authority, the Minister may, by notice in the Gazette, declare any area of land to be a National Reserve.

(3) The provisions of this Part shall apply to a National Reserve as they apply to a National Park except in so far as – (*a*) They are modified or excluded by any such conditions or restrictions as are mentioned in subsection (2); or (*b*) They are further modified or excluded as the Minister may, by the notice declaring the area to be a National Reserve or by a subsequent notice in the Gazette, otherwise direct.

(4) Any areas which, immediately before the appointed day, were administered by the former Trustees as national reserves became National Reserves.

6. (1) The Minister, after consultation with the competent authority, may by order declare any area of land to be a National Park.

2.2.6 The Fisheries Management and Development Act, 2016

This is an Act of Parliament to provide for the conservation, management and development of fisheries and other aquatic resources to enhance the livelihood of communities dependent on fishing and to establish the Kenya Fisheries Services; and for connected purposes

2.2.7 The Climate Change Act, 2016

This is an Act of Parliament to provide for a regulatory framework for enhanced response to climate change; to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes

2.2.8 The Community Land Act, 2016

This is an Act of Parliament to give effect to Article 63 (5) of 2016. the Constitution; to provide for the recognition, protection and registration of community land rights; management and administration of community land; to provide for the role of county governments in relation to unregistered community land and for connected purposes.

2.2.9 The Agriculture, Fisheries and Food Authority (Amendment) Act No. 37 of 2013

This is an Act of Parliament to amend the Agriculture, Fisheries and Food Authority Act, 2013 and for connected purposes. The act provides legislative control for soil conservation aimed at

stimulating development of agricultural land in accordance with the accepted practices of good land management and husbandry. This Act primarily guides and regulates farming practices and is the principal land use statute covering, *inter-alia,* soil conservation and agricultural land use.

Of direct relevance to the proposed project are the basic land usage rules under the Act, which cover issues such as soil erosion; protection of lands exceeding 12% slope and watercourses. The rule states that "Clearing of vegetation from steep slopes or in areas next to water courses without authorization is forbidden". Basic land usage rules should be observed by members of the proposed project

2.2.10 The Lakes and River Act Chapter 409 Laws of Kenya

This Act provides for protection of River, lakes and associated floral and fauna. The provisions of this Act may be applied in the management of the project.

2.2.11 Public Health Act Cap 242 (Revised Edition 2012)

This Act concerns the protection of public health in Kenya and lays down rules relative to, among other things, food hygiene and protection of foodstuffs, the keeping of animals, protection of public water supplies, the prevention and destruction of mosquitos and the abatement of nuisances including nuisances arising from sewerage. The Act establishes the Central Board of Health and a county health management board in each county. It also establishes and defines functions of health authorities.

2.2.12 Physical Planning Act Cap 286

The said Act section 29 empowers the local Authorities to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section allows for prohibition or control of the use and development of an area.

Section 30 state that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development permission granted by the respective local Authority.

2.2.13 The National Construction Authority Act No. 41 of 2011

This is an Act of Parliament to provide for the establishment, powers and functions of the National Construction Authority and for connected purposes.

The National Construction Authority in short NCA Kenya is a body constituted under Act No. 41 of 2011 Laws of Kenya. Contractors operating or willing to undertake construction operations in Kenya are required by law to register through the NCA.

NCA is mandated to clear Kenya builders and contractors as a way of eliminating rogue contractors and malpractices in building and construction. The authority, which has recently started inspecting construction and building projects around the country to ensure high quality of work and close projects posing health risks and collapse hazards, is expected to provide the regulatory framework for registration and renewal of contractors

National Construction Authority Regulations, 2014

The regulations deal with:

- Registration of contractors
- Identification and reporting of construction
- Works, contractors or projects by owner
- Certification and accreditation of skilled
- Construction workers and construction sire supervisors
- Collection and payment of construction levy

2.2.14 Building Code 1968

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local Authority for permit to connect to the sewer line and all the wastewater must be discharged in to sewers. The code also prohibits construction of structures or building on sewer lines.

The Building Code, a regulatory document which spells out the regulations that should govern any type of buildings constructed in the country. Over the years the government has been trying to prepare a new building code. However this is yet to be realized.

2.2.15 Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. During the construction phase the works contractor must adhere to the requirements of this Act.

(i) Safety and Health committee rules of 2004

These rules state that any employer/proponent/occupier who employs more than twenty persons must establish a committee to address the health, safety and welfare of workers. The employer must also cause to be carried out a health and safety audit of all his operations on an annual basis by a registered health and safety advisor who should forward such a report to the DOHSS.

(ii) First Aid Rules

These have details on first aid requirements in terms of facilities and capacity building among non medical workers.

(iii) Hazardous Substances Rules

These regulate the handling, transportation and use of certain listed chemicals which may have negative effects on the body when one is exposed.

(iv) Noise Prevention and Control Rules of 2005

These rules have set minimum maximum exposure limits beyond which workers and members of the public should not be exposed to noise without adequate means of protection. The rules also have limits for exposure out of workplaces. The rules have several recommendations on a

comprehensive noise control program for workplaces that includes a requirement for medical examination of workers who are exposed to noise. The rules have also set the minimum noise levels that should emanate from a facility to public/neighbouring areas by day or by night

(v) Medical Examination Rules

The rules offer a guide on the need and target of workers who have to undergo regular medical examination to identify the symptoms of hazardous exposures on the body. This is with a sole purpose of monitoring exposure for remedial action.

(vi) Building Operations and Works of Engineering Rules

The rules guide health and safety matters in all building/construction and civil engineering works. These rules state clearly that it is the duty of the proponent to ensure health, safety and welfare of workers and authorized visitors to the site before commencement of operations, the proponent should notify the DOHSS of the intention so that from then on the Director advises and follows up on the necessary conditions to safeguard the health, safety and welfare of workers on site.

The rules also state that qualified and experienced persons must be appointed to act as safety supervisors by the proponent. These should supervise the enforcement of standards to achieve the objectives mentioned above. The rules have specific sections on excavations, transport, demolitions, formwork and scaffolds, lifting and lifting equipment and other safety measures.

2.2.16 County Governments Act 2012

This act gives effect to Chapter Eleven of the Constitution, which provides the county governments the powers to function and take responsibilities for the delivery of services within their designated counties including management of environment and natural resources among other responsibilities. The functions provided for in Article 186 of the constitution and as assigned in the Fourth Schedule of the Constitution. These include management of water resources, biodiversity, forests, and National Reserves among others.

2.2.17 Traffic Act (Cap 403)

The act it prohibits obstruction of traffic, either by persons or facilities constructed in such a way as to interfere with the flow of traffic on roads or road reserves. The law also regulates the quality of exhaust emissions from such mobile vehicles.

2.2.18 Occupier's Liability Act Cap. 34

The act regulates the duty that an occupier of premises owes to his visitors in respect of dangers due to the state of the premises or to things done or omitted to be done on them. It requires that the occupier warn the visitors of the likelihood of dangers within his premises to enable the visitor to be reasonably safe.

2.3 Regulatory framework for Tea Production

The tea industry is well developed and is controlled by law under the Tea Act (Chapter 343 of the Laws of Kenya). The Tea Act established TBK, which falls under MALF as the body responsible for

regulating the industry with regard to the growing, research, manufacture, trade and promotion of tea. TBK disseminates information relating to tea and advises the Government on policy issues. The Tea Act governs the registration of growers, manufacture, and export relating to tea, as well as the Board's financial provisions, which include tax on tea, allocation of TBK cash flows, investment and borrowing. Since 2013, the legal framework within the tea sector has changed. The tea industry is now controlled by law under the Crops Act, 2013 (which replaces the Tea Act). The Tea Board of Kenya was abolished and was turned into the Tea Directorate under the Agriculture, Food and Fisheries Authority (AFFA).

The Kenya Agricultural and Livestock Research Act, 2013 established the Kenya Agricultural and Livestock Research Organization (KALRO) while the Tea Research Foundation of Kenya (TRFK) has become the Tea Research Institute (TRI) which is part of KALRO.

(i) Establishment of new tea farms

In order to establish a new tea plantation, a farmer must meet certain requirements, such as (i) the land must be within the demarcation of the Brown lines and (ii) TRFK is to provide technical support. There are two reasons for this. The first relates to preventing the planting of tea in unsuitable regions, as well as controlling the soil types, which could reduce the quality of Kenyan tea. The second reason is to safeguard the supply of agricultural goods (mainly food crops) in tea producing areas.

(ii) Licensing of new factories

TBK regulates and controls the cultivation of tea, registers the tea growers and overseas management agents. It also licenses the manufacturing factories and regulates and controls manufacturing methods, ensuring that there are adequate tea leaves to meet processing capacity and avoiding over-capacity in any given area. Licensed factories are required to maintain, on behalf of TBK, a register of the growers that distribute to them. Prior to issuing a licence to new investors, TBK decides the distribution of growers between existing and new factories. Licences are issued to factories or firms that have at least 250 ha of planted tea bushes. They may also be applied for by a group of persons or business on the condition that there are at least 250 ha of tea bushes and that the land parcels are within a 50-kilometre (km) radius. In the case of high-value or specialty teas, TBK may grant the licence based on the economic viability, technology used or range of products. TBK may modify, cancel or suspend a licence that is issued to a company if the terms and conditions of the licence are violated.

(iii) Tea ad valorem levy, 2011

MALF has enacted a value added levy under the Tea Act, payable at the rate of 1 percent of the customs value for manufactured tea exports and imports, excluding bulk tea imports into Kenya for blending and re-export. Of this, 50 percent is passed on to TBK, 40 percent to TRFK and 10 percent flows into infrastructure. Manufactured tea that is packed in Kenya, in accordance with Kenya Standard 1927:2005 (tea packets &containers), however, is exempt from value added tax.

2.4 Regulatory Framework

2.4.1 Environmental Impact Assessment and Environmental Audit regulations, 2003

The regulations apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act.

The regulation state as follows: 4. (1) No proponent shall implement a project - (*a*) Likely to have a negative environmental impact; or (*b*) For which an environmental impact assessment is required under the Act or these Regulations; unless an environmental impact assessment has been concluded and approved in accordance with these Regulations. (2) No licensing authority under any law in force in Kenya shall issue a licence for any project for which an environmental impact assessment is required under the Act unless the applicant produces to the licensing authority a licence of environmental impact assessment issued by the Authority under these Regulations. (3) No licensing authority under any law in force in Kenya shall issue a trading, commercial or development permit or license for any micro project activity likely to have cumulative significant negative environmental impact before it ensures that a strategic environmental plan encompassing mitigation measures and approved by the Authority is in place.

The proposed project is classified as a high risk project by the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2016 i.e. Further the Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2019 requires projects classified under high risk projects to conduct and submit to NEMA an Environmental Impact Assessment Study Report.

2.4.2 Waste Management Regulations 2006

These are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Regulations apply to all categories of waste as provided in the Regulations and include: industrial wastes, hazardous and toxic wastes, pesticides and toxic substances, biomedical wastes and radioactive substances.

These Regulations outline requirements for handling, storing, transporting, and treatment / disposal of all waste categories as provided therein.

2.4.3 Water Quality Regulations 2006

These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following:

- Protection of sources of water for domestic use;
- Water for industrial use and effluent discharge;
- Water for agricultural use.

These Regulations outline:

- Quality standards for sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;

- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment

2.4.4 Conservation of Biological Diversity (BD) Regulations 2006

These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes Conservation of threatened species, Inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties.

2.4.5 Fossil Fuel Emission Control Regulations 2006

These regulations are described in Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006. The regulations include internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalysts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

2.4.6 Air Quality Regulations 2014

The objective of the Regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination Act, 1999. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas. The emission standards for mobile sources are however stipulated under KS 1515.

2.4.7 Wetlands, River Banks, Lake Shores & Sea Shore Management Regulations, 2009

The aim of these Regulations is to ensure conservation and sustainable use of river banks, wetlands, Lake Shores and Sea Shore in Kenya. The regulations provide guidelines on the above natural resources management

2.4.8 Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

Section 14 (1) says, where defined work of construction, demolition, mining or quarrying is to be carried out in an area, the Authority may impose requirements on how the work is to be carried out including but not limited to requirements regarding - (a) Machinery that may be used, and (b) The permitted levels of noise as stipulated in the Second and Third Schedules to these Regulations. (2) The relevant lead agency shall ensure that mines & quarries where explosives & machinery used are located in designated areas and not less than two kilometers away from human settlements. (3) Any person carrying out construction, demolition, mining or quarrying work shall ensure that the vibration levels do not exceed 0.5cm per second beyond any source property boundary or 30m from any moving source.

On Permissible noise levels, section 5 say No person shall make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property.

2.5 Institutional Framework

2.5.1 Institutions under EMCA (Amendment) 2015

The Government established the following institutions to implement the Environmental Management and Coordination (Amendment) Act (No. 5 of 2015). National Environmental Council, National Environmental Management Authority, County Environmental Committees, Public Complaints Committee & standards and enforcement Committee

2.5.2 Institutional setup for Tea production in Kenya

The Tea Research Foundations of Kenya

Institutionally, MALF provides direction, while TBK regulates the industry and TRFK. TRFK's objectives are "to promote research and investigate problems related to tea and such other crops and systems of husbandry as are associated with tea throughout Kenya including the productivity (yield), quality and suitability of land in relation to tea planting; and matters ancillary thereto".

Kenya Tea Development Agency Ltd.

The Kenya Tea Development Agency (KTDA) represents smallholder tea farmers (owning less than 2.5 ha) and acts as the management agent for the 67 smallholder factories that are technically owned by the small-scale producers through shareholding. The management of a factory is undertaken by a Board of Directors, elected by the farmers, and technical personnel who are recruited by the Board.

Kenya Tea Growers Association

The Kenya Tea Growers Association (KTGA) is the entity that represents Kenya's industrial estates. Its role is to promote the common interests of its members in the cultivation and manufacture of tea and to promote good industrial relations and sound wage policies for workers. Currently, the tea industry owns 39 factories, each of which operate as an independent entity, including tea management activities such as farm management and green leaf assembling, processing and transportation to markets. In most cases, factories also sell tea using other avenues outside the Mombasa auction market

Nyayo Tea Zones Development Corporation Ltd

The Nyayo Tea Zones Development Corporation Ltd. promotes forest conservation by guarding against human encroachment into forestland. This is done by growing tea and assorted tree buffer belts to surround the forests. The tea zones protect the forests while, at the same time, contribute towards the rehabilitation of fragile ecological areas. The corporation operates in 17 zones across the country with 2 factories.

East Africa Tea Trade Association

The role of the East Africa Tea Trade Association includes facilitating the Mombasa tea auctions; facilitating the settlement of tea trade disputes; promoting the best interests of Africa's tea trade; compiling and circulating statistical information; and promoting close relations within the tea industry.

2.5.3 Institutional Structure of the Water Sector

The National Policy on Water Resources Management and Development and the Water Act 2016, presently guides water resources management. The overall goal of the national water development policy is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way. This policy separates policy formulation, regulation and services provision and defines clear roles for sector actors within a decentralized institutional framework and includes private sector participation and increased community development

Under the policy, the Ministry of Water and Irrigation is responsible for policy development, sector co-ordination, monitoring and supervision to ensure effective Water and Sewerage Services in the Country, sustainability of Water Resources and development of Water resources for irrigation, commercial, industrial, power generation and other uses. The Ministry executes its mandate through the following sector institutions:

Water Resources Authority (WRA)

WRA is a state corporation established under Section 11 of the Water Act, 2016. Pursuant to Section 6 of the Act, the Authority is an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating the use and management of water resources.

WRA was operationalized on 21st of April, 2017 vide Gazette Notice No. 59. However, the Authority has been in existence for 12 years following its establishment under the Water Act, 2002 as Water Resources Management Authority (WRMA).

The powers and functions of WRA which include:

- Developing principles, guidelines and procedures for the allocation of water resources;
- Monitoring the national water resources management strategy;
- Receiving and determining applications for permits for water use;
- Monitoring and enforcing conditions attached to permits for water use;
- Regulating and protecting water resources quality from adverse impacts;
- Managing and protecting water catchments.

Water Services Regulatory Board (WASREB)

The regulatory Board is responsible for the regulation of the water and sewerage services in partnership with the people of Kenya. The mandate of the regulator covers the following key areas;

- Regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution.

- Overseeing the implementation of policies and strategies relating to provision of water services licensing of Water Services Boards and approving their appointed Water Services Providers,
- Monitoring the performance of the Water Services Boards and Water Services Providers,
- Establish the procedure of customer complaints,
- Inform the public on the sector performance,
- Gives advice to the Minister in charge of water affairs.

Water Services Trust Fund (WSTF)

This body assists in the financing of the provision of Water Services to areas of Kenya which are without adequate water services. This shall include providing financing support to improved water services towards;

- Capital investment to community water schemes in underserved areas
- Capacity building activities and initiative among communities
- Water services activities outlined in the Water Services Strategic Plan as prioritized by the Government
- Awareness creation and information dissemination regarding community management of water services
- Active community participation in the management of water services

Water Services Boards (WSBs)

The WSBs are responsible for the efficient and economical provision of water and sewerage services in their areas of jurisdiction. Tana Water Services Board is among the eight Water Services Boards established under the Water Act, 2002 and is mandated to;

- Develop the facilities, prepare business plans and performance targets
- Planning for efficient and economical provision of Water and sewerage services within their areas of jurisdiction;
- Appointing and contracting Water Service Provider
- Asset holding of Central Government facilities

Water Services Providers (WSPs)

Water Service Providers are the utilities or water companies. They are state owned but have been commercialized to improve performance and run like business within a context of efficiency, operational and financial autonomy, accountability and strategic, but minor investment

2.6 International Conventions and Treaties

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment which aims at achieving sustainable development. According to the Registrar of International Treaties and other Agreements in Environment (UNEP 1999), there are 216 treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, protection of natural resources and protection of the atmosphere. The agreements are both regional and international and became legally binding on Kenya upon ratification thereof by the rightfully designated Kenyan

Authority. The agreements of interest to Kenya can be categorized as those for protecting natural resources, atmosphere and social well being of man.

There are 12 agreements of significance to Kenya under protection of natural resources category which the country has signed and ratified. This section reviews a number of policies that are triggered or met by the proposed project:

- United Nations Convention to Combat Desertification (UNFCCC) of 1994
- Convention on Biological Diversity, 1992
- The Convention on Wetlands of International Importance (Ramsar, 1971)
- Kyoto Protocol to the United Nations Framework Convention
- World Commission on Environmental and Development (The Brundtland Commission of 1987)
- Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, 1990
- The Convention of Control of Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly In Africa (UCCD)(1992)
- The Basel Convention

3.0 ENVIRONMENTAL AND SOCIAL BASELINE INFORMATION

3.1 Introduction

The following baseline information describes the environmental, socio-economic and bio-physical characteristics of the site. It is expected that it will provide for a benchmark for continued monitoring and assessment of the impact of project on the environment.

3.2 Geographic location

3.2.1 Mau Forest

The Mau Forests Complex covers approx. 400,000 ha that comprises 22 forest blocks, 21 of which are gazetted as state forests. It is the largest closed-canopy montane forest ecosystem in East Africa, and prior to recent excisions, was larger than Mt. Kenya and the Aberdares combined. The Mau ecosystem is considered as the most important of the five water towers in Kenya, being the upper catchments of many major rivers, which feed, partially or exclusively, the lakes of Natron, Turkana, Baringo, Naivasha, Nakuru and Victoria.

As a consequence of increased population pressure and political conflict, large parts of the Mau Forest have been degraded or transformed into other land use types, leading to a reduction of over 25% of forest cover (Government of Kenya, 2009).

Much of the converted land has become susceptible to soil erosion and this supposedly resulted in a decrease in water quality in rivers and lakes downstream (Olang and Kundu, 2011). Moreover, deforestation has led to an increase of the seasonality of discharge, with rivers like the Mara running at very low levels during dry seasons thereby even affecting the unique Serengeti ecosystem due to decreased water access for wildlife (Milhahn, 2014). Although hydrological change in the Mau Forest and downstream areas is often attributed to land use change and the related loss of forest ecosystem services (e.g. Khamala 2010), very little reliable scientific evidence is available. The relevant research that has been carried out is often model based (e.g., Baker and Miller, 2013; Baldyga et al., 2004; Defersha and Melesse 2012; Mango et al., 2011; Mati et al., 2008; Notter et al., 2007), lacking long-term measurements and thorough understanding of the rainfall-runoff process and water storage, which determine the flow regime in the area as well as downstream. These data and knowledge are essential for the assessment of the effect of land use on water related ecosystem services.

3.2.2 Study area - South West Mau Forest Zones

South West Mau Forest Zones lie within the eastern part of the Sondu-Miriu river basin (3,461 km^2; Figure 1a). The elevation in the study area ranges between 1,700 and 2,700m and the geology is dominated by Tertiary lavas from early Miocene times (Edwards and Blackie, 1979; Figure 1b). The lower part of the study area is characterized by phonolites, but on higher elevations phonolitic nephelinites dominate (Binge, 1962; Woolley, 2001). The soils are stone free, heavily leached and uniform down to a depth of 6m (Edwards and Blackie, 1979); they are classified as mollic Andosols in the eastern part of the study area and humic Nitosols in the remaining majority of the area (Krhoda, 1988).

The area has a bi-modal rainfall pattern, with the 'long rains' falling between April and August and 'short rains' between October and December, while January and February are generally the driest months. Average annual precipitation in Kericho is 1,800 mm per year, but this value decreases with increasing elevation (Krhoda, 1988). The average temperature is 16°C at 2,000 m and does not vary much over the year (Edwards and Blackie, 1981; Krhoda, 1988). Average annual potential evapotranspiration (ET) is 1,570 mm per year, with decreasing ET with increasing elevation (Trabucco and Zomer, 2009).

The land use in the area is a mixture of commercial tea and tree plantations, natural forest and smallholder agriculture (Figure 1c). A belt of natural forest is found between 1,930 and 2,470 m elevation. Commercial and smallholder tea plantations are found below the natural forest, while higher elevations are dominated by smallholder or subsistence agriculture, where the main crops are maize, beans and potatoes. While the southwestern border of the natural forest of the South-West Mau is relatively stable since the establishment of the commercial tea farms, there is much encroachment and forest degradation through cattle grazing, collection of firewood, illegal logging and charcoal burning on the north-eastern side, where the forest borders the smallholder farms.

Figure: 3-1. Maps of the study area: (a) elevation in the South West Mau Forest Zones and surrounding area, (b) lithology in the main and sub-catchments, and (c) land use in the main and sub-catchments.

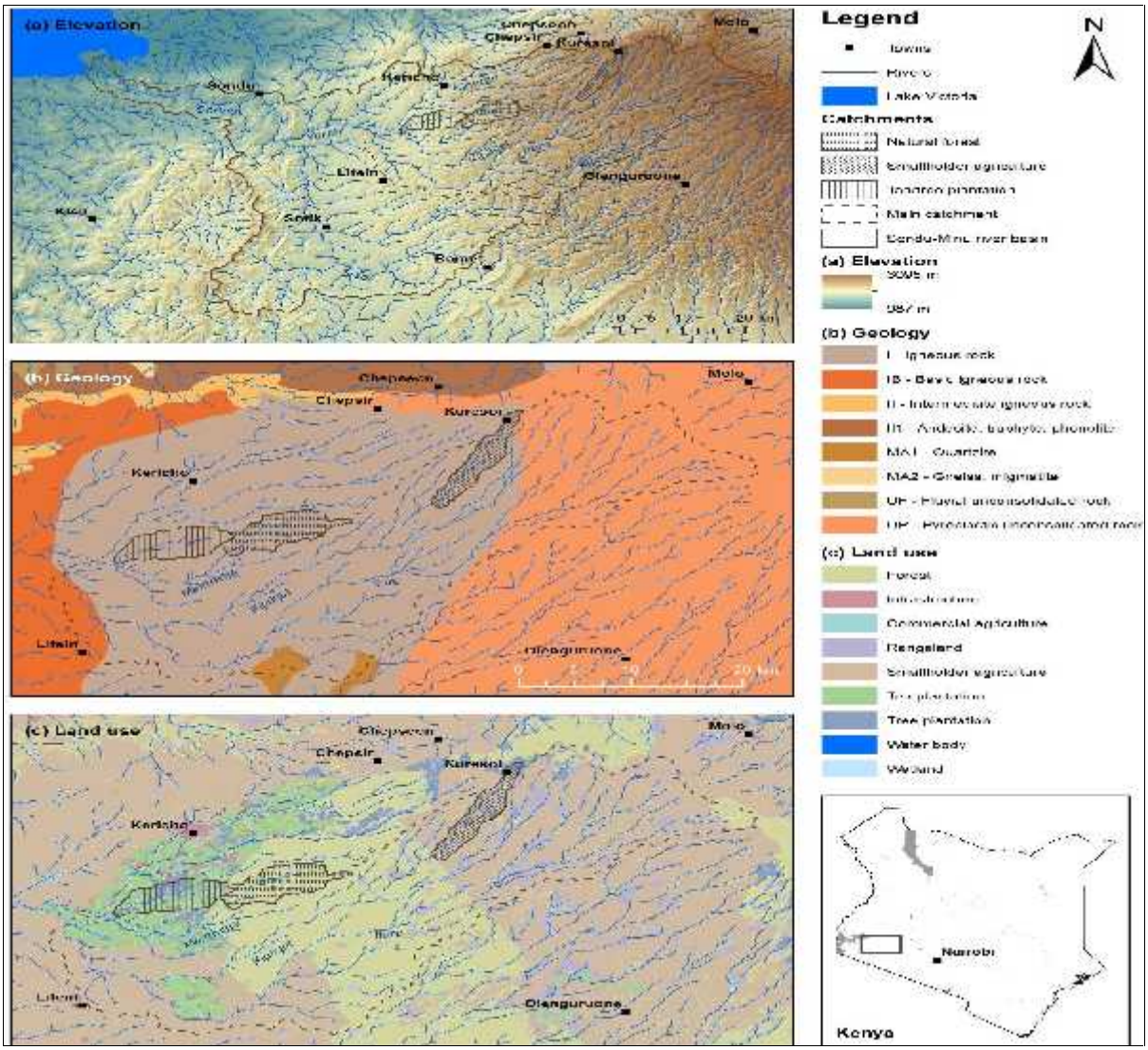


Figure: 3-2. Stable forest mask

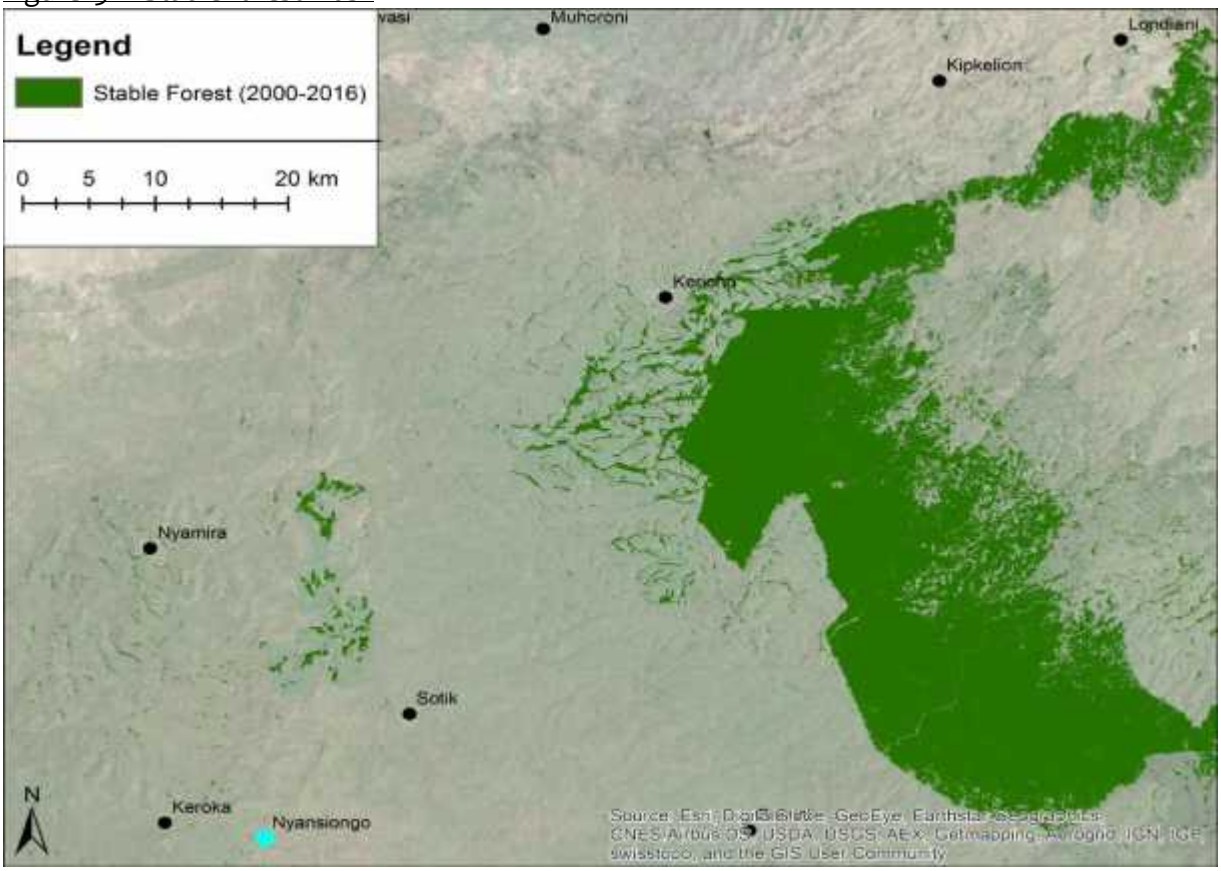


Figure: 3-3. Annual forest degradation maps for the year 2010

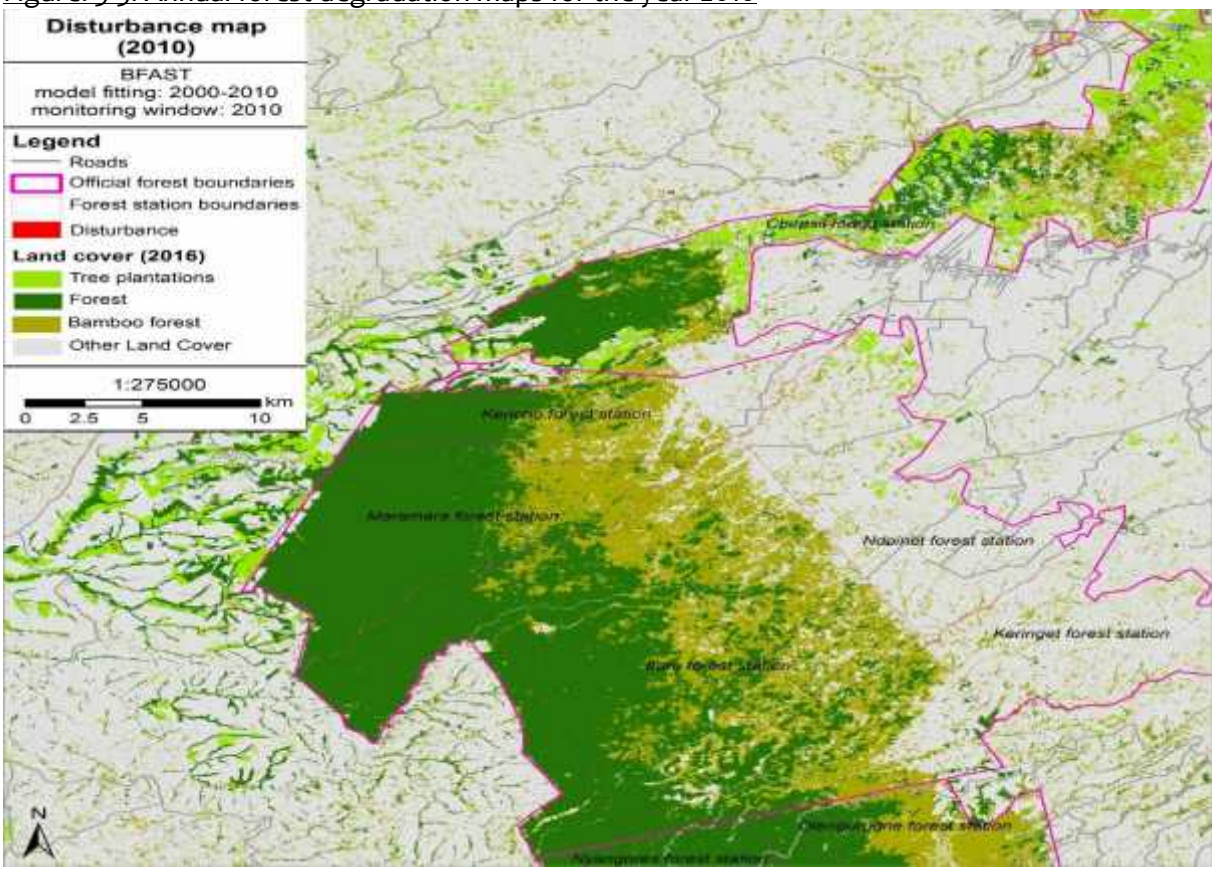


Figure: 3-4. Annual forest degradation maps for the year 2011

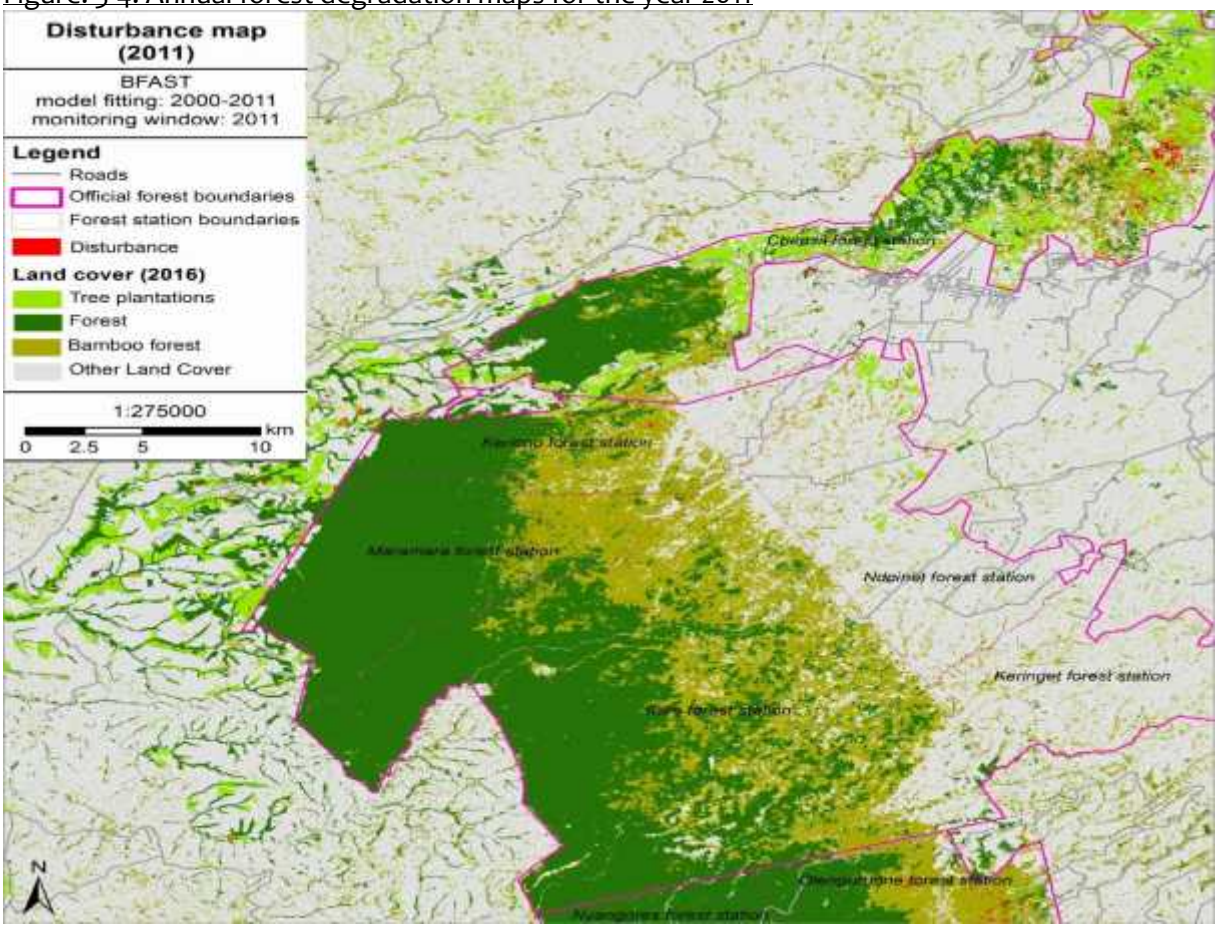


Figure: 3-5. Annual forest degradation maps for the year 2012

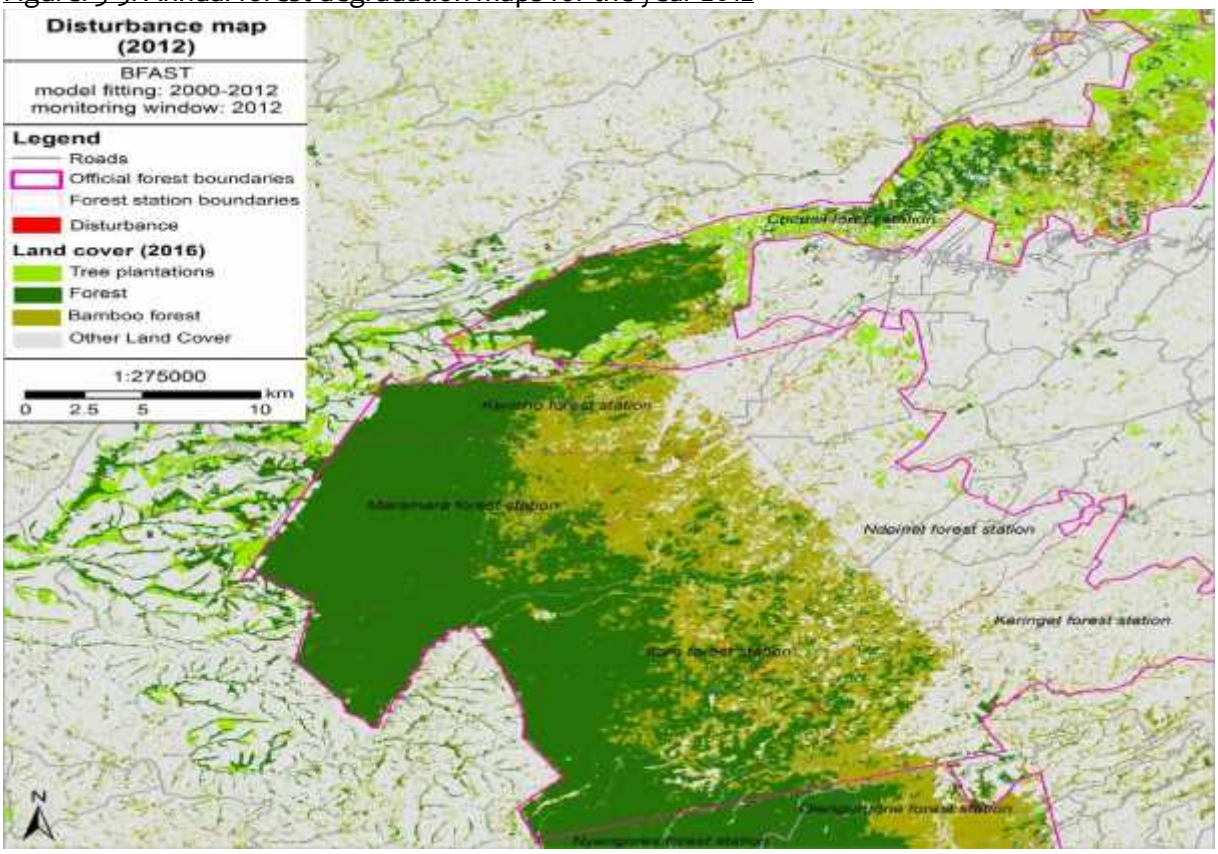


Figure: 3-6. Annual forest degradation maps for the year 2013

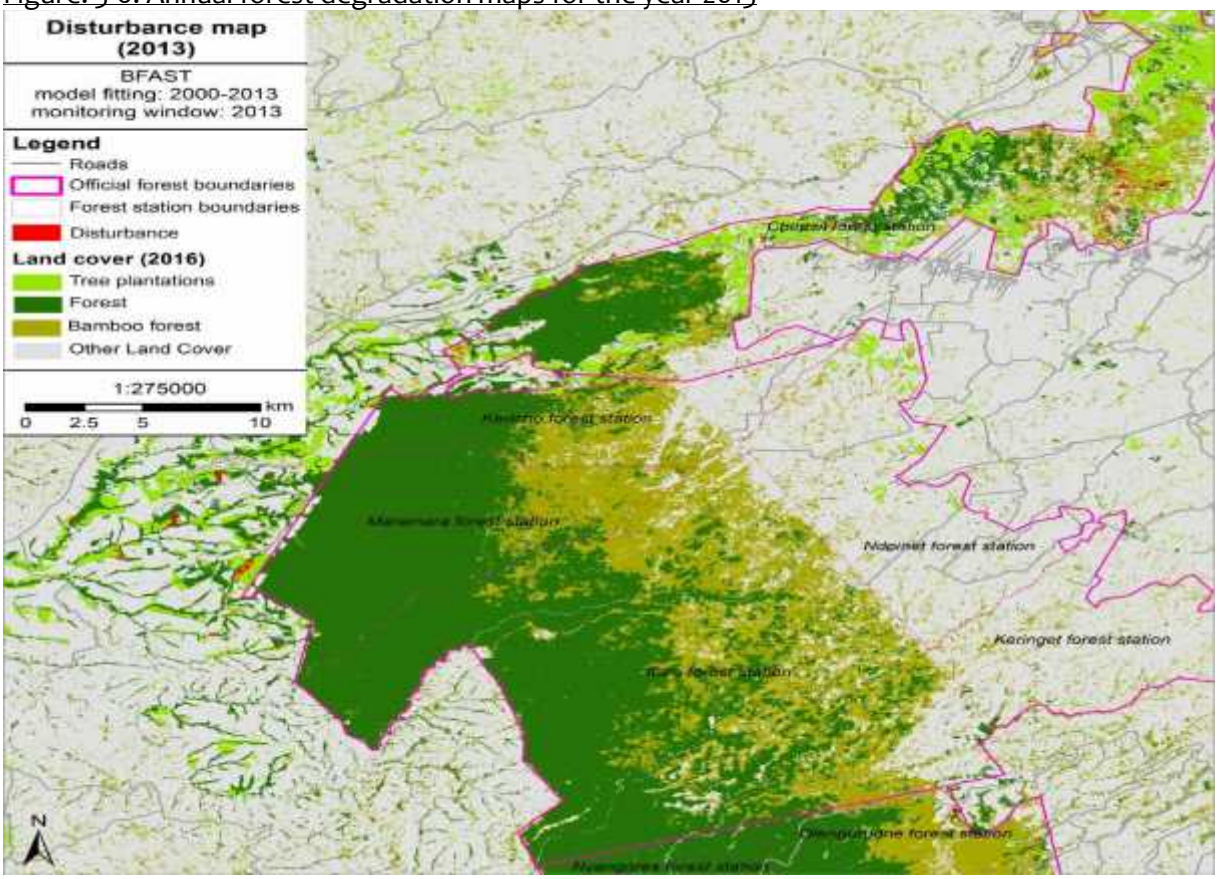


Figure: 3-7. Annual forest degradation maps for the year 2014

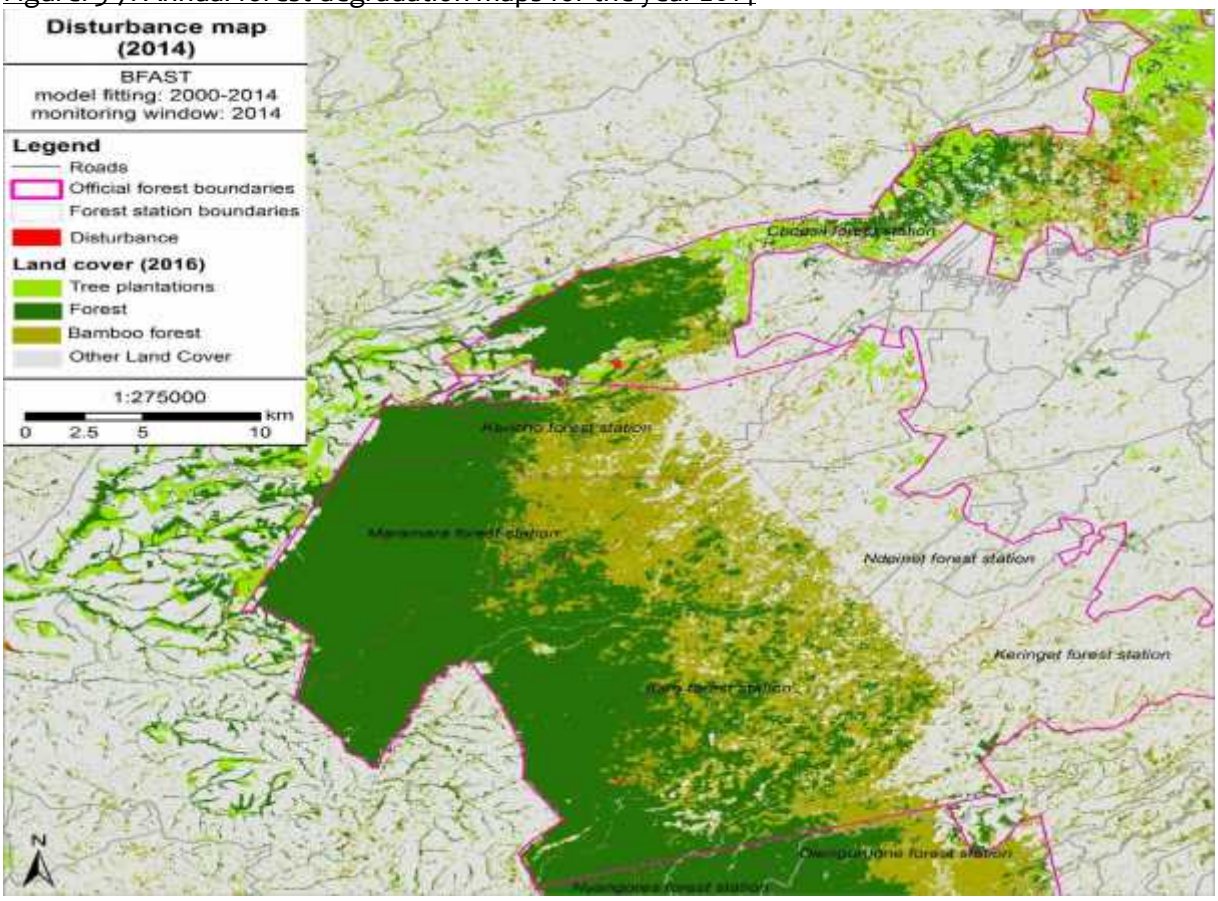
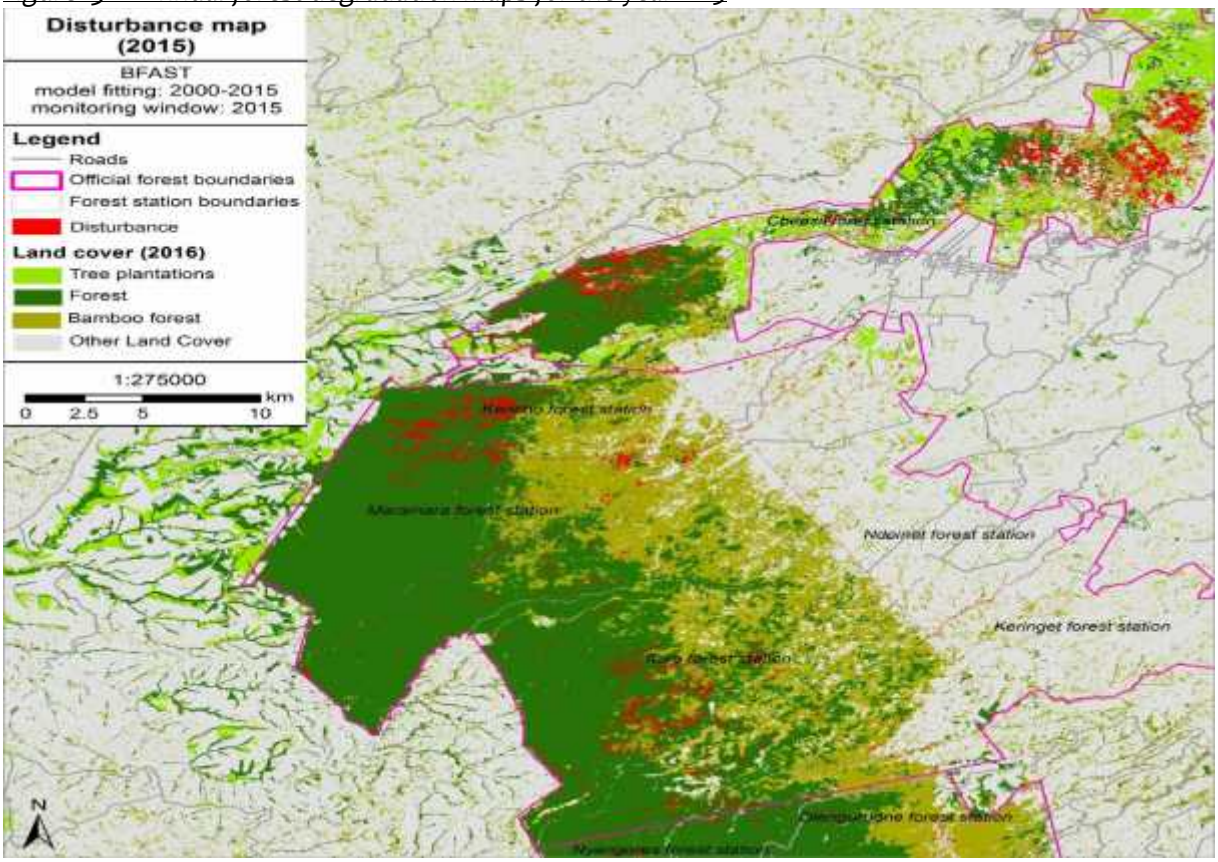


Figure: 3-8. Annual forest degradation maps for the year2015



3.3 Topography and Drainage

The Mau forest complex is in a mountainous topography and is comprised of hills, valleys, escarpments, plateaus and Hat surfaces. Mau Escarpment covers the western and south eastern parts of Nakuru County comprising Molo, Elburgon, Njoro and Olenguruone Divisions and the Naivasha area. These areas generally lie above 2500 masl. The topography of Kericho County slopes westwards and consequently, the rivers drain in the same direction. These rivers include Kipchorion which originates from Western Mau forest and flows through Londiani, Kipkelion and Chilchila Divisions to join river Nyando on the Kericho-Kisumu border. Rivers Kipturet and Timbilil both flow through Londiani and Chilchila Divisions from Tinderet forest before joining River Nyando.

A hilly shelf is formed between the Mau Escarpment and the lowlands of Kisumu County. To the north - east are the Tinderet hills and Mau Escarpment and between them is the gently rolling land which forms Londiani Division. To the north-west are the hilly areas of Kipkelion and Chilchila Divisions rolling towards Koru. The central parts of Kericho to the east reach 3000m high at the Mau Ridge. The Kericho plateau forms the central part of the Kericho County and slopes gently from 2500m to about 1800m and relief is a major climate factor in Kericho County.

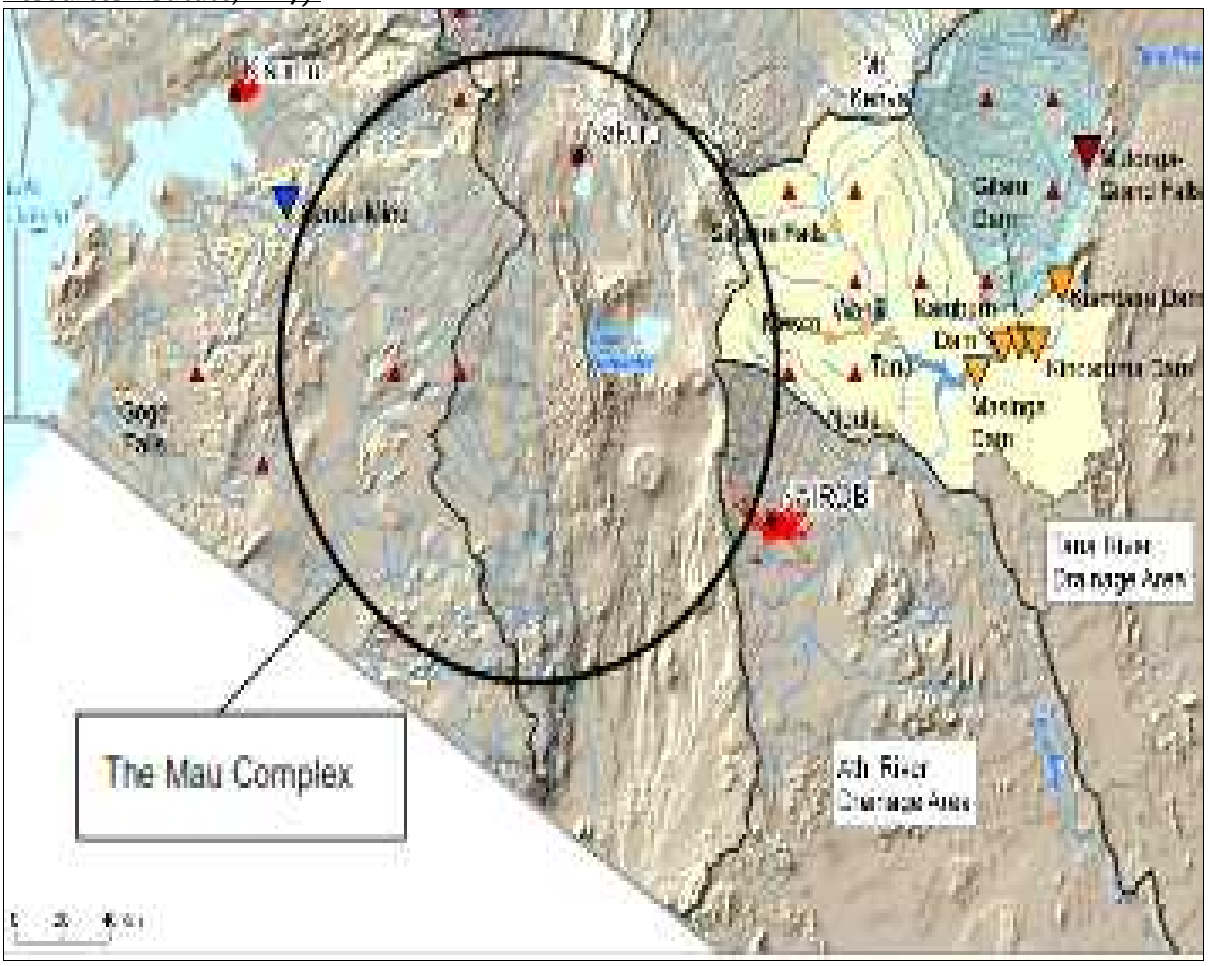
Moderately well drained, moderately deep, reddish brown to red firm clay loam with a humic topsoil (ando-luvic PHAEOZEMS). In Narok County, Mau complex covers parts of Upper Mau, Olokurto and Olmotiok Divisions. Included here are the Mau Escarpment and the Suswa Crater which rises over >300 metres. The lowlands stand between 1000 – 1500masl. Main rivers are the

Mara from Maasai Mau and the Ewaso Nyiro and its tributaries namely Siapei and Narok. The two drain into Tanzania.

The topography in Bomet County is generally the same with that of Kericho County. The general altitude varies between 1800m in the south and 3000m to the north. This is the area covered by the South Western Mau forest. The rivers in Bomet generally drain in a parallel fashion -Bowing from north-east to south-west. Some of the rivers include Nyangores which Bows from South Western Mau forest and proceeds south-wards through Tenwek and Tebenik/Kiptiget which Bows along the northern boundary of the county from the Londiani forest. There are both surface and underground water resources in the Mau complex area. In Nakuru County, rivers that originate from the Mau forest complex are Njoro, Nderit, Maka Makalia and Lamriak which drain into Lake Nakuru. The other rivers are Molo, Rongai, Kaumura and Nessuit which drain into Lakes Baringo and Bookie.

Mara River originates from the Mau and drains through Narok County into Lake Victoria basin, covering a distance of 395 km. It discharges into the Mara Bay of Lake Victoria in Tanzania. The river is easily accessible except in its lower reaches, which falls in the Maasai Mara Game Reserve. The water is used for livestock by the Maasai pastoralists, wildlife in the Maasai Mara Reserve and for domestic purposes. Seyapei River originates from the south-eastern part of Mau Escarpment and drains into Ewaso Nyiro River between Oletukat and Nkuta. Water from this river is used for general irrigation, livestock and domestic purposes.

Figure: 3-9. Physical features, including the drainage network of the Mau Forest Complex (World Resources Institute, 2007).



3.4 Climatic conditions

3.2.3 Climate

(i) Temperature

The temperatures in the Mau forest complex are strongly influenced by altitude and physical features such as forest cover, escarpment and mountains. There are considerable variations in climate in the various parts and counties comprising Mau complex. The maximum temperature in the northern and eastern parts of Mau forests complex is about 30° C with December to March being the hottest months. July is the coldest month with average temperatures of 23.9° C.

The climate in the western and south western parts can be described as highland sub-tropical climate with moderate temperatures, low evaporation rates and high rainfall in lower highland areas. At the upper highland areas, the temperatures are high with high evaporation and low rainfall. The temperatures of this region range from about 16°C to about 20° C. The coldest months are usually July and August with mean monthly temperature of 16.6° C and 16.9° C. while the hot season starts from around December to February with temperatures ranging from about 16.9° C to 18.6° C. In the southern parts of the Mau complex, the temperatures range from 8°C-28°C. Low temperatures in this region reach 8°C in June - September and maximum in November - February.

(ii) Rainfall

In the eastern parts of Mau forest complex, there are two climatic zones known as zones I and II. Zone I receives an average rainfall of 1270 mm per annum and it covers areas above 2,400masl. The areas covered by this zone include Mau Narok, Molo and Olenguruone. Zone II covers altitudes between 1,800 metres and 2,400masl and receives rainfall between 760mm and 1270mm per annum. This is a dry sub-humid equatorial climate and covers the lower parts of Molo and Njoro among others. This region receives very little rainfall in the Months of December to February. The wet Months are from March to May characterized by the long rains while the short rains occur from late August to October. June to August have an average rainfall of 27mm.

Western and north-western parts of Mau complex receive continental type of rainfall which is influenced by altitude. The annual rainfall ranges from 1,700mm to 2020mm per annum. Rainfall is highest in the lower highland zone of Ainamoi, Buret and Belgut Divisions while the upper highland zone covering Kipkelion and Londiani which is mainly forest land (the Mau) is drier and receives low rainfall. The upper midland zone which lies to the west of the Rift Valley experiences uniform rainfall. The zone covers Roret Division among other areas. Rainfall is well distribution except for the short dry season in January and February. The wettest months are April and May though there is no real break between short and long rains in the whole area. The average monthly rainfall between 1991 and 1995 were 167.8; 166.4; 142.2; 166.3; and 144.4mm respectively. Total annual rainfall ranges from 1700mm - 2020mm per annum.

The south-western parts of Mau receive rainfall all the year round with the peaks in March to May (the long rains). Apart from December, all the months have mean rainfall of between 100mm and 150mm. The southern parts of the Mau complex consist of highlands rising over 2,300m and lowlands 1000m to 1500masl. The lowlands cover parts of Osupuko, Ololunga and lower Mau areas. This region has a bi-annual passage of the Inter-Tropical Convergence Zone (ITCZ). Thus, both the altitude and ITCZ determine the climatic conditions of the region. It experiences high rainfall caused by south easterly winds between the months of March and June (long rains). The

annual average rainfall is 1200 to 1800mm. Between October and March, the area is influenced by north easterly winds which are relatively dry and cause low to moderate rainfall.

3.2.4 Agro-ecological Conditions

Most areas of Kericho receive high rainfall, more than 1400 mm on average. The rainfall is well distributed except for the small dry season in January and February. There is no real break between the first and the second rains, and the sub-zones of the Agro-Ecological Zones are therefore often characterized by one very long cropping season or two variable ones, i.e. planting times may differ according to the factors other than climate.

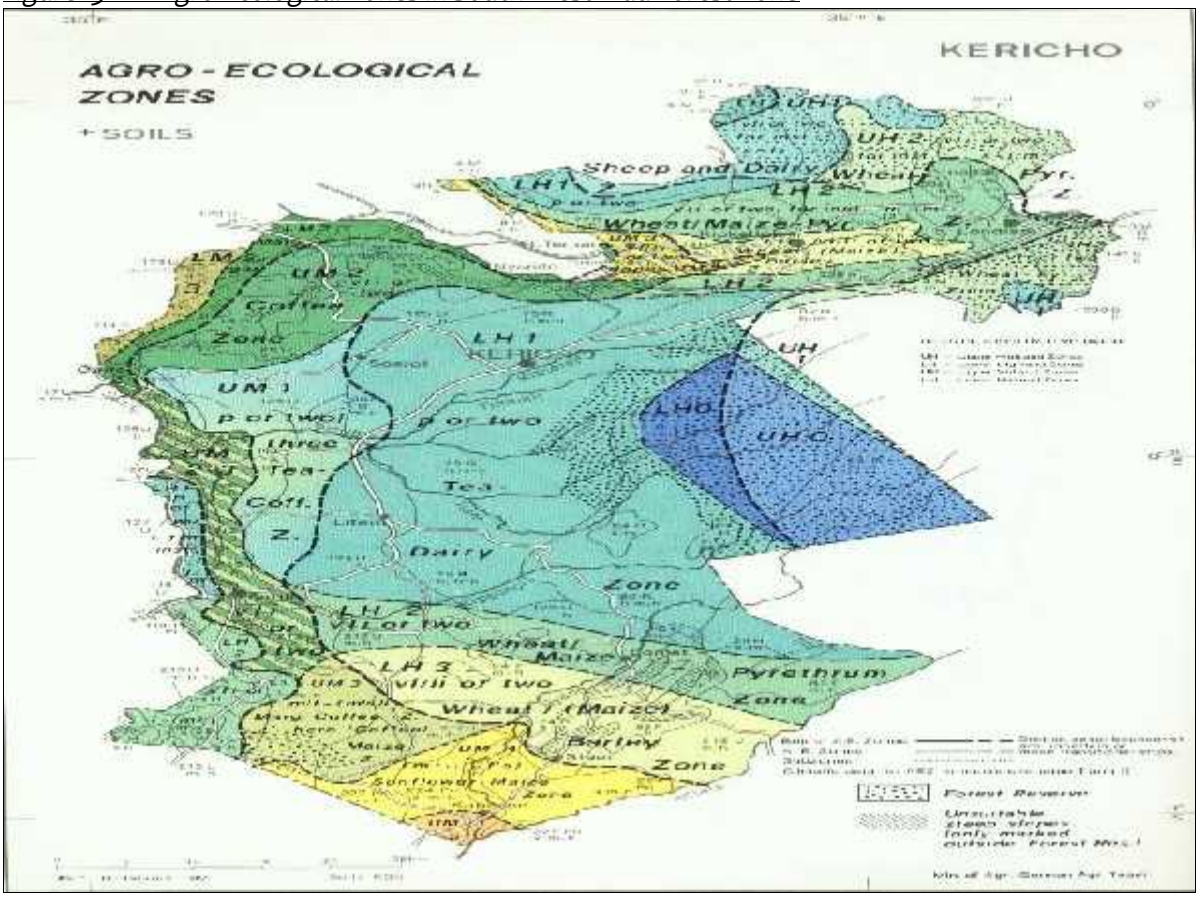
The largest rainfall area is mainly **LH 1,** the Kericho tea zone. The slightly drier zones 2 in the upper highlands (**UH 2)** are still mainly forest. This is the best land use for the area because the slopes are steep. Lower Highlands (**LH 2)** have a good potential for pyrethrum. The zone Upper Midland (**UM 2)** is the main coffee Zone in East Kenya. Coffee does not do well in Kericho due to the evenly distributed rainfall that discourages flowering and favours the spread of diseases. The soils are also not suitable for coffee. **UM 4** is a zone with a potential for maize and sunflower, whereas zone **UM 5 is a** livestock-sorghum zone. The rainfall characteristics are as shown in the table below:

Table 3-1: Climate and Agro-ecological Zones

Agro-Ecological Zone	Subzone	Altitude in m	Annual mean temperature in °C	Annual av. rainfall in mm	60 % reliability of rainfall[1)]		60 % reliability of growing period		
					1st rains in mm	2nd rains in mm	1st rains[2)] in days	2nd rains in days	Total[3)] in days
UH 0 Forest Zone		2 300–2 450	16.0–15.1	1 750–2 000	900–1 000	600–700	Whole year very wet		
UH 1 Sheep-Dairy Zone	vl i or two	2 350–2 800	15.7–13.0	1 300–1 750	550– 950	500–680	130 or more	160–190	290–320
UH 2 Pyrethrum-Wheat Zone	vl i or two	2 350–2600	15.7–14.2	1 100–1 300	450– 650	430–600	130 or more	150–170	280–300
LH 0 Forest Zone		2 100–2 300	17.2–16.0	1 800–1 950	900–1 000	600–700	Whole year very wet		
LH 1 Tea-Dairy Zone	p or two	1 850–2 350	18.7–15.7	1 400–1 800	550– 950	410–650	160 or more	190–205	350–365
LH 2 Wheat/Maize-Pyrethrum Zone	vl i or two	1 900–2 350	18.4–15.7	1 200–1 500	(500–)800	320–500	140 or more	130–200	270–340
LH 3 Wheat/Maize-Barley Zone	vl/l i or two	1 900–2 350	18.4–15.7	1 100–1 300	450– 650	310–480	120 or more	130–150	250–270
UM 1 Coffee-Tea Zone	p or two/three	1 800–1 900	19.0–18.4	1 400–1 650	650– 850	440–610	165 or more	185–200	345–365
UM 2 Coffee Zone	vl i or two	1 650–1 950	19.9–18.1	1 150–1 500	550– 750	420–520	155 or more	120–180	270–335
UM 3 Marginal Coffee Zone	vl/l i or two m/l – (m/s)i	1 550–2 000	20.5–17.8	1 200–1 350 1 150–1 300	600– 720 400– 600	400–470 280–390	150 or more 155 or more	110–160 115–135	260–310 270–290
UM 4 Sunflower-Maize Zone	f m i – f s	1 650–1 950	19.9–18.1	1 000–1 200	300– 480	230–350	130 or more	75–115	205–265

Source: Jaetzold and Schmidt (1983).

Figure: 3-10. Agro-Ecological Zones in South West Mau Forest Zone



3.5 Geology and Soils

The geology of Mau forest complex is predominantly volcanic in origin making most of the soils to be deep and well drained because of their high nutrient content. This study categorized the geology and soils according to their altitudinal locations and therefore we have the geology and soils found in the bottomlands which comprise soils developed on infill from volcanic ashes and from intermediate igneous rocks. The former (Bl) are found in small bits in parts of Londiani, Mount Londiani, Tinderet, Ol Pusimoru and Western Mau forests while the latter (B2) are found in Metkei forest only.

The most common rock formation from which soils were developed in the Mau complex is found on the hills and minor scarps on slopes predominantly over 16%. It comprises basic igneous rocks such as serpentinites, basalts and nepheline pholites; ashes and other pyroclastic rocks of recent volcanoes; intermediate igneous rocks such as syenites and trachytes plus quartzite. Soils developed from basic igneous rocks (HI and H2) are found in Nabkoi, Tinderet, Northern Tinderet and Londiani forests while those developed from ashes and other pyroclastic rocks of recent volcanoes (114 and 116) are found in Eburru, Mau Narok and Eastern Mau forests.

The soils developed from intermediate igneous rocks (H7) are found in Western Mau forest while those from quartzite (1116) are in a small part of South West Mau forest. Another category is found on plateau or upper-level upland transitions with undulations and is also composed of ashes and other pyroclastic rocks of recent volcanoes. The soils (Lul and Eu2) are developed from

ashes and other pyroclastic rocks of recent volcanoes and are found in Southern Mau, Eastern Mau and Ol Pusimoru forests.

The rock formation found on mountains and major scarps on slopes predominantly over 30% include olivine basalts and ashes of major older volcanoes. These soils (M2, M5 and M6) are found in Mount Londiani, Kilombe hill, Tinderet, Western Mau and Metkei forests. On the foot-slopes of between 2 and 8 per cent are soils formed on colluvium from quartzite and irom basic igneous rocks such as basalts and serpentinites. Those developed on colluvium Irom basic igneous rocks (F2 and F4) are found in Tinderet forest while the soils from quartzite (F I7) are found in Western Mau forest. At the volcanic foot-ridges including dissected lower slopes of major older volcanoes and mountains, tertiary or basic igneous rocks plus ashes and other pyroclastic rocks of recent volcanoes are found. The soils R2, R5, R9 and RIO are developed on tertiary basic igneous rocks and are found in most parts of Northern Tinderet, part of Lembus, South West Mau, Western Mau, Transmara and Tinderet forests. The soils developed on ashes and other pyroclastic rocks of recent volcanoes (R13) are found in most parts of Maasai Mau, Transmara and 01 Pusimoru forests.

On the upper-level uplands, usually of rolling to hilly altitudes of 6500 to 11,000 feet and about 4,000 feet above local base level, tertiary or older basic igneous rocks of basalts and nepheline phonolites, among others are found. The soils formed (Uh2, Uh3, Uh3 + Uh4) are found in Maji Mazuri, Mount Londiani, Tinderet, Northern Tinderet, Lembus, Chemorogok and Timboroa forests. At lower middle-level uplands, usually of undulating altitudes of between 3,500 and 65,000 feet and about 1,500 feet above local base level are found basic igneous rocks and biotite gneisses.

The soils developed from basic igneous rocks (Um4) are found in Eastern Mau, Molo and Mount Londiani forest. Those developed on biotite gneisses are found in Northern Tinderet forest. Some soils (Pv9) were developed on Dissected Erosional Plains from various volcanic rocks and ashes and other pyroclastic rocks of recent volcanoes and are found in Kilombe forest.

The soils in Kericho are developed on Tertiary basic Igneous rocks (basalts, nepheline phonolites; basic turfs included) (Exploratory Soil Map…) The soils found in Kericho are an association of well drained, extremely deep, dark reddish brown, friable clay, with acid humic top soil (humic NITISOLS). Ando-humic NITISOLS soil type are found in the South East of Kericho town

3.6 Vegetation

Vegetation patterns in the Mau are complex, but there is a broad altitudinal zonation from west to east, with lower montane forest starting below' 2,300 m of altitude and giving way to thickets of bamboo Arundinaria alpina (now called Yushania alpine K. Schum) mixed with forest and grassland, and finally to montane sclerophyllous forest near the escarpment crest. The lower montane forest is in best condition in the South-western Mau Nature Reserve, where characteristic trees include Aningeria adolfi-friedericii and Strombosia scheffleri. Elsewhere, this zone has been heavily logged, most recently for plywood from Polyscias kikuyuensis. Logged-over areas are dominated by pioneer species such as Tabernaemontana stapfiana, Syzygium guineense and Neoboutonia macrocalyx, while pockets of less-disturbed forest hold Olea capensis, Primus africana, Albizia gummifera and Podocarpus latifolius.

Substantial parts of the high Junipertts-Podocarpus-Olea forest have been encroached and cleared, although some sections remain in good condition. Large areas of both the Eastern and

Western Mau have been converted to plantation forest comprising of cypress, pines and eucalyptus among others.

3.7 Socio-Economic Activities

The ethnic landscape of Mau Forest Complex is characterized by a diversity of cultures and a variety of livelihood strategies matching the environmental diversity of the region. Among the indigenous communities in the Mau forest complex region are the Kalenjin, Ogiek and the Maasai. The Kalenjin are sedentary in their livelihood and renown farmers who are involved in both crop and livestock farming. The Ogiek are hunters and gatherers and have been relying totally on the Mau ecosystem for their livelihood (shelter and honey plus hunting) although they have started to adopt livestock keeping and some of them have considerably changed towards sedentary and farming oriented livelihood not notably different from the one practiced by other farming communities (MFRS, 2009).

The Maasai have been associated with the Mau forests complex over the years especially the Maasai Mau. Being pastoral community, they have used the Mau in a sustainable manner- going to graze and water their livestock in the forests during drought only. Their love for, and dependent on herbal medicine have always made them to keep and take care of nature. The other category is the immigrants who came from neighbouring counties, mainly the Kikuyu and Kisii. They are farmers and their settling near the Mau forest complex came with a lot of interference to the forest ecosystem through farming. The last group is the recent invaders who were allocated land in the forest illegally and the legally settled people in the land excised by the government of the day to settle the landless. Due to the diverse culture and livelihood strategies of these people and the fact that, Mau complex has high agricultural potential, the region is characterized by all types of activities ranging from agriculture, quarrying, to off farm activities such as business and agricultural industrial production in the urban centres (MFRS, 2009).

3.8 Agriculture and livestock Farming

3.8.1 Agriculture

Agriculture plays a very important role in the socio-economic welfare of the people living within the Mau forest complex since the region is endowed with fertile soils and high amounts of rainfall. The main staple food grown are maize, beans, pulses, Irish potatoes, millet and sorghum while the main cash crops grown are tea, coffee, pyrethrum, sugarcane and wheat.

Mau forest complex is very important to the horticultural and cut flower industry in that, the fraction of water from Lake Naivasha which is fed by inflows from Mau forest helps to port a very dynamic horticultural and cut flower industry. The latter produces about 14 % of Kenya's total export earnings. Currently the horticultural industry is the fastest growing agricultural sub-sector in the country and is ranked third in terms of foreign exchange earnings from exports after tourism and tea. Reports from the Ministry of Agriculture show that Cut flower industry was the highest foreign currency earner in Kenya in 2018, grossing at least KSh. 153.68 billion.

Fruits, vegetable and cut Power production are the main aspects of horticultural production in Kenya. Kenya has a long history of growing horticultural crops for both domestic and export

markets. The climate is highly varied supporting the growth of a wide range of horticultural crops. Horticulture in Kenya is mainly rain-fed though a number of farms, especially the ones growing horticultural crops in the Naivasha area for export, but also uses irrigation through water abstraction from mainly Lake Naivasha.

Kenya has seen phenomenal growth in its exports of cut Powers recently even taking into account mounting competition from Colombia, Ecuador, Israel, India, China, Zimbabwe, Zambia, Ethiopia and Uganda. Cut Powers have spurred great economic prosperity in Kenya- the loss of this industry would create a void in export earnings. While it seems to fit the model of sustainable industry, there are aspects and complications such as unsustainable water extraction from Lake Naivasha that make long-term viability difficult to guarantee.

3.8.2 Livestock industry

Livestock industry accounts for about 10 per cent of the country's GDP and over 30 per cent of the farm-gate value of agricultural commodities. Kenya livestock local production depends in large parts from production from the Rift Valley mainly from Nakuru and Kajiado. The production and distribution of livestock in Kenya, especially in Rift Valley is influenced by rainfall patterns. However alteration in the catchments hydrological regime, resulting in increased stream flow seasonality, declining water wells and bore holes and frequent prolonged drought episodes as occurred in 1993, 1994, 1995, and 1996 aggravated by poor land use and deforestation in the Mau ecosystem pose a serious threat to the sector (Ministry of Livestock & Marketing, 1998).

3.9 Forestry and wildlife resources

3.9.1 Forest Resources

Forest products and services are estimated to contribute about 7.0 billion shillings to the economy, and provide direct and indirect employment to 50,000 and 30,000 respectively in the country. The forest plantations, so far, remain the main source of raw materials for the forest industries in the country which are in large part located near Mau Forest Complex. The Counties of Nakuru, Kericho, Narok, Bomet, Nandi, Baringo (Koibatek District) and Uasin Gishu are among the counties endowed with forests. Areas covering Molo South, Olenguruone, Keringet and Mau Narok Divisions as well as south east Molo and Siape in the Nakuru County are under forests.

Natural forests are home to biodiversity (flora and fauna), are water catchments, and provide aesthetic values as well as carbon sinks. Increased extraction of forest products and allocation of forest land to non-forest uses have caused negative environmental and social impacts. This trend is expected to change due to advocacy for public awareness to conserve and protect the environment. Kenya has started re-afforestation programme in the Mau complex, although this programme can only succeed if there are strong government institutions and informed community participation. Kenya needs to learn from countries like China, Malaysia, Indonesia, India and Brazil which have gone far with re-afforestation programmes. Most of these programmes have had varying degrees of success with China being credited to have planted the largest area of forest plantation in the World.

3.9.2 Wildlife

The southern forests of the Mau Complex are not only rich in biological diversity in terms of flora but also in fauna. They host ungulates such as the Bongo and the yellow-backed Duiker;

camivores, including the Golden Cat, the Leopard and the forest elephant which are known to occur in Trans Mara and South Western Mau forest reserves, which neighbour the Maasai Mau Forest (KWS, 2003). Some of the animals of special interest that are known to inhabit the higher moist forest zone of the Mau Complex, including the Maasai Mau are Giant Forest Hog, Colombus Monkey, Potto, Sotik Bushbaby and the Greater Galago. In the other forest formations, animals commonly found include lions, leopards and hyenas, Grant Gazelle, Coke's Hartebeest, giraffes, Cape buffalo, hippopotamus, rhinoceros and African elephant.

The wildlife earns Kenya a lot of foreign exchange from tourism, the industry which largely dependents on wildlife. In 2018, up to 45% of Kenya's foreign exchange earnings came from tourism and related activities. The sector contributed close to KSh. 157 billion to the country's economy making it the largest contributor to the economy. In Kenya, wildlife based activities comprise a major share of the tourism market, where it is estimated to contribute roughly 70% o f the sector's earning.

3.10 Socio-Economic Concerns

3.10.1 Land Use

Land is one of the most important resources in Kenya; as the economy is primarily agro-based and over 90% of rural Kenyans obtain their livelihood directly from the land. However, because of increasing populations and the land tenure system currently in place, the amount of arable land and land productivity is decreasing tremendously. These causes along with environmental degradation have been key factors in post-colonial problems in the Kenyan economy.

Land in the project area has been adjudicated and classified as freehold. Farmers have title deeds which can allow transfer of ownership and use of land as collateral for bank loans. Within the project area small holders own plots that average 2Ha per family of about 7 persons. Available arable land per household as well as per person is considered unsustainable.

Land use in the project area and surrounding areas is mainly rain-fed mixed farming with the main crops grown being: maize, beans, tea and peas but on a small scale level. The main livestock in the area is dairy cattle and shoats.

3.10.2 Population and Demography

The average population density is high at approximate 400 persons/km^2. High density, as is typical in a number of rural areas in Kenya, is an indicator of ecological potential and is a strong determinant of settlement patterns in the project area. The total population for the neighbouring villages is estimated at 15,400.

Some of the villages (forest community) along the project area include; Araruet, Kibara, Korabariet, Kisingenek, Kamweng Boiyo, Kipkoris, Kures, Tirita, Kepsegem, Chepkapsrot and Chematich

3.10.3 Public utilities

The project area lack piped water hence water for domestic use is mainly fetched by women and children from the rivers.

There are several public schools in the area surrounding the project area. The primary schools are Kibara, Kurabariet, Kesigenek, Kipkoris, Kures, Terita and Ndoinet Primary School. The secondary schools in the area are: Kibara, Korabariet, Kipkoris Girls, Kiptororo Mixed and Kures secondary school. Other schools include private schools.

3.10.4 Infrastructure and communication:

Roads infrastructure: Transportation to and within the project area is by earth roads, 60% of which were in poor state due to inadequate maintenance. "Matatus and Boda Boda" are the most frequently used mode of transport, although farmers also use wheelbarrows and hand-carts to transport farm produce to the roadside or nearest collection point. NTZDC and KFS provide regular repair of roads in their area of operation on a need basis. However it should be noted that the poor road network affects timely delivery of agricultural produce to the markets.

Telecommunication: The main telecommunication services include coverage from Safaricom and Airtel. However the coverage signal is normally poor and sometimes unavailable at some points.

The trading centres in this area include: Korabariet, Chebitai, Kehara, Kipkoris, Kiptororo, Ndoinet and Chematich

3.10.5 Energy

The main fuel is firewood with over 95 % of the households in the area using the same. Firewood is obtained from existing natural vegetation and pruning of trees planted on farms and farm boundaries. Charcoal is mainly supplied from the forest where illegal charcoal burning is a common practice. High dependency on firewood is exerting pressure on the adjacent forest. Other sources of energy are paraffin and KPLC electricity does not have a good coverage. However trading centres and schools are well served with electricity.

3.10.6 Housing

Although most farmers in the project area live in semi-permanent dwellings made of timber walls and iron sheet roofs, it was observed that a sizeable number have permanent dwellings.

4.0 PROJECT DESCRIPTION

4.1 Project location

The proposed project site is located in South West Mau Forest Zone which is spread over three counties: Nakuru, Kericho, Bomet. The proposed buffer zone lies along the Kericho - Nakuru Counties boundary. This is a straight line that runs perpendicular to many tributaries of Sondu River. The project site (tea Buffer Expansion project) lies between GPS coordinates: 0°18'51.8"S 35°28'47.4"E and 0°27'44.7"S 35°30'40.9"E.

The entire South West Mau Forest Zones is located in southwest Kenya (S 00.36 – S 00.65; E 35.71 – E 35.29). The South West Mau Forest Zones was originally 953 km^2 but, after excisions, now stands at 600 km^2. The Forest Zone has had both its size (38% lost) and conservation values substantially reduced over the past 85 years. In 2001, 234 km^2 was excised. The SW Mau FR was 953 km^2 in 1932 but only 600 km^2 in 2016. Of the remaining 600 km^2, 182 km^2 is grassland/scrub/bracken fern, 404 km^2 is forest (although much of this is degraded and fragmented), and 8.2 km^2 is encroached and covered with crops, exotic trees, pasture, and settlement.

Administratively majority of the area of the tea zone is within Kericho County, Londiani Sub-County, Chepsion Division, Chepsion Location. The villages that boarder the tea zone include; Araruet, Kibara, Korabariet, Kesigenek, Kamweng Boiyo, Kipkoris, Tirita, Kepsegem, Chepkapsrot and Chematich.

4.2 Problem statement and intervention

In most places in Kenya, natural forests within protected areas (e.g., forest reserves, national reserves, and national parks) are adjacent to land with a high human population density, a high human population growth rate, intensive cultivation, and inadequate law enforcement and management as concerns the use and protection of natural resources, including the water catchment. Conservation buffer zones are either absent or small, undeveloped, and poorly managed and protected. As such, there is often illegal, unsustainable, use of the natural forest by people, particularly those living closest to the forest, and severe damage to the water catchment.

Given this situation, if what remains of the Nation's high-quality water catchment is to be protected, the Government of Kenya, seem to have no better option than to develop a buffer zone between local communities and protected areas.

Mau forest ecosystems have been faced by severe threats and challenges that have led to degradation reducing their capacity to provide critical environmental services. These threats include; excisions, encroachment, loss of biodiversity, unsustainable forest resources use, unsecured forest boundaries and increased poverty levels in the surrounding areas. The degradation can be largely attributed to increasing population pressure which manifests in the growing exploitation of forest resources. Lack of governance and poor regulatory policies in the past led to the excision of vast forest areas for settlements. Despite renewed political efforts against human encroachment, forest destruction continues, especially through the burning of charcoal, one of the cheapest household energy sources. Frequently, degrading forests are soon converted into areas of subsistence agriculture or pastures.

Following the eviction and compensation of illegal settlements in some sections of Mau and Embobut forests, it was deemed fit to put in place measures to sustain and enhance the gains made in conserving the two major water towers. Hence, during the official opening of Kipchabo Tea Factory, on 11 July 2014, the President gave a directive to establish tea buffer belts to protect the two forest eco-systems. With regard to the foregoing, a preparatory meeting comprising NTZDC and KFS Managing Directors and technical staff from the two institutions was convened to chart the way forward towards implementation of the presidential directive. A Task Force comprising Nyayo Tea Zones Development Corporation, Kenya Forest Service and Tea Research Foundation of Kenya was constituted to lead the process.

The proposed project aims to deal with emerging issues which include inter alia, forest degradation and encroachment, human conflict which are in themselves symptomatic cause of complex problems of both national, regional and global concern.

The project therefore aims to introduce broad interventions that will ameliorate the problems and where possible, reverse any adverse impacts occasioned by the current and past situation. The Mau buffer belt establishment project will create an economic buffer round designated forest ecosystems within the Mau Forest complex. The buffer belt will be a complex undertaking which will include tea buffer component, restoration of degraded forest areas component and community livelihoods improvement components.

Tea buffers are not a new concept and have been developed in other areas of the country under similar circumstances. The first tea buffer belts were developed in 1986 and have so far met with considerable success. The tea provides a live fence for the buffered forest as well as providing a source of employment for local communities

The project objectives are:

- To create a buffer-belt that will deter and if possible, reverse encroachment into the South West Mau Forest.
- To restore the ecosystem integrity of the protected forest block
- To increase national tea output and therefore increase foreign exchange earnings
- To foster and nurture sustainable livelihoods arising from wise-use of the protected forest resources

In order to achieve these objectives, the project will be executed under the following three key components:

- Tea buffer belt establishment
- Forest Rehabilitation
- Livelihood enhancement in Peri-Forest Communities.

4.3 South Western Mau Forest Reserve at a glance

The South Western Mau Forest Reserve (SW Mau FR) has had both its size (38% lost) and conservation values substantially reduced over the past 85 years. In 2001, 234 km² was excised. The SW Mau FR was 953 km² in 1932 but only 600 km² in 2016. Of the remaining 600 km², 182 km² is grassland/scrub/bracken fern, 404 km² is forest (although much of this is degraded and fragmented), and 8.2 km² is encroached and covered with crops, exotic trees, pasture, and settlement.

The Mau Forests Complex represents the largest area of montane closed forest in Kenya. Large tracts of the original natural forest of the Mau Forests Complex ecosystem have been destroyed for agriculture and human settlement, while most of what remains has been degraded through the unsustainable removal of forest products and fragmentation. Given the high demand for land and forest products in southwest Kenya, and the rapid human population growth in the region, all of the SW Mau FR must be considered under severe threat at this time.

All along the east boundary of the Western Mau Forest Reserve (W Mau FR) and along the SW Mau 2001 excision boundary there is a high human population density. There is near complete loss of forest on the farmlands to the east and for 2-3 km to the west on the former encroached land. Once a 'hard edge' like this has developed, there is little option for conservation of a forest but to separate the forest from the people by erecting an effective physical barrier. Such a barrier does not necessarily mean that people no longer have access to the forest and forest products, but it should mean that the management authorities are able to gain control of the situation so that utilization of the forest can be undertaken in a controlled, managed, and sustainable manner. A barrier also does not mean that other protective measures are not also employed. For example, community education, awareness and conservation campaigns, problem animal removal, etc., are still required activities to be undertaken hand-in-hand with the barrier.

4.4 Description of the proposed project

4.4.1 Existing South West Mau forest buffer

The entire South West Mau forest buffer stretch is estimated at 440Ha (44Km at 100m width) and lies between Kericho and Kuresoi North. More than half of the total stretch 222Ha (23km at 100m width) have already been established with tea buffer while the balance of 21km is not established.

4.4.2 Proposed South West Mau forest buffer expansion

The proponent intends to extend the existing buffer on the remaining stretch of 210Ha (21Km long at 100m width) between Kericho and Kuresoi North. (GPS coordinates: 0°18'51.8"S 35°28'47.4"E and 0°27'44.7"S 35°30'40.9"E). The buffer will consist of 70% tea plantation and 30% conservation area.

The proposed buffer expansion project will have three components consisting of the tea buffer component, restoration of degraded forest areas and community livelihoods improvement.

The project's primary objective will be to protect South West Mau Forest Zones from human encroachment by establishing continuous belts of tea bushes and assorted tree species which acts as a buffer between forests and communities living adjacent to the forests.

Most of the buffer land has already been cleared due to encroachment by the adjacent communities.

This component will have the following outcomes:

- Improved forest cover and reduced encroachment
- Increased tea production
- Poverty reduction through employment creation and community empowerment

- Enhanced business opportunities and growth as a result of tea industry supply chain requirements

The establishment and operation of a tea buffer belt will entail the following key activities:

- Land Surveying and mapping
- Land preparation (bush clearing, de-stumping and ploughing)
- Tea planting operations (seedling production, planting and tending)
- Tea and buffer belt management (agronomic practices, harvesting, leaf delivery, security patrols, maintenance, etc)
- Construction of allied infrastructure (access roads, bridges, tea collection centers, labour lines, etc)

Table 4.1: Design summary for the proposed project

Name of the Project	Proposed Tea Buffer Expansion Project in South West Mau Forest Zones
Project location	Kericho and parts of Nakuru Counties
Total length of South West Mau forest buffer	Length of the buffer 44Km Width of the buffer - 100m Total Hectare of the buffer - 440Ha
Existing South West Mau forest buffer	Length of the buffer 23Km Width of the buffer - 100m Total Hectare of the buffer - 222Ha
Proposed Buffer Expansion	Length of the buffer 21Km Width of the buffer - 100m Total Hectare of the buffer - 210Ha
Percentage of tea coverage to the total buffer area	70%
Percentage of conservation area coverage to the total buffer area	30%
Type of tea bush	Camellia sinensis O. Kuntze
Conservation area vegetation type	Natural/indigenous vegetation
Riparian area vegetation type	Riparian of 30-60m riparian with grass and Bamboo vegetation

4.4.3 Forest rehabilitation

By design, tea buffer establishment always goes hand in hand with forest rehabilitation. This is done because not all areas targeted for buffer establishment are suitable for tea and also, there are areas inside the forest beyond the buffer that also need to be rehabilitated to ensure that the integrity of the ecosystem is restored and sustained. In the past, Nyayo Tea Zones Development Corporation has established about 4500 hectares of fuel wood plantations to support the tea industry's needs and relieve pressure on other state and community owned forests. Most of the plantations established under this programme were eucalyptus (blue gums). Due to increasing concerns over the suitability of eucalyptus growing in water catchment's areas, the Corporation has adopted bamboo as a key flagship species to mitigate the impacts of forest degradation. It is envisaged that this will be the species of choice under this project whereby, it is intended to establish approximate 60Ha of bamboo forests. This will be further bolstered with the planting of an assortment of suitable indigenous species in Environmentally Sensitive Areas.

Forest rehabilitation will entail activities similar to those of tea establishment. These are:

- Land Surveying and mapping
- Tree planting operations (seedling production, planting and tending)
- Construction of allied infrastructure (access roads, bridges, fire towers, forest guard posts, etc)
- Forest management (silvicultural practices, harvesting, security patrols, maintenance, etc)

This component will have the following outcomes:

- Improved forest cover and reduced encroachment
- Enhanced production of forest goods and services (firewood, medicinal plants, river flow regimes, eco-tourism, recreation, cultural ceremonies, etc)
- Poverty reduction through employment creation and community empowerment
- Enhanced business opportunities and growth as a result of forest industry supply chain requirements.

4.4.4 Livelihood Enhancement in Peri-Forest Communities

More than three quarters in Kenya of the population lives in rural areas, and rural households rely on agriculture for most of their income. The rural economy, in turn, depends mainly on smallholder farming, which produces the majority of Kenya's agricultural output. Rising population and requisite increase in population density has brought a lot of pressure to bear on natural resources as the rural communities struggle to eke a living out of ever shrinking land. Forests have not been spared and have borne the brunt of this expanding population. Illegal settlement has occurred as the landless lay claim to huge swathes of forest land in a bid to establish homes and make a living. This has given rise to conflict between the communities and authorities as evictions have become the order of the day. Though of necessity, evictions are not a panacea to the problem. A more humane and sustainable approach to human displacement is required. The evictees need to be supported to attain sustainable livelihoods that support or complement conservation while at the same time providing them with tangible means of livelihood. It is against this background that this component of the project aims to provide the affected and forest neighboring communities with the wherewithal to acquire and retain self reliance as well as produce surplus for commerce and industry.

Support to community livelihoods enhancement will include:-

- Baseline survey
- Framework of funding (identification of groups)
- Sensitization, needs assessment and capacity building on critical areas of intervention
- Nurturing of ideas (community based micro projects)
- Technical and financial support (alternative means of livelihoods)
- Technical support to adaptation and mitigation interventions
- Continuous monitoring and evaluation
- Technology transfer (field exchange visits)

This component will have the following outcomes:

- Reduced encroachment on the forest
- Increased awareness on ecosystem conservation

- Enhanced production of agricultural and forest goods and services (food security, firewood, medicinal plants, river flow regimes, eco-tourism, recreation, cultural ceremonies, etc)
- Poverty reduction through employment creation and community empowerment
- Enhanced business opportunities and growth as a result of agricultural forest industry supply chain requirements
- Transfer of technology.

4.4.5 Work plan and Budget

The proposed project is estimated to cost a total of Kenya Shillings. Five Hundred Million (Ksh. 500,000,000).

Table 4.2: The anticipated expenditures for the project may be summarized as follows:

NO.	COMPONENT	TOTAL
▪	Feasibility Study	
▪	Planning and design	
▪	Tea Buffer	
▪	Forest Rehabilitation	
▪	Livelihoods enhancement	
▪	Administrative costs	
	Grand Total	**500,000,000.00**

Figure: 4-1. The major forest blocks of the Mau Forests Complex, Kenya

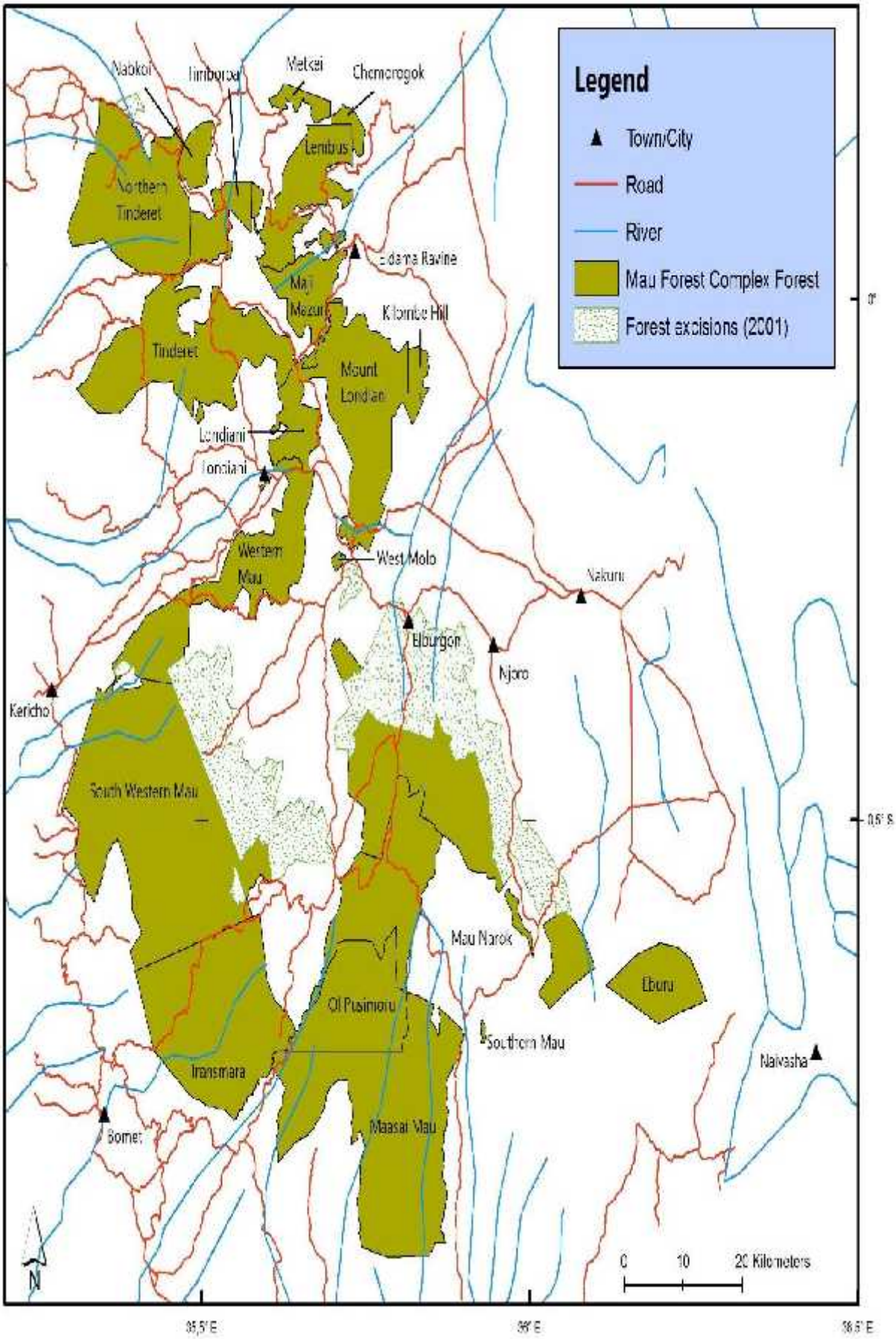


Figure: 4-2. South Western Mau Forest Reserve of the Mau Forests Complex, Kenya

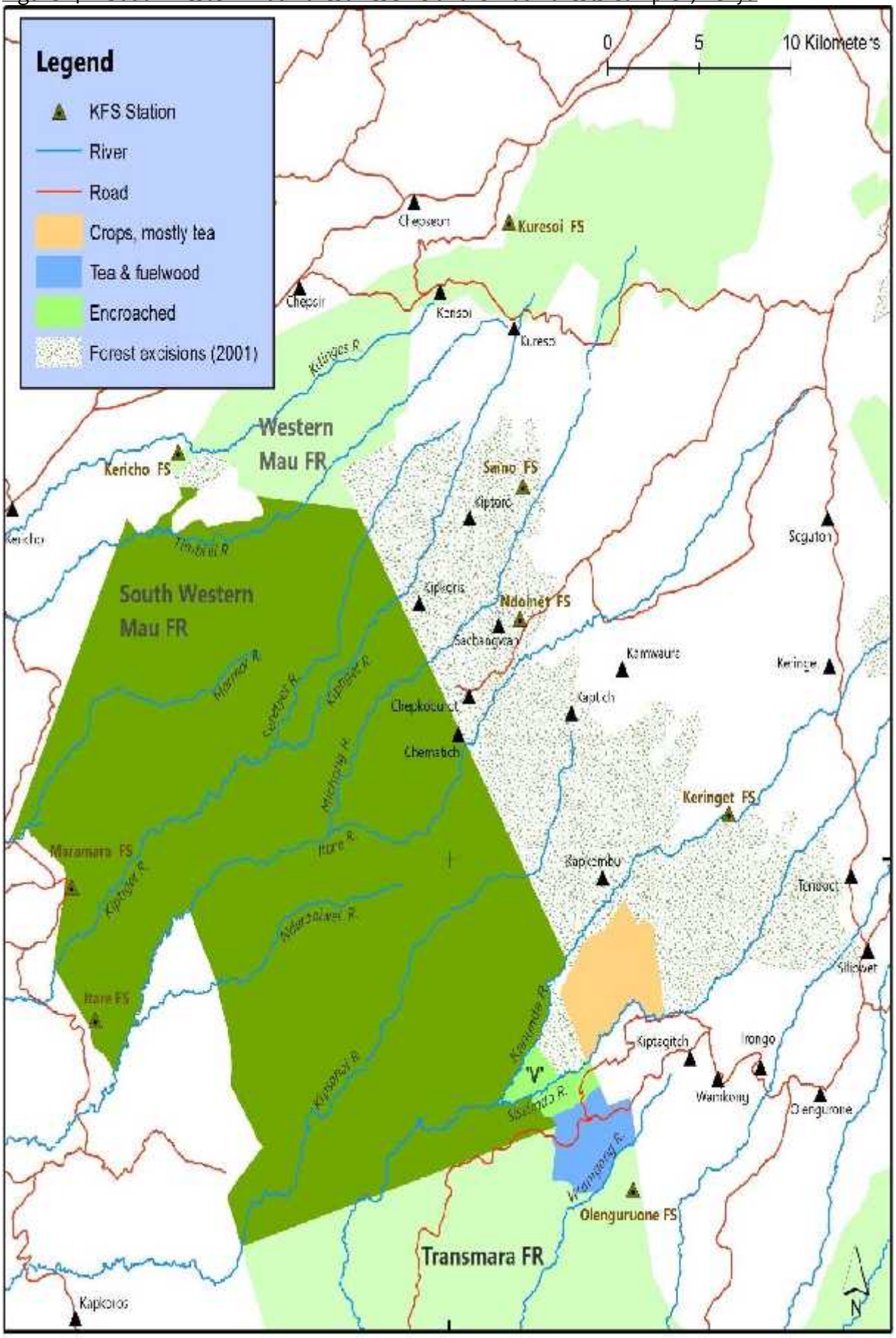


Figure: 4-3. Proposed Tea Buffers In Mau Forest Complex

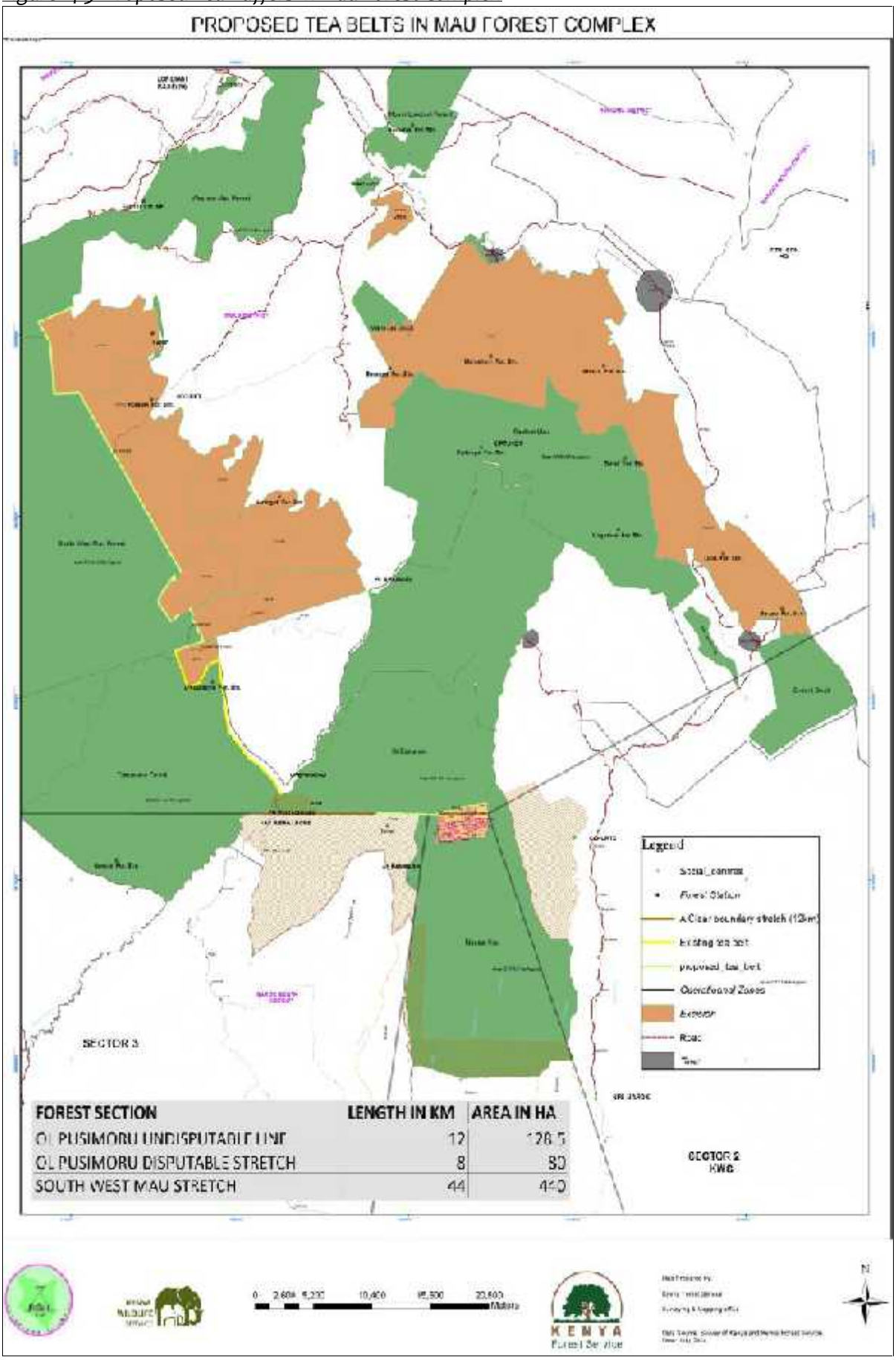


Figure: 4-4. South Western Mau Forest Reserve of the Mau Forests Complex, Kenya

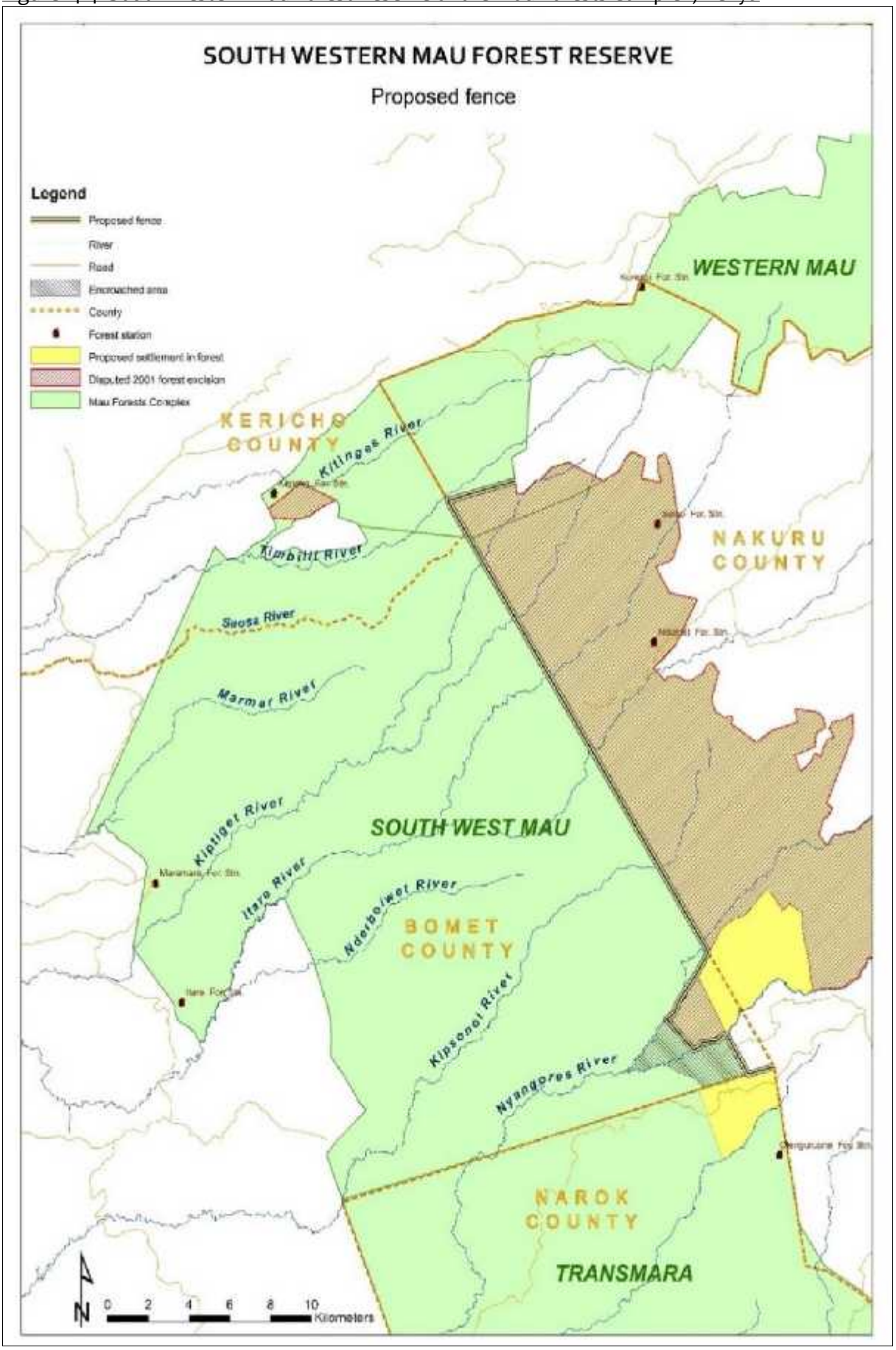


Figure: 4-5. Map showing South West Mau and forest boundary

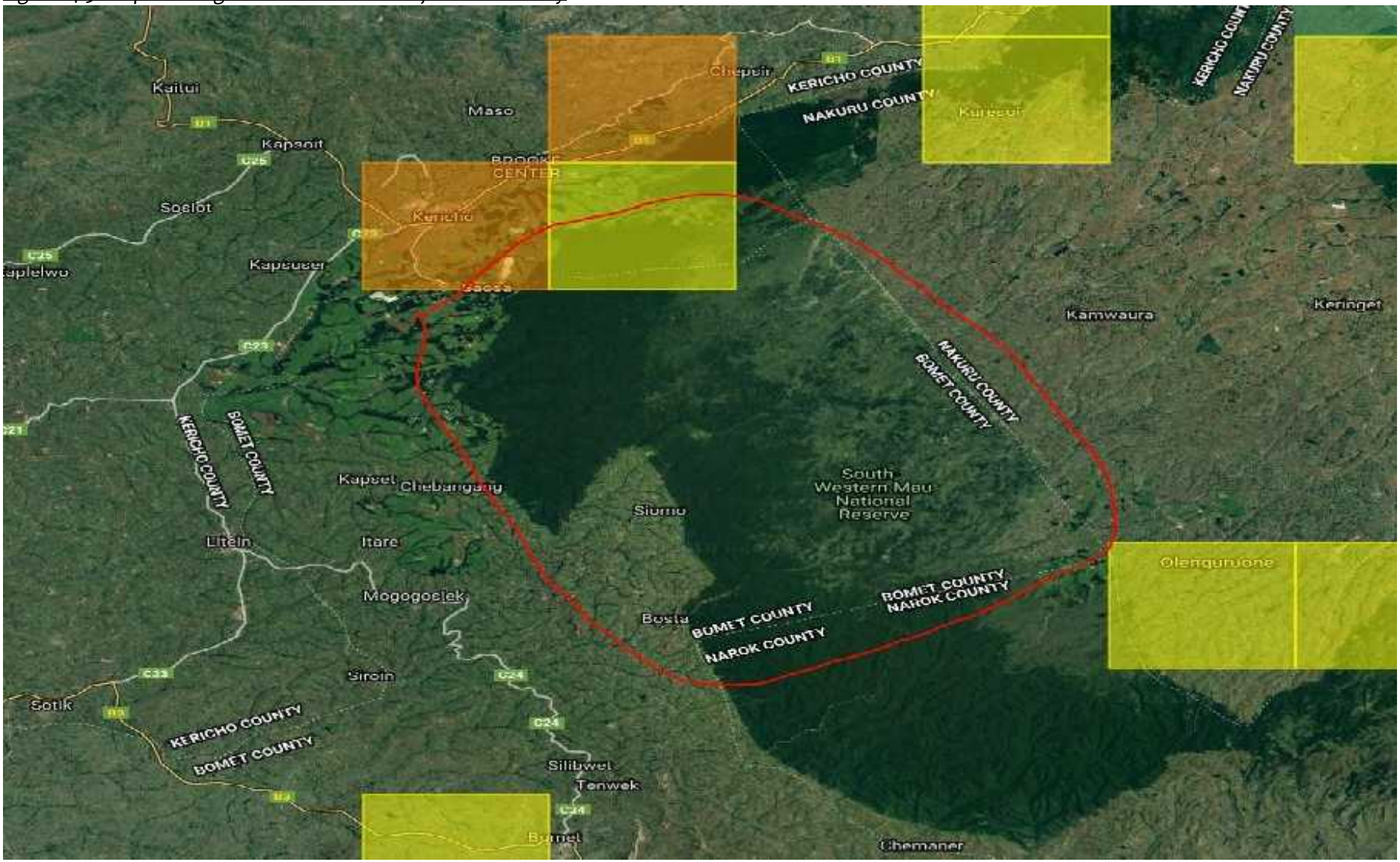


Figure: 4-6. Proposed 21km Tea Buffer Expansion in South West Mau Forest Zones GPS Coordinates: 0°18'51.8"S 35°28'47.4"E - 0°27'44.7"S 35°30'40.9"E

Figure: 4-7. Proposed 21km Tea Buffer Expansion in South West Mau Forest Zones GPS Coordinates: 0°18'51.8"S 35°28'47.4"E - 0°27'44.7"S 35°30'40.9"E

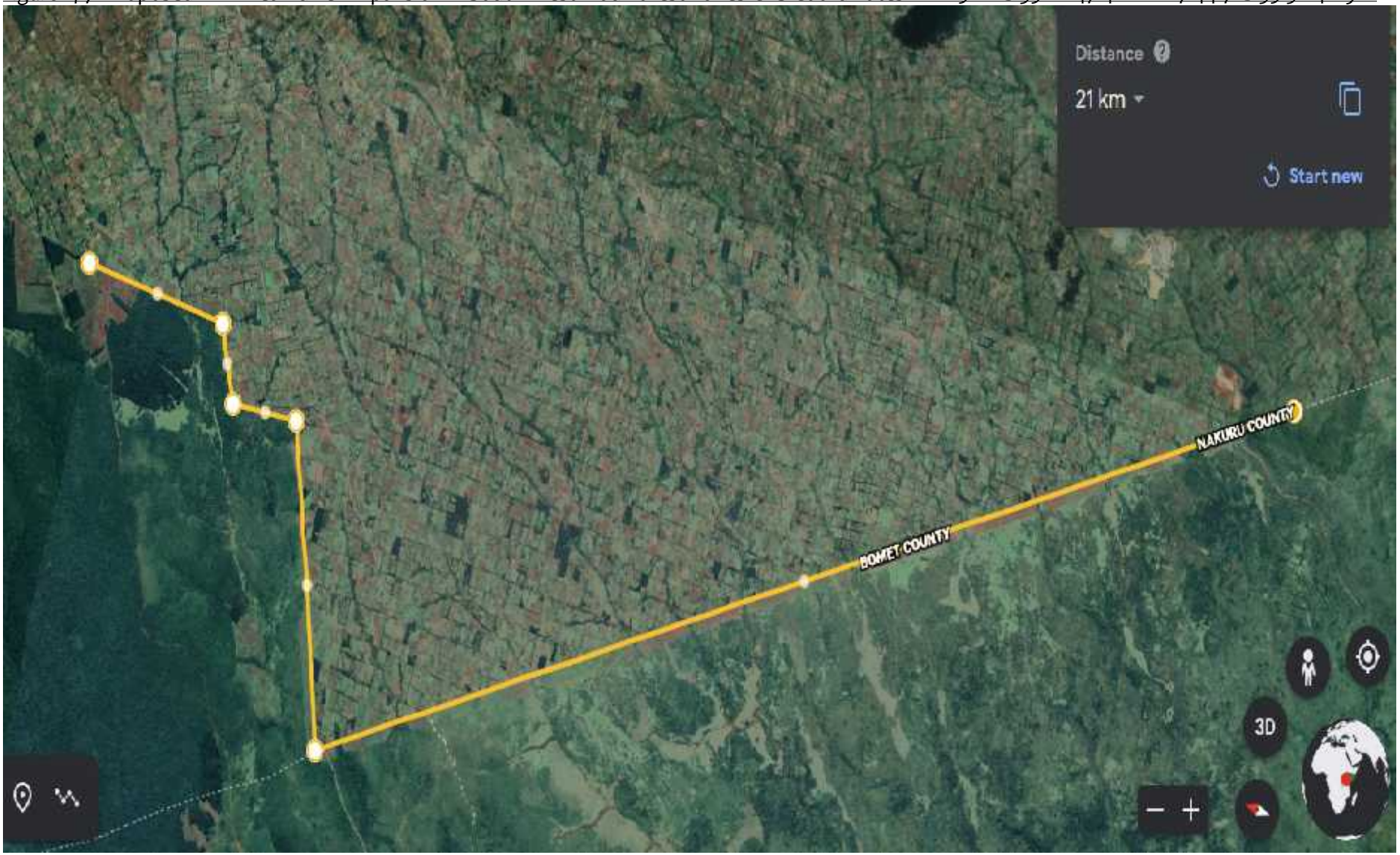


Figure: 4-8. Section of the proposed buffer expansion project site which was encroached by the community

Figure: 4-9. Section of the proposed project site

Figure: 4-10. Section of the proposed project site

Figure: 4-11. A model Nyayo Tea zone buffer belt protecting part of Mau forest complex from encroachment

Figure: 4-12. A model Nyayo Tea zone buffer belt protecting part of Mau forest complex from encroachment

5.0 ANALYSIS OF ALTERNATIVES

5.1 Identification of Alternatives

The ESIA identifies and assesses alternatives to the proposed projects. Only the best alternative (one with the least adverse impacts) is selected based on less negative impacts and cost-benefit analysis. An important alternative to be analyzed is the "no project". This is a very important analysis because it helps the proponents measure the impacts from the project against those which would have taken place without the project. In this section, the alternatives to the proposed project are discussed.

The principle alternatives studied in the context of the proposed project are:

- Alternative 1: The "No Action" alternative - the project site remains as it is;
- Alternative 2: Relocation option; and
- Alternative 3: Development of the proposed project at the proposed site with adequate mitigation measures.
- Alternative 4: Alternative types of buffer zones

5.1.1 Alternative 1: The "No Action" Alternative

The no-action alternative is often defined by the baseline information and is crucial in the assessment of impact because other alternatives are weighed with reference to it. This alternative would mean that the project does not proceed.

Without a buffer zone, the threat to the conservation area is such that the intended conservation of the area becomes impossible over time, e.g. major protected species will disappear or the area will degrade completely and irreversibly.

From the analysis above, it becomes apparent that the "No Action" alternative is therefore not considered as a viable alternative on either social or environmental grounds and is therefore discarded accordingly.

5.1.2 Alternative 2: Alternative Project site

Alternative project site is an alternative that is not suitable for the project implementation. Relocation of the project to alternative community land will require land acquisition which will be significantly costly.

5.1.3 Alternative 3: Implementation of the Proposed Project at the Proposed Site

Under the proposed Project alternative, the proponent would be issued with an EIA License. In issuing the license, NEMA would approve the proposed project, provided all environmental measures are complied with during the planning, implementation and operational phases.

5.1.4 Alternative 4: Alternative types of buffer zones in Forest Conservation

Buffer zone is defined as 'any area, often peripheral to a protected area, inside or outside, in which activities are implemented or the area managed with the aim of enhancing the positive and

reducing the negative impacts of conservation on neighbouring communities and neighbouring communities on conservation'.

Buffer zone management has gone through three development stages:

- At first, buffers were mainly defined as a means to protect people and their crops from animals leaving the conservation areas and forests;
- Until 10-20 years ago the buffer zone principle was applied as a remedy to protect conservation areas from negative human influences;
- Presently, buffer zones are more often applied to simultaneously minimise human impact on conservation areas and addressing the socio-economic needs and wants of the affected population (former resource users of the conservation area).

This section describes various buffer zones, all following the same principle, but applied under completely different conditions.

(i) Forest Plantations Buffer Zone

Forest plantations buffer zone, which can be planted or natural, are probably the oldest, known buffer zone created for exploitation purposes. In most cases this involved converting natural forest into planted forest estates. The remainder (natural forests) was later often treated as core zones. The functional quality of a buffer zone is best when the buffer is an extension of the core zone habitat, in this case a natural forest buffer. Exploited natural forest buffers based on a sustainable system often have a surplus of biomass, which is advantageous for browsing species such as elephants. However, some timber-dependent species will be affected negatively. Cases of forest buffers are exotics plantations.

It is important to apply a forest management system which has a minimal negative impact on the ecological conditions of the buffer zone. Examples are low-impact forest management, allowing other uses as well and taking the biological value of the forest into account. In a natural forest zone, it will be important to leave patches of natural forest untouched.

Advantages of forest buffers are relevant biodiversity in the case of natural forests, production of timber, extension of habitat or deterring habitat for crop-raiding animals, depending on the species. However, they also have the following disadvantages: they can be a fire hazard (in the case of exotics), transformation of natural forest into softwood plantations, disturbance by logging and the risk of over-exploitation, primarily of wildlife.

(ii) Economic Buffer Zone

This type of buffer zone is not always easy to define. Normally, economic buffers are located outside the conservation area.

This type of buffer zone has a production function, which may be pure cash crops (low biodiversity) or adapted agricultural systems (relatively high biodiversity). Examples of cash crops are tea, cashew, and sisal plantations, which are good buffers against crop-raiding animals. Fruit trees, wildlife utilisation and adapted agriculture are more 'true' buffer zones in the sense that they have a higher biodiversity.

Economic buffer zones carry a risk of attracting people from elsewhere. Since economic development is the priority, investments are made. The improved infra-structure and increased production which result are reasons for people from outlying areas to move into the buffer zone.

(iii) Physical Buffer Zone

In some cases, physical barriers are the only way to protect conservation areas from being degraded or destroyed. (In these cases the term buffer zone is not quite accurate, but as it performs some of the buffer zone functions it has been included here.) The best physical barriers are natural features such as rivers, cliffs and canyons. In densely populated areas in Western Europe, artificial barriers such as fences, walls and canals are often used.

Physical buffers have several purposes:

- Clear demarcation of the area,
- Preventing animals from leaving the area, and
- Preventing people from entering the area.

In principle, these physical buffer zones do not have a production function, except for rivers

5.2 Comparison of alternatives

Tea buffer belt is not a new concept in conservation and has been going on with considerable success since 1986. This work has been spearheaded by the Nyayo Tea Zones Development Corporation which was established in 1986 with the mandate to create tea buffer belts around the country's water towers of Mt. Kenya, Aberdare Range, Mau Forest, Mt. Elgon and Cheranganyi Hills. In addition, belts were also created in Nyambene hills, Nandi Forest, Kakamega Equatorial Forest and Kaptagat forest. Since its inception, over 8,000 hectares of buffer belt has been established comprising tea, fuel wood and indigenous forest. Of this area, about 3,400 hectares is currently under tea. Under this project, a further 210 hectares of tea will be established.

In evaluating various alternatives the proposed development alternative has been found the best available alternatives as it maximises the benefits to all beneficiaries and the potential negative impacts are not so significant and can further be mitigated by adherence to the proposed EMP. Under the proposed tea buffer, the project would support forest conservation and livelihood of the local community. Under the No Action Alternative, forest degradation and encroachment would be continued unchecked.

6.0 PUBLIC CONSULTATION

6.1 Public Stakeholders Consultation

Public participation is an essential and legislative requirement for environmental authorization. The expert undertook the Public Stakeholders Consultation (PSC) for the proposed project in accordance with the requirements stipulated in the EMCA 2015 and EIA/ EA Regulations 2003.

Section 17 of the Environmental (Impact Assessment and Audit) Regulations 2016 states that an ESIA should "seek the views of persons who may be affected by the project." The public consultation should involve direct contact with the respondents or their representatives. The respondents were people who are likely to be affected by the proposed project or stakeholders whose individual or collective interests in the short term of long-term may be affected. The respondents are therefore neighbours, business people, consumers, community leaders or generally Kenyans who have a collective interest in the project.

6.2 Objectives of Public Consultation

The overall goal of the consultation process is to disseminate project information and to incorporate the views of the project beneficiaries and Project Affected Persons (PAPs) in the design of the mitigation measures and a management plan.

The specific aims of the consultation process are to:

- Improve project implementation plans and thereby, minimize conflicts and delays in implementation;
- Increase long term project sustainability and ownership;
- Reduce problems of institutional coordination;
- Ensure that all stakeholders and interested parties, are fully informed of the project and have the opportunity to raise their concerns;
- Ensure that any issues resulting from this process are addressed in the ESIA and incorporated into the implementation of the project.
- Consultation is done on sensitive issues and mitigation measures are established for management of any impacts that may arise during implementation of the project
- An important element in the process of impact assessment is consulting with stakeholders to gather the information needed to complete the assessment.
- Obtain the main concerns and perceptions of the population and their representatives regarding the project;
- Obtain opinions and suggestions directly from the affected communities on their preferred mitigation measures.

6.3 Approach used in carrying out the public and stakeholders consultation

The public consultation for this project was done through a public and stakeholders meeting on 23rd May 2019 near the project site. The attendants consisted of area residents, NTZDC officials

among others. Questionnaires were also issued to various stakeholders to allow them to provide their views concerning environment, economic, social, health and safety issues of the proposed project.

Figure: 6-1. Session during public consultation baraza

Figure: 6-2. Session during public consultation baraza

6.4 Comments and Responses from the Stakeholders

Public and stakeholder consultation provided views, opinions and suggestions on the proposed project. Generally, all the stakeholders consulted at the project site had no objection of the proposed project. The public and stakeholders' views, opinions and suggestions on the proposed project have been summarized below.

6.4.1 Positive Impacts

The respondents mentioned the following positive impacts related to the proposed project.

- Improvement of the local and national economy
- To restore the ecosystem integrity of the protected forest block
- Improved forest cover and reduced encroachment
- Poverty reduction through employment creation and community empowerment
- Increased awareness on ecosystem conservation
- Enhanced production of agricultural and forest goods and services (food security, firewood, medicinal plants, river flow regimes, eco-tourism, recreation, cultural ceremonies, etc)
- Transfer of technology.

6.4.2 Negative Impacts

The respondents attributed ongoing negative impacts to lack of buffer.

- Lack of employment has lead to degradation of the forest through: poaching, charcoal burning, encroachment, deforestation and crime.

6.4.3 Recommendations

The respondents gave the following recommendation.

- Local community sought to be given priority in employment opportunities.

7.0 POTENTIAL ENVIRONMENTAL IMPACTS

7.1 Introduction

The tables 7-1 and 7-2 below summarizes the anticipated environmental problems observed which may be created by the project.

7.1.1 Summary of environmental and social impacts

Table 7-1: Summary of environmental and social impacts

Environmental and social impact	Positive/ negative	Direct / indirect	Temporary /permanent	Major / Minor	Occurrence	
					Design and Implementation	Operation
Employment opportunities	Positive	Direct/Indirect	Permanent/ Temporary	Major	√	√
Creation of markets for suppliers	Positive	Direct	Temporary	Minor	√	-
Impact on water quality and quantity	Positive	Direct	Permanent	Major	√	√
Improved household income and local economy	Positive	Direct	Permanent	Major	√	√
Interference with the physical setting	Negative	Direct	Permanent	Major	√	√
Loss of vegetation	Negative	Direct	Permanent	Major	√	√
Soil degradation	Negative	Direct	Permanent	Major	√	√
Noise generation	Negative	Direct	Temporary	Major	√	-
Dust emissions	Negative	Direct	Temporary	Major	√	-
Disposal of spoil	Negative	Direct	Temporary	Major	√	-
Land take	Negative	Direct	Permanent	Major	√	√
Solid waste generation	Negative	Direct	Temporary	Major	√	√
Vegetation loss	Negative	Direct	Permanent	Major	√	√
Accidental spills and leakages	Negative	Direct	Temporary	Minor	√	√
Occupational health and safety	Negative	Direct	Permanent	Major	√	√

hazards						
Archaeological and other cultural properties	Negative	Direct	Temporary	Minor	-	-
Increase in HIV/AIDS prevalence and other STIs	Negative	Direct	Permanent	Major	√	√
Spread of communicable diseases and other infections	Negative	Direct	Temporary	Minor	√	√
Ecological impact	Negative	Direct	Permanent	Major	√	√
Emergency preparedness	Negative	Direct	Direct	Permanent	√	√

Table 7.2: Summary of specific environmental and social impacts

Project Activity	**Potential Impact**	**Level of significance**
Tea buffer belt		
Land surveying and mapping	Vegetation disturbance	Low
Land preparation (bush clearing, de-stumping and ploughing)	Loss of vegetation cover	Moderate
	Soil erosion	Moderate
Tea planting operations (seedling production, planting and tending)	Vegetation disturbance	Low
	Soil & soil organism disturbance Loss of soil biota, decreased organic matter, lower cation exchange capacity, reduced water retention, soil compaction, soil erosion and nutrient leaching from fertilizer	Moderate
	Siltation of water bodies downstream Contamination of water resources from fertilizer use	Moderate
Tea and buffer belt management (agronomic practices, harvesting, leaf delivery, security patrols, maintenance, etc)	Soil compaction/vegetation trampling	Low
Construction of allied infrastructure (access roads, bridges, tea collection centers, labour lines, etc)	Soil compaction/Vegetation trampling	Low
Transportation of materials	Increase in air pollution by exhaust emission and dust particles during transportation of materials to site.	Moderate
Forest rehabilitation		
Land Surveying and mapping	Vegetation disturbance	Low

Tree planting operations (seedling production, planting and tending)	Vegetation disturbance	Low
	Soil & soil organism disturbance Loss of soil biota, decreased organic matter, lower cation exchange capacity, reduced water retention, soil compaction, soil erosion and nutrient leaching from fertilizer	Moderate
Construction of allied infrastructure (access roads, bridges, fire towers, forest guard posts, etc)	Generation of construction wastes Soil and vegetation disturbance & Vegetation loss	Moderate
Transportation of materials	Increase in air pollution by exhaust emission and dust particles during transportation of materials to site.	Moderate
Forest management (silvicultural practices, harvesting, security patrols, maintenance, etc)	Lack of funds to maintain the forest, hence affecting its sustainability and hence the buffer purpose	Low
Livelihood Enhancement in Peri-Forest Communities		
- Baseline survey - Framework of funding (identification of groups) - Sensitization, needs assessment and capacity building on critical areas of intervention - Nurturing of ideas (community based micro projects) - Technical and financial support (alternative means of livelihoods) - Technical support to adaptation and mitigation interventions - Continuous monitoring and evaluation - Technology transfer (field exchange visits)	Social –economic impacts	Low

7.2 Negative impacts during implementation

7.2.1 Biophysical Impacts

A 100 metres wide corridor will be cleared for development of tea buffer. This will result in the clearing of vegetation in terms of trees, shrubs and undergrowth. Despite some section already having being cleared, some large tracts of vegetation will have to be cleared to facilitate establishment of the tea buffer. Clearing of vegetation will destroy some biodiversity and wildlife habitat.

Table 7.3: Summary of Biophysical impacts

Impact	Mitigation
Loss of vegetation (trees) and other biodiversity	▪ Reserve at least 30% of the buffer as conservation zones preferable through indigenous species. ▪ Provide riparian vegetation (grass/bamboo) along the river riparian ▪ Provide clear demarcation of boundaries- (maximum width of 100m) ▪ Restrict clearance to the buffer alignment, avoid cutting down iconic trees and avoid spill over effects ▪ Plant more indigenous trees in the degraded areas ▪ Buffer line to follow forest boundary as much as possible ▪ Human labour to be used during construction ▪ Confine construction activity within the buffer cut line
Impact on soil erosion and water pollution	▪ Provided soil erosion measures/structures within the buffers. ▪ Practice low-impact tillage methods to reduce disturbances to soil; ▪ Use green manure to produce organic fertilizers ▪ Minimize grease and oil leakages from machinery. ▪ Re-vegetate all open or disturbed area. ▪ Avoid tillage on steep slopes;
Impact on water resources Used oil and filters from machinery resulting in contamination of soils, surface and ground waters	▪ Avoid stockpiling excavated materials within area prone to flooding. ▪ Hazardous materials should not be stored above flood level and at least 40 meters from any water course ▪ Where possible, tillage/ploughing should be done during dry season
Insularization of wildlife habitat (Injuries to wildlife due to risks of falling into the trenches, disturbance to animal serenity during implementation and disruption of wildlife movements)	▪ Leave the riverines semi closed to act as a corridor for species movement ▪ Continous monitoring of key biodiversity indicators ▪ Erect barriers to all open excavations to keep off wildlife and workers
Dust and noise pollution from use of tillage machinery	▪ Provide workers in noisy sections with ear muffs/plugs ▪ Ensure strict enforcement of on-site speed limit ▪ Maximize the use of manual labour and hand tools.
Solid and liquid waste (Sanitation waste, damaged tea leaves, waste food, papers, plastics, packaging materials and maintenance waste). ▪ Contamination of air, soils, surface and ground water; ▪ Occupation health and safety concerns from vermin infestation and disease risk	▪ Encourage use of compost from plant waste ▪ Adequate sanitary facilities should be provided and maintained separate for male and female workers ▪ All solid waste generated during the course of buffer establishment and operation should be properly collected and stored in a designated area to facilitate sorting, before being disposed of at designated and approved disposal sites. ▪ Solid waste including vegetative matter should not be subjected to open burning
Energy and water	▪ Provide adequate energy and water conservation

Increased demand on fossil fuels (mainly diesel) to run transport vehicles and machinery. Increased water demand for crop and domestic	▪ Staff should be sensitized to switch off machinery and trucks when not being used ▪ Provide proper planning for transportation of materials in order to save fossil fuels

Overall biophysical assessment

The project has more positive biophysical assessment impacts than negative ones. The forest is already surrounded by human activities with minimal natural habitat ecosystem connectivity hence insularization of species is almost negligible. There will be increased forest regeneration with less livestock and higher success of growth for planted trees. Better forest health will enhance species diversity and abundance. There will be minimal net loss of biodiversity in the short term but far higher biodiversity net gain in the long-term after project implementation

Carbon sequestration to mitigate climate change is enhanced when the forest is maintained intact. Ecotourism, nature based enterprise and access to forest genetic resources and benefit sharing will all be enhanced. This will improve the local and regional economy.

7.2.2 Social cultural impacts

Table 7.4: Summary of social cultural impacts

Impact	Mitigation
Restricted access to forest resources Potential for buffer vandalism Boundary disputes within existing settlements excisions from the forest	▪ Provide community access gates to the forest where necessary ▪ Take some of the resources outside forest to the community e.g. pipe water out where possible ▪ Establish community wood lots ▪ Support community enterprise projects ▪ Support alternative community energy projects ▪ Community sensitization and awareness creation ▪ Encourage community policing by employing community scouts and buffer attendants from forest adjacent communities ▪ KWS and KFS to undertake regular security patrols along the buffer ▪ Establish Local level buffer project committees ▪ Undertake a boundary survey before establishment of the buffer ▪ Establish grievance resolution mechanism at village level
Interference with cultural practices	▪ Access gates to be provided at strategic entry points of all identified cultural sites and shrines ▪ Empower and involve local cultural elders in the forest conservation awareness programmes ▪ Conduct awareness and sensitization ▪ Farmers should be sensitized to maintain their fence on the boundary between their farms and the buffer
Occupational health and safety	▪ Provide all workers with suitable PPEs and enforce their use. ▪ Provide workmen's compensation insurance cover for workers. ▪ Provide properly stocked first aid kits and trained first aiders.

Injuries from accidental falls, injuries from equipments, fire and air pollution etc	▪ Create EHS awareness among the workers ▪ All access to the hazardous areas should be secured. ▪ Provision of adequate sanitary facilities to workers
Public Health Issues Increased HIV/AIDS and other STIs	▪ Support implementation of HIV/AIDS prevention programmes within the project area in collaboration with other stakeholders
Child labour and poor treatment of workers	▪ Provide labourers with sufficient wages and working conditions ▪ Avoid hiring labourers who abuse drugs and alcohol ▪ Check the background of any person to be hired to ensure they are of the right age (above 18 years). ▪ Up hold women's rights and ensure that there will not be any form of exploitation of workers including forced labour or services, sexual exploitation etc

Overall Social cultural assessment

Most of the negative social impacts are based on perceptions and will be significantly reduced through community sensitization and conservation education awareness programmes. Coordinated community sensitization between local leaders and project implementing agencies is required

7.2.3 Economic Impacts

Table 7.5: Summary of economic impacts

Impact	Mitigation
Loss of income generated from forest resources	▪ Provide alternative community enterprise projects comprising of nature based and ecotourism activities ▪ Agricultural extension programmes such as Zero grazing, breed improvement to reduce livestock numbers ▪ Employ local content in the entire project cycle ▪ Promote farm forestry and domesticate some forest plants for commercial production ▪ Educate community on genetic resource commercialization ▪ Enforce laws on illegal income from charcoal burning, mining and illegal logging

Overall economic assessment

The project will have an impact on income generating when livestock grazing are completely stopped amongst the households that are currently undertaking this activity. KFS need to gradually annul grazing and farming in the forest as the community gets more and more empowered on alternative livelihoods that are compatible with forest conservation. In the short term food security for farmers may be affected negatively but in the long term sustainable forest conservation will augment food security in the region through climate regulation

7.2.4 Ecosystem services

SW Mau FZ has a number of ecosystem services at local level, regional and even global. The proposed tea buffer will have an enhancement effect on most of the services but in the short

term it will impact negatively to the local level services. Ecosystem services of particular importance include livestock grazing resources, firewood resources, medicinal plants, fresh water for human and livestock use and cultural and spiritual sites. Most impacts to these are associated with the buffer development phase with the most significance dependency being the need for effective management of forest adjacent community access to the forest for basic resources. However through mitigations such as provision of access gates, piping water out of the forest to the community and robust community sensitization before project implementation these impacts will be negligible

7.3 Positive Environmental Impacts/Conservation benefits

7.3.1 Increased conservation

Fencing will enable forest restoration of the already degraded forest sections by incompatible land use activities such as cultivation.

Illegal activities such as poaching or subsistence hunting will be minimized. Other activities such as illegal logging and exploitation of forest vegetation will also be reduced. People will only use forest resources for specific purposes and in a non-degrading manner such as firewood collection and collection of fruits, tubers and other available food sources. The buffer will also provide excellent firebreaks and protect the core zone from invasion by exotic plant and animal species;

7.3.2 Reduced human-wildlife conflict

Human-wildlife conflict has resulted in decline in agricultural productivity due to crop damage, demoralized farmers, and social upheaval. With the tea barrier in place, crop damage will be minimized, thereby allowing increased farm productivity by farmers adjacent to the forest and a return to social order. This will enhance food security and alleviate poverty.

7.3.3 Secure SW Mau FZ

The tea buffer will lead to reduced catchment degradation whose positive impacts will be felt through improved water flow within rivers and underground. This will bring benefits to surrounding farming communities and community further downstream.

7.3.4 Climate change mitigation and adaptation

Forest restoration will lead to improved carbon sequestration and thereby help reduce the accumulation of carbon dioxide (CO_2) in the atmosphere. Coupled with improved water flow, this will also enhance the capacity of local people to cope with climate change through livelihood adaptation.

7.3.5 Local employment

The project will employ local community adjacent to the forest who will provide non-skilled labour during the project implementation and operation. Most of the employment during construction will be temporary but semi permanent labour will be continuously required for the tea buffer maintenance

A socio-economic assessment of the existing 23Km of South West Mau indicates major contribution to poverty reduction through employment of about 1,500 labour force of which 80% are mostly women. The assessment also indicates that the community supports the project activities. The survey also showed that school attendance was higher and more stable in the tea buffer zone than the adjacent areas (without buffer). This was associated with the improved income of project beneficiaries and their enhanced ability to pay fees. To improve the poverty reduction impact of the project however, the communities need to be more gainfully involved beyond labour employment.

7.3.6 Improved rural infrastructure

The project is expected to contribute to rural roads maintenance in the areas. This will improve accessibility by the community to other key area and public amenities.

7.3.7 Improved tea farming/knowledge

Many tea farmers in the project areas will have the opportunity to purchase improved tea seedlings from project nurseries for higher crop yields that are important to raising farm incomes. The farmers will also have the opportunity to participate in the project agro-forestry initiatives especially during World Environmental Day.

7.3.8 Revenue to national and county governments

Since the project is more of an economic buffer the government will earns revenue from sale of tea. The project will therefore contribute towards the national and local revenue earnings

7.4 Land take and resettlement

Nyayo Tea Zone has already developed a buffer zone belt on the south West Zone referred to as Kuresoi. The proposed tea zone is an extension of the same and will be developed on forest land. The proposed project is therefore not expected to lead to land take and subsequently compensation.

7.5 Monitoring and Evaluation

Monitoring and evaluation is very important in buffer zone projects, particularly as the investments made yield few direct or short-term benefits. Because these projects are typically long-term exercises, it is important to be able to prove the usefulness and effectiveness of buffer zones from various angles (ecological, social, economic, institutional, etc).

8.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Table 8-1: Environmental and Social Management Plan

Phase	Environmental Impact	Proposed Mitigation measures	Responsibility	Time frame	*Cost (KES)
Establishment and management of the tea buffer	Compliance with development standards	▪ During the establishment and management of the tea buffer ensure there is regular consultation with various government authorities notably the KFS, KWS, WRA, KWT and the agricultural department	NTZDC	Implementation period	Implementation and maintenance cost
	Loss of vegetation (trees) and other biodiversity	▪ Reserve at least 30% of the buffer as conservation zones preferable through indigenous species. ▪ Provide riparian vegetation (grass/bamboo) along the river riparian ▪ Provide clear demarcation of boundaries- (maximum width of 100m) ▪ Restrict clearance to the buffer alignment, avoid cutting down iconic trees and avoid spill over effects ▪ Plant more indigenous trees in the degraded areas ▪ Buffer line to follow forest boundary as much as possible ▪ Human labour to be used during construction ▪ Confine construction activity within the buffer cut line	NTZDC	Implementation and management periods	Implementation and maintenance cost
	Impact on soil erosion and pollution	▪ Provided soil erosion measures/structures within the buffers. ▪ Practice low-impact tillage methods to reduce disturbances to soil; ▪ Use green manure to produce organic fertilizers ▪ Minimize grease and oil leakages from machinery. ▪ Re-vegetate all open or disturbed area. ▪ Avoid tillage on steep slopes;	NTZDC	Implementation and management periods	Implementation and maintenance cost
	Impact on wildlife	▪ Leave the riverines semi closed to act as a corridor for species movement ▪ Continous monitoring of key biodiversity indicators ▪ Erect barriers to all open excavations to keep off wildlife and		Implementation period	Implementation and maintenance cost

Phase	Environmental Impact	Proposed Mitigation measures	Responsibility	Time frame	*Cost (KES)
		workers.			
	Impact on water resources	▪ Avoid stockpiling excavated materials within area prone to flooding. ▪ Hazardous materials should not be stored above flood level and at least 40 meters from any water course ▪ Where possible, tillage/ploughing should be done during dry season		Implementation and management periods	Implementation and maintenance cost
	Restricted access to forest resources Potential for buffer vandalism Boundary disputes within existing settlements excisions from the forest	▪ Provide community access gates to the forest where necessary ▪ Take some of the resources outside forest to the community e.g. pipe water out where possible ▪ Establish community wood lots ▪ Support community enterprise projects ▪ Support alternative community energy projects ▪ Community sensitization and awareness creation ▪ Encourage community policing by employing community scouts and buffer attendants from forest adjacent communities ▪ KWS and KFS to undertake regular security patrols along the buffer ▪ Establish Local level buffer project committees ▪ Undertake a boundary survey before establishment of the buffer ▪ Establish grievance resolution mechanism at village level			
	Dust and noise pollution from use of tillage machinery	▪ Provide workers in noisy sections with ear muffs/plugs ▪ Ensure strict enforcement of on-site speed limit ▪ Maximize the use of manual labour and hand tools.	NTZDC	Implementation and management periods	Implementation and maintenance cost
	Solid and liquid waste management	▪ Encourage use of compost from plant waste ▪ Adequate sanitary facilities should be provided and maintained separate for male and female workers	NTZDC	Implementation and managemen	Implementation and maintenan

Phase	Environmental Impact	Proposed Mitigation measures	Responsibility	Time frame	*Cost (KES)
		▪ All solid waste generated during the course of buffer establishment and operation should be properly collected and stored in a designated area to facilitate sorting, before being disposed of at designated and approved disposal sites. ▪ Solid waste including vegetative matter should not be subjected to open burning.		t periods	ce cost
	Occupational Health and Safety	▪ Provide all workers with suitable PPEs and enforce their use. ▪ Provide workmen's compensation insurance cover for workers. ▪ Provide properly stocked first aid kits and trained first aiders. ▪ Create EHS awareness among the workers ▪ All access to the hazardous areas should be secured. ▪ Support implementation of HIV/AIDS prevention programmes within the project area in collaboration with other stakeholders	NTZDC	Implementation and management periods	Implementation and maintenance cost
	Interference with cultural practices	▪ Access gates to be provided at strategic entry points of all identified cultural sites and shrines ▪ Empower and involve local cultural elders in the forest conservation awareness programmes ▪ Conduct awareness and sensitization ▪ Farmers should be sensitized to maintain their fence on the boundary between their farms and the buffer			
	Traffic impacts	▪ Minimize damage to existing road and drainage system. ▪ Avoid spillages of materials on the roads ▪ Provide adequate warnings on use of heavy vehicles/machinery ▪ Ensure strict enforcement of on and off -site speed limits	NTZDC	Implementation and management periods	Implementation and maintenance cost
	Energy and water demand	▪ Provide adequate energy and water conservation ▪ Staff should be sensitized to switch off machinery and trucks when not being used ▪ Provide proper planning for transportation of materials in	NTZDC	Implementation and management periods	Implementation and maintenance cost

Phase	Environmental Impact	Proposed Mitigation measures	Responsibility	Time frame	*Cost (KES)
		order to save fossil fuels			
	Socio-economic	▪ Provide alternative community enterprise projects comprising of nature based and ecotourism activities ▪ Agricultural extension programmes such as Zero grazing, breed improvement to reduce livestock numbers ▪ Employ local content in the entire project cycle ▪ Promote farm forestry and domesticate some forest plants for commercial production ▪ Educate community on genetic resource commercialization ▪ Enforce laws on illegal income from charcoal burning, mining and illegal logging ▪ Provide labourers with sufficient wages and working conditions ▪ Avoid hiring labourers who abuse drugs and alcohol ▪ Check the background of any person to be hired to ensure they are of the right age (above 18 years). ▪ Up hold women's rights and ensure that there will not be any form of exploitation of workers including forced labour or services, sexual exploitation etc	NTZDC/ Community	Implementation and management periods	Implementation and maintenance cost
De-commissioning	Loss of livelihood	▪ Propose alternative livelihood activities	NTZDC	De-commissioning Period	De-commissioning costs
	Soil erosion	▪ Plant grass and other native vegetation along the buffer area ▪ Maintain soil conservation works until the site stabilizes.			
	Visual impacts	▪ Carry out regeneration of vegetative cover around the buffer area;			
	Generation of waste material	▪ Waste from decommissioning of the buffer should be carted away and disposed off in a manner that is acceptable under waste management regulation 2006			
	Risk of accidents	▪ Secure all unsafe and potentially dangerous areas			

9.0 INTEGRATION OF CLIMATE CHANGE VULNERABILITY ASSESSMENT

9.1 Integration of Climate Change Vulnerability Assessment

The Earth's climate is a complex system consisting of the atmosphere, land surface, snow and ice, oceans and other bodies of water, and living things. The atmospheric component of the climate system most obviously characterizes climate; climate is usually defined as "average weather," described in terms of the mean and variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years (the typical period is 30 years).

Projecting changes in climate systems is different from a weather forecasting and is indeed a much more manageable issue. Based on the foundation of current climate models, there is considerable confidence that climate models provide credible quantitative estimates of future climate change. However, to be able to predict changing climate, the results not only depend on the interaction among characteristics of the climate, but also on the amount of greenhouse gasses (GHGs) released into the atmosphere. The amount of GHGs in the atmosphere is determined by released gases both from human and natural sources and by their removal through sinks, which mainly include photosynthesis in vegetation. Furthermore, the climate reacts over long periods to influences upon it; many GHGs remain in the atmosphere for thousands of years.

Impacts of climate change pose very serious risks for vital ecosystems, and sectors including agriculture, forestry, health, local economic activities and biodiversity. In conjunction with other pressures, they could also exacerbate other serious local and regional challenges, such as poverty, poor healthcare, inequitable distribution of resources, diminishing ecological resiliency and energy insecurity. This chapter help identify impacts of changing climate and developing adaptive responses.

9.2 Climate Change Vulnerability Assessment in Nakuru and Kericho Counties

9.2.1 Nakuru County Climate Risk Profile (Climate change, related risks/vulnerabilities, adaptation to climate change and variability)

- Nakuru County lies within the Great Rift Valley, bordering eight other counties: Kericho and Bomet to the west, Baringo and Laikipia to the north, Nyandarua to the east, Narok to the south-west and Kajiado and Kiambu to the south. The County covers an area of 7,495.1 square kilomters (Km^2) (GoK, 2013).
- Nakuru is a diversified County in terms of climate, people and livelihoods. Agriculture is the main sector providing food, income, employment creation and raw materials for industries pursuing processing. The sector provides about 48% of the household income and employs over 60% of the employed population. However, climate change is a major factor affecting the sector.
- Drought, intense rains, floods, and high temperatures already challenge productivity, incomes and food security in the County and are expected to pose even greater challenges in the future. Looking to the future in the years 2021-2065, prolonged moisture stress is projected to occur across both seasons of the year analysed and consecutive days of moisture stress are projected to more than double in the first wet season from approximately 35 days to over 70 days on average. While only small changes in intense precipitation are expected to occur, precipitation is projected to increase by 0.3% in the

first wet season, and 6% in the second wet season. These all indicate the need of adaptation to expected increased incidence of droughts and floods in the future.

- At the moment, climate-adaptive strategies to cope with climate hazards include tree planting, soil and water conservation and improved agricultural systems (changing crop type, and, to lesser extents, staggered cropping, diversification of enterprises, and post-harvest storage and processing). However, the lack of productive resources, infrastructure, and technical skills has often resulted in low uptake and adoption of these strategies.
- Successful implementation of climate adaptation strategies requires strengthening of the institutional and financial capacity of relevant stakeholders.

9.2.2 Kericho County Climate Risk Profile (Climate change, related risks/vulnerabilities, adaptation to climate change and variability)

- Kericho County covers a total area of 2,479 km2. It borders Nakuru County to the east and Bomet County to the south, Uasin Gishu County to the north, Baringo County to the northeast, Nyamira and Homa Bay Counties to the southwest, Kisumu County to the west and Nandi to the northwest. Kericho County has six sub-counties; Sigowet/Soin, Belgut, Ainamoi, Bureti, Kipkelion East and Kipkelion West. Kericho County is characterized by undulating topography where the lowest altitude is at 1800 m while the highest is at 3000 m above sea level (GoK, 2013b).
- Agriculture is the main source of livelihood in Kericho County, contributes more than 80% of household incomes, and employs over 50% of the county's population. The county has an absolute poverty rate of 41.3% while 38.7% of the population lives below the food poverty line. Negative impacts of climate change and variability on agriculture further aggravate the food security.
- The county has fertile soils and adequate rainfall but this has gradually changed especially in the last 3 decades due to climate change. There are prolonged dry spells characterized by high moisture stress that negatively affect crops like tea. Rainfall is now erratic throughout the year and this affects both the long and short planting seasons. Intense rainfall occurrence is also on the rise especially in the Second Season (July-December). Extreme precipitation over short periods has caused flash floods that have destroyed crops e.g. in Soin.
- Adaptation strategies in crops and livestock include agro-forestry, conservation agriculture, planting drought resistant varieties and early maturing crops. water conservation strategies that include rainwater harvesting from rooftop catchments, water pans and dams, crossbreeding local breeds with drought resistant breeds such as Galla goats and Dorper rams, fodder conservation in form of silage and hay and use of maize stover/cobs as alternative livestock feed.
- Poor coordination between different departments and institutions within the county has negatively influenced adaptation efforts. Contradicting programmes and policies and overlapping mandates between sectors and programs cripple adaptation efforts. There is a need to define clear-cut roles at the county level for key players and enhance coordination among stakeholders.
- Research, conservation agriculture, early warning systems, insurance schemes and climate-focused extension services will go a long way in improving resilience and supporting adaptation efforts in the County. Strengthening of institutions capacity on climate change adaptation and streamlining institutions' mandates is important.
- There is need for improvement in financial and human capacity related to implementation of climate change adaptation programmes in all relevant sectors to ensure that they provide sound solutions and alternatives to deal with climate change and variability

Figure 11-1: Past and future impacts of climate hazards in Nakuru County

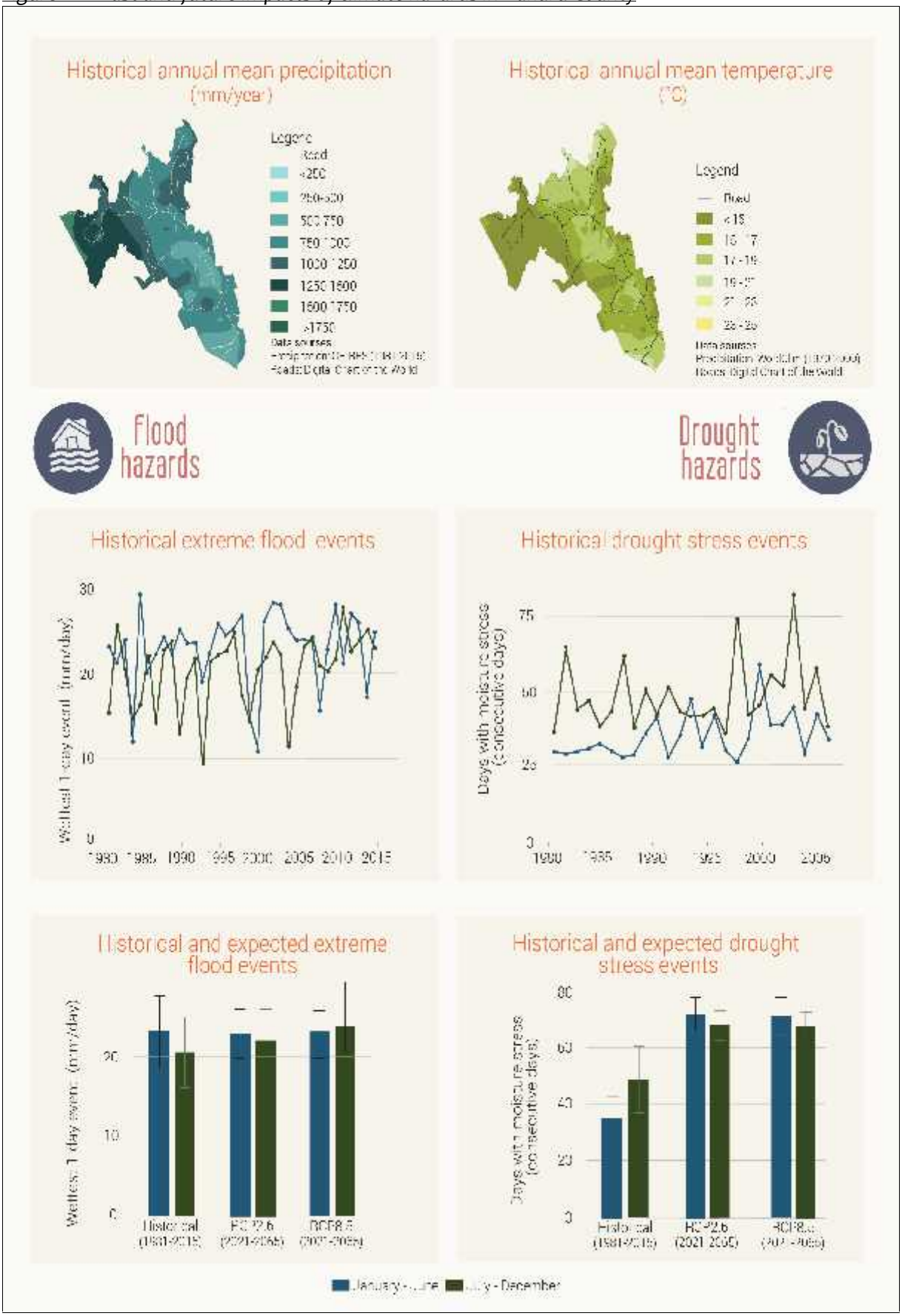
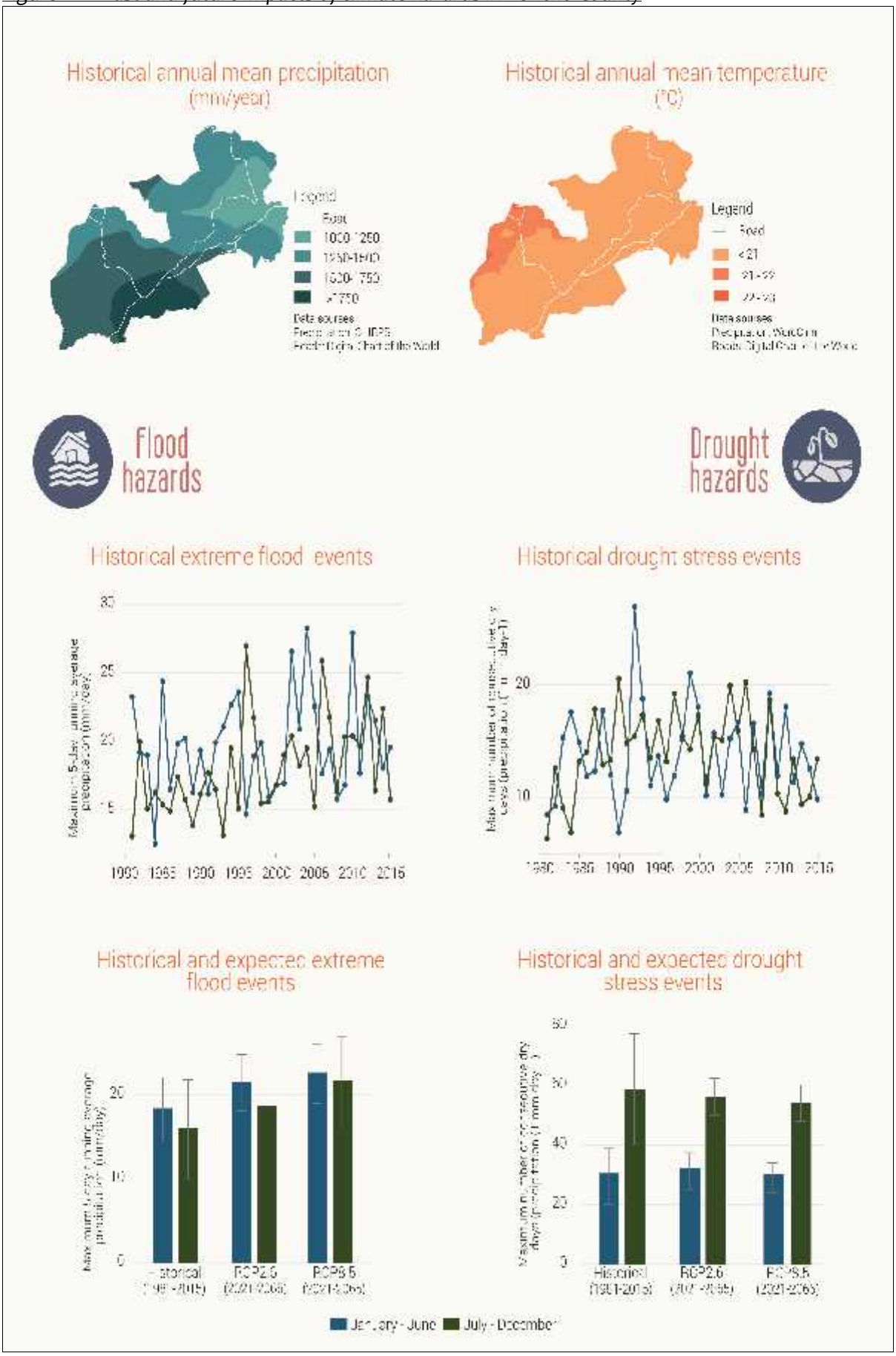


Figure 11-2: Past and future impacts of climate hazards in Kericho County



9.3 Relevant Adaptation to Climate Change and Variability

9.3.1 Climate Change related risks

Table 11-1: Climate Change related risks for the buffer zone

Hazard	Climate related Risk
Rainfall events and flooding	▪ Extreme rainfall conditions (heavy rain extending for several days) may cause physical damage to crops ▪ Damage to crops due to increased soil cracking and subsidence in areas with clay soils caused by increased drought. ▪ Increased operation and maintenance costs caused by increases in heavy precipitation and flooding. ▪ Increased erosion and weathering of exterior caused by extreme rainfall conditions ▪ Increased insurance costs ▪ Workplace health and safety is greatly affected by rainfall events. Injuries from slip and trip falls in outdoor areas are common in wet conditions and may be fatal or extremely bad. ▪ Molds and fungal infection are associated with extended wet conditions
Landslide & mudslides	▪ Extreme rainfall conditions (heavy rain extending for several days) may trigger geomophological phenomena sensitive to extensive and steep slope and earth movements in form of landslides and mudslides.
Storms and wind gusts	▪ *Buffer crop* may be damaged by winds storm and debris,
Lightening strike	▪ Lightening are common phenomena in tropical regions. ▪ Increased frequency of storms and extreme conditions also presents high probability of lightening. ▪ Lightening strikes may damage project associated amenities and equipments or at the worst could lead to fatal situations
Drought Higher temperatures	▪ Drought may affect supply of water causing scarcity for buffer zone. ▪ The frequency of days above 30°C in Kenya is rising and the same trend is confirmed for hot days. ▪ Projected increase in daily maximum temperatures present risks of crop failure. ▪ High temperature presents a risk on the heat stress affecting agility of workers at the site which may lead to delayed completion. ▪ Elevated temperature may increase levels of air pollution, ground level ozone and polutants such as carbon monoxide, nitrogen oxides and other volatile organic compounds

9.3.2 Relevant Adaptation to Climate Change and Variability

Relevant adaptation options for the project will include; tree planting, water harvesting, increased soil and water conservation.

10.0 CONCLUSION AND RECOMMENDATION

10.1 Recommendations

The following are part of recommendations for the project:

- The proponent should ensure that all legal requirements as pertaining to the project are met as specified by the law.
- Ensure workers are equipped with the necessary facilities and skills for effective management of the safety, health and protection of the environment.
- The entire project implementation should not cause any unnecessary disruption to pubic utilities, storm water/surface runoff drainage systems, ecological systems and human settlement. Whenever any of these problems or any other impact highlighted in this report are anticipated, appropriate mitigation actions should be taken.
- For a buffer zone to succeed there must be recognition of the role of all stakeholders. Stakeholders must communicate intensely and participate in all stages of buffer zone establishment and management. In order to achieve true and meaningful participation, in particular from the local population, the locals should appreciate the real benefits of buffer zones in order to adopt them as a long-term survival strategy. Although there will be obvious benefits from the appreciation of the value of nature conservation and preservation of the natural resource base for their own livelihood, planning must also include direct short-term economic benefits or a fair compensation for the lack of them.

10.2 Conclusion

In conclusion the proposed project has been assessed with an objective to determine the possible socio- economic and environmental impacts (both positive and negative) it is likely to have on environment and to propose appropriate mitigation measures.

The proposed project will have numerous positive impacts with the main one being forest conservation. Without the buffer zone, the conservation values of SW Mau FR will, undoubtedly, continue to erode, thereby negatively affecting well-being of millions of Kenyans and further eroding the Nation's valuable biodiversity. Other benefits of the project will include creation of employment, improved infrastructure and increased revenue among others. The project negative impacts are largely on potential soil erosion, water contamination and occupation health and safety.

The report recommends several measures to mitigate negative effects of the buffer zone, improve its effectiveness and reduce pressures on the resources of SW Mau FR from local communities. It is recommended that, the proponent should focus on implementing these measures as outlined in the ESMP as well as adhering to all relevant national and international laws and regulations. It is also recommended that the positive impacts that emanate from such activities should be enhanced.

Given the above considerations ranging from environmental and socio-economic as well as policy considerations, it's expected that the project will contribute immensely to forest conservation and local economy. This EIA is hereby submitted for scrutiny and approval to facilitate the inception of the project.

ANNEX 1: REFERENCES

- Kenya gazette supplement Acts 2000, Environmental Management and Coordination Amendment Act. *Government printer, Nairobi*
- Kenya gazette supplement Acts *Building Code 2000 by government printer, Nairobi*
- Kenya gazette supplement Acts *Land Planning Act (Cap. 303) government printer, Nairobi*
- Kenya gazette supplement Acts *Local Authority Act (Cap. 265) government printer, Nairobi*
- Kenya gazette supplement Acts Penal Code Act (Cap.63) *government printer, Nairobi*
- Kenya gazette supplement Acts *Physical Planning Act, 1999 government printer, Nairobi*
- Kenya gazette supplement Acts *Public Health Act (Cap. 242) government printer, Nairobi*
- Kenya gazette supplement number 56. Environmental Impact Assessment and Audit Regulations 2003. *Government printer,* Nairobi