KENYA
Forest Service

FOREST STATUS REPORT 2024 - KENYA



KENYA FOREST SERVICE

DECEMBER 2024

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FOREST STATUS REPORT 2024 -KENYA

A REPORT BY KENYA FOREST SERVICE

I. Foreword



It is with great pride and pleasure to introduce the inaugural Forest Status Report- Kenya (FSR). This comprehensive document represents a significant milestone in our sustainable forest management and conservation journey. Globally, forests are integral to the health of our planet. They serve as vital ecosystems that support biodiversity, regulate climate, and provide essential resources and services to communities. In Kenya, our forests are not only reservoirs of biological diversity, but are also sources of livelihood for millions of people, key water catchment areas, regulate our micro-climate through carbon sequestration, and protect and regenerate our soils.

In recent years, our forests have faced unprecedented threats that include, illegal logging, encroachment, forest fires, infestation by pests and diseases, conversion to other land-use practices and invasion by exotic plants. These challenges underscore the urgent need for accurate and up-to-date information on the status of our forests so as to inform evidence-based policy-making and management decisions. The Forest Status Report- Kenya therefore provides a comprehensive assessment of the status and trends of Kenya's forest ecosystems. In doing so, the report draws upon the management and operational information from KFS Management Team, scientific information from collaborating institutions such as KEFRI, KWS, NMK and Academia.

As we embark on this journey that embraces knowledge and stewardship, let us reaffirm our commitment to safeguarding Kenya's forests for present and future generations. Together, let us work tirelessly to promote sustainable forest management practices, conserve biodiversity, mitigate climate change, and enhance community livelihoods.

I trust that this Forest Status Report- Kenya shall serve as a valuable resource to inform forest strategies, guide forest sector policy reforms, provide a platform for applied research and be a vehicle for public information sharing on forestry matters

Titus Kipkoech Korir,
Chairman: Board of Directors,
Kenya Forest Service

II. Acknowledgement



It is my privilege to present the inaugural Forest Status Report- Kenya (FSR). The report marks a significant step towards the realization of Kenya's commitment to achieving sustainable forest management, using applied research to inform forestry practices, involving communities in forest conservation, promoting partnership and collaboration between government institutions, embracing partnership with non-governmental organizations and civil societies, and broadening collaboration with international, multilateral and bilateral partners. Equally important is that the report marks the emergence of evidence-based decision-making in forest management.

Kenya's forests are invaluable assets that serve as the cornerstone of our nation's ecological integrity, socio-economic development, and cultural heritage. As custodians of these precious ecosystems, it is imperative that we assess the status of our forests so as to identify emerging threats, and take decisive actions to ensure their sustainable stewardship for future generations.

In summary, the report highlights the extent and distribution of forest cover, trends in deforestation and degradation, drivers of forest change, effectiveness of our conservation programs and the challenges and opportunities facing our forests. The report also underscores the urgent need for concerted action to address deforestation, illegal logging, land degradation and climate change. I am deeply encouraged by the dedication and commitment of the expert teams, whose tireless efforts have made this report possible.

I extend my gratitude to all the members of the FSR-Kenya Committee at the Kenya Forest Service (KFS) listed here below for their dedication to the task of data collection, analysis and generation of information and knowledge that formed the foundation of this report. Special gratitude is to KFS field officers and all our partners, including government agencies, research institutions, civil society organizations, and local communities for their invaluable contributions and collaboration.

An activity of the magnitude of assessing and reporting on the status of our forests requires substantial financial resources and technical expertise. We are indebted to the Japan International Cooperation Agency (JICA) through the (SFS-CORECC) Project for providing both financial and technical support and Conservation International (CI) for their financial support. I am confident that this Forest Status Report- Kenya will serve as a valuable resource for policymakers, planners, researchers, and practitioners and guide our collective efforts toward the sustainable management and conservation of Kenya's forests.

Together, let us reaffirm our unwavering commitment to protect and nurture Kenya's forests.

Alex Lemarkoko, EBS, 'ndc' (K)
Chief Conservator of Forests,
Kenya Forest Service

III. Acronyms and Abbreviations

%	Percentage
AFR100	African Forest and Landscape Restoration Initiative
ANR	Assisted Natural Regeneration
ART-Trees	Architecture for REDD+ Transactions -The REDD+ Environment Excellence Standard
ARR	Afforestation Reforestation and Revegetation
ASALs	Arid and Semi-Arid Lands
AU	African Union
BTR	Biennial Transparency Report
BUR	Biennial Update Report
CADEP-SFM	Capacity Development Project for Sustainable Forest Management
CBD	Convention on Biological Diversity
CCF	Chief Conservator of Forests
CDM	Clean Development Mechanism
CFA	Community Forest Association
CITES	Convention on International Trade on Endangered Species
COP	Conference of Parties
CS	Cabinet Secretary
DRC	Democratic Republic of the Congo
DRSRS	Department of Resource Survey and Remote Sensing
EAC	East African Community
EBS	Elder of the Order of the Burning Spear
ELC	Environment Law Court
EPRA	Energy and Petroleum Regulatory Authority
EPZA	Export Processing Zones Authority
ES	Ecosystem Services Valuation
ETF	Exchange Traded Funds
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FCC	Forest Conservation Committee
FCMA	Forest Conservation and Management Act, 2016
FD	Forest Department
FLEGT	Forest Law Enforcement Governance and Trade
FLR	Forest Landscape Restoration
FOLAREP	Forest and Landscape Restoration Implementation Plan
FPP	Forest Peoples Programme
FRA	Forest Resource Assessment
FRL	Forest Reference Level
FSR	Forest Status Report
GDP	Gross Domestic Product
GHGs	Green-House Gases
GIS	Geographic Information System
GFW	Global Forest Watch
ICPAC	IGAD Climate Prediction and Application Centre
ICRAF	International Centre for Research in Agroforestry
IGAD	Inter-Governmental Authority on Development

IPCC	Inter-Governmental Panel on Climate Change
JAXA	Japan Aerospace Exploration Agency
JICA	Japan International Cooperation Agency
JJ-FAST	JICA-JAXA Forest Early Warning System in the Tropics
KACP	Kenya Agriculture Carbon Project
KAFP	Kenya Adaptation Fund Program
KCCAP	Kenya Climate Change Adaptation Program
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KIFCON	Kenya Indigenous Forest Conservation Project
KFWG	Kenya Forest Working Group
KMD	Kenya Meteorological Department
KMFRI	Kenya Marine and Fisheries Research Institute
KNBS	Kenya National Bureau of Statistics
KTDA	Kenya Tea Development Authority
KTGA	Kenya Tea Growers Association
KSA	Kenya Space Agency
KWS	Kenya Wildlife Service
LULUCF	Land Use, Land-Use Change and Forestry
MCM	Marketing Content Management
MDAs	Ministries Departments and Agencies
MEAs	Multi-Lateral Environmental Agreement
MECCF	Ministry of Environment Climate Change and Forestry
MoE	Ministry of Energy
NBE	Nature-Based Enterprise
NCCC	National Climate Change Committee
NDC	Nationally Determined Contributions
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
NLC	National Land Commission
NMK	National Museums of Kenya
NFMS	National Forest Monitoring System
NFI	National Forest Inventory
NFSR	National Forest Status Report
NTFP	Non-Timber Forest Product
NPV	Net Present Value
NWMP 2030	The National Water Master Plan 2030
PELIS	Plantation Establishment and Livelihood Improvement Scheme
PFM	Participatory Forest Management
PFMP	Participatory Forest Management Plan
REDD+	Reducing Emissions from Deforestation and forest Degradation, conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
SBAE	Sample Based Area Estimation
SDGS	Sustainable Development Goals
SFS-CORECC	Project for Strengthening Forest Sector Development and Community Resilience to Climate Change through Sustainable Forest Management and Landscape Restoration
SLEEK	System for Land Based Emission Estimation for Kenya

SWOT	Strengths Weaknesses Opportunities and Threats Analysis
TELIS	Trees Establishment and Livelihood Improvement Scheme
UAV	Unmanned Aerial Vehicle
UKPACT	United Kingdom Partnering for Accelerated Climate Transitions
UNCCD	United Nations Convention to Combat Desertification
UNESCO	United Nations Educational Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
VCS-JNR	Verified Carbon Standard-Jurisdictional & Nested REDD+ Framework
VIIRS	Visible Infrared Imaging Radiometer Suite
WRA	Water Resources Authority
WRI	World Resource Institute
WRTI	Wildlife Research Training Institute
WWF	World Wide Fund for Nature

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IV. Executive Summary

This Forest Status Report - Kenya (FSR), is the first edition prepared to meet the requirements of section 8 (k) (i) of the Forest Conservation and Management Act, (FCMA) 2016. The law requires Kenya Forest Service (KFS) to prepare a Forest Status Report biennially for the Cabinet Secretary responsible for forestry. The Forest Status Report serves as a comprehensive assessment of the current status of Kenya's forests by providing; a synthesis of management and governance structures, forest cover trends, conservation status of the forests, contribution of forests to the economy, roles of forests in climate change mitigation, and priority interventions to be carried out to ensure the posterity of the forest sector. The report also aims to inform evidence-based decision-making to guide policy formulation and support initiatives to promote the sustainable management and conservation of Kenya's forest resources.

At the county level, there are 47 County Forest Conservation areas based on the 47 counties in the country mandated with the responsibility of managing 380 gazetted public forests spread within 197 Forest Stations.

Forest governance and management in Kenya is informed by constitutional provisions, legislative instruments, rules and regulations. Beginning from the Ukamba woods and forest regulation of 1897 to the current Constitution of Kenya 2010, Articles 42, 69, 71 and 174 holistically established the framework for forest governance and management in the country. The Articles guided the establishment of forest policy, legislation and several regulations. In particular, the legislative instruments, 'Forest Conservation and Management Act 2016', provided for the setting up of institutions and placement of coordination and oversight roles for the forest sector at the Ministry of Environment, Climate Change and Forestry. Also established were government agencies that includes Kenya Forest Service (KFS), Kenya Forestry Research Institute (KEFRI), National Environment Management Authority (NEMA), amongst others to conserve, manage, research and regulate forests and forest resources.

Under the Forest Conservation and Management Act 2016, KFS shall manage and conserve public forests. County Governments shall provide advisory services in community and private forests. To date, Kenya has made considerable strides towards conservation and sustainable management of forests through the Ministry of Environment, Climate Change and Forestry (MECCF). Oversighted and coordinated from the MECCF, Kenya Forest Service has mandate to conserve and manage state forests through ten (10) Regional Forest Conservation Areas that have been zoned -out based on the different ecosystems within the country. The 10 regional conservation areas are Central Highlands, Nairobi, Eastern, North Eastern, Mau, North-Rift, Ewaso North, Western, Nyanza, and Coast. These regions are coordinated through Forest Conservation Committees (FCC) for each area where County Governments are key members of the committees. At the county level, there are 47 County Forest Conservation areas based on the 47 counties in the country mandated with the responsibility of managing 380 gazetted public forests spread within 197 Forest Stations.

The National government through KFS provides advisory services, capacity building and technical support on forestry matters to the County Governments. On the other hand, County governments while implementing national policies on forest management and conservation within community and private forests may enter into a management

agreement with community or private forest owners to collaborate in the conservation of the forests.

Forest cover and trends in Kenya are exemplified by diverse ecosystems. The diversity of Kenya's forest ecosystems ranges from montane forests, dry land forests to coastal and mangrove forests. Assessment of forest cover from the year 2000 to date presents a trend which has been fluctuating from 7.8 % cover in the year 2000 to 6.6% in the year 2008 and at 8.83% in the year 2021. Key drivers of forest degradation that impact negatively on forest coverage include: agricultural expansion, unsustainable logging, livestock grazing, rapid population growth leading to high demand for forest products and inadequate forest governance.

Acknowledging that forests have been degraded, the government has prioritized the restoration of forests and related landscapes. While the interventions include protecting and conserving gazetted forest areas, implementing forest management plans, promoting community-based forest management initiatives, and adopting policies and strategies that enhance forest conservation and restoration. Towards this, Kenya has committed to restore 5.1 million hectares of degraded forests by 2030 under the implementation of African Landscape Restoration Initiative (AFR100). Further through its National Commitment, Kenya is focused to restore 10.6 million hectares of degraded forests by 2032 through the 15 Billion Tree Growing National Landscape and Ecosystem Restoration Strategy. Forest restoration is therefore a national priority, informed by the fact that Kenya before colonization had over 30% forest cover. The forest cover has been significantly reduced and shall have to be restored for posterity.

Forests while playing a central role in Kenya's natural heritage also contribute to the nation's ecological, social, and economic well-being. The diversity of Kenya's forest ecosystems ranges from montane forests, dry land forests to coastal and mangrove forests. These forests support rich biodiversity, regulate local and regional climate, and provide essential ecosystem services such as water provision, soil conservation, and carbon sequestration. Kenya is a mega bio-diverse country with over 35,000 species of flora and fauna. This diversity is served by the variable ecosystems ranging from marine, mountains, tropical, dry lands, forests and arid lands. In addition to these are some 467 inland lakes and wetland habitats covering about 2.5% of the total area that directly contribute to the abundance of biodiversity.

On record, our forests contribute 3.6% to the GDP. This figure does not take into consideration the environmental services, ecosystem services, socio-cultural contributions and sector support services that forests provide. There is therefore an urgent need for an all-inclusive assessment and evaluation of the forest sector contribution to the economy with an aim to inform the level of investment that Kenya needs to put into the forestry sector to boost economic growth. The Forestry sector has a capacity to sustainably supply 31.4 million cubic meters of wood annually with an estimated demand of 56.2 million cubic meters of wood resulting in a deficit of 24.8 million cubic meters of wood. To fill this gap, Kenya therefore imports timber from Tanzania and the Democratic Republic of Congo. It is envisaged that with proper incentivization of investment in forestry, Kenya shall quickly close this gap leading to an end to expensive importation of timber.



467 inland lakes and wetland habitats covering about 2.5% of the total area that directly contribute to the abundance of biodiversity.

Forest's contribution to mitigation of climate change has been domesticated at the policy and legislation level. The creation of the Ministry of Environment, Climate Change and Forestry (MECCF) attests to the prioritization of the forestry sector nationally. Towards this, oversight roles for the establishment and operations of forestry sector agencies to actualize green programs and projects leading to climate change mitigation are in place. Our forests if well conserved shall be at the forefront in mitigating the adverse effects of climate change.

Similar to other sectors, technological innovations are now at the forefront in supporting how we manage our forests. The use of modern computer-based technologies shall be deployed in nursery seedlings production, silvicultural practices, harvesting and processing of timber, value addition to timber products and timber value chain tracking. To enhance forest protection and conservation, Geographic Information System (GIS) and Remote Sensing technologies shall be used for forest monitoring, assessment and reporting. The forestry sector is alive to the fact that adaptation of technological innovations promotes efficiency, transparency and accountability in all forest operations. KFS is now at the forefront in adopting technological innovation in forestry practices.

This report further highlights the priority interventions that shall support sustainable forest management in Kenya. Central to these measures are: developing a forest certification framework; mechanization of forest operations; enhancing investments in green spaces, urban forestry and avenue planting; strengthening linkages and partnerships in research, training and extension services; adopting nature-based solutions and mobilizing adequate resources for forest management and conservation. It is therefore our humble submission that the forests shall be protected for posterity for the good of humanity.



CHAPTER 1

INTRODUCTION

Forests are vital components of Kenya's natural heritage, contributing to the nation's ecological, social, and economic well-being. With diverse ecosystems ranging from montane forests, western rain forests, dryland forests, coastal forests to mangrove forests, Kenya's forests support rich biodiversity, regulate local and regional climate, and provide essential ecosystem services such as water, soil conservation, and carbon sequestration. Historically, Kenya's forests have played a central role in the cultural practices and livelihoods of indigenous communities, providing food, medicine, and materials for shelter and crafts. However, over the years, forests have faced significant challenges emanating from factors such as deforestation, illegal logging, land-use changes, and climate change impacts. These threats have led to the degradation and fragmentation of forest ecosystems, loss of biodiversity, and reduced resilience to environmental stressors. In response to these challenges, Kenya has made considerable efforts to conserve and sustainably manage its forests. These efforts include the protection of gazetted forest areas, development of commercial plantations, promotion of agro-forestry in the farmlands, promotion of community-based forest management initiatives, and adoption of policies and strategies aimed at enhancing forest conservation and restoration through collaboration with other public institutions and private sector.

The Forest Status Report - Kenya (FSR) serves as a comprehensive analysis of the current status of Kenya's forests, providing a synthesis of available data, analysis of trends, and evaluation of management practices. It aims to inform evidence-based decision-making, guide policy formulation, and support initiatives aimed at promoting the sustainable management and conservation of Kenya's forest resources. Through this report, stakeholders will gain insights into the status of Kenya's forests across different land tenure systems, identify key challenges and opportunities, and explore strategies for enhancing the resilience and long-term sustainability of forest ecosystems. By fostering a deeper understanding of the importance of forests and the need for their conservation, the Forest Status Report - Kenya will catalyze collective action towards safeguarding Kenya's forests for present and future generations.

The Forest Status Report - Kenya, 2024, represents a significant milestone in Kenya's commitment to forest conservation and management. Pursuant to Section 8(k) (i) of the Forest Conservation and Management Act (FCMA) 2016, this is the first report aimed at fulfilling the statutory requirement for the Kenya Forest Service to prepare a Forest Status Report for the responsible Cabinet Secretary every two years. The Forest Status Report - Kenya serves as a vital tool for presenting factual information and trends on all types of forests,

as well as assessing the performance of the commercial forestry sector and its value chains. Effectiveness of forest governance and management arrangements are also highlighted in the report.

The overarching objective of the FSR is to present the current forest status in Kenya through systematic monitoring and reporting of progress on sustainable forest management. To achieve this, the report's specific objectives are to:

- **Present factual information and trends on forest status to inform sustainable management and decision-making processes.**
- **Establish the extent to which forests and trees contribute to livelihoods and ecosystem services, thus uplifting living standards.**
- **Map trends that may either enhance or hinder the capacity of forests to fulfill their ecosystem functions effectively.**
- **Make recommendations on interventions required to identify opportunities and mitigate any negative trends.**
- **Provide information on forestry-related matters of national importance, enhancing transparency and public awareness and garner greater public support and interest in credible governance of forest resources.**
- **Entrench efficiency and effectiveness in sustainable forest management, including the development and review of forest policies and programs.**

By fulfilling these specific objectives, the FSR Kenya shall contribute to informed decision-making processes, promote sustainable forest management practices, and enhance the conservation and utilization of Kenya's forest resources for the benefit of current and future generations.



CHAPTER 2

SITUATIONAL ANALYSIS

Kenya is situated in East Africa along the equator between 4° North to 4° South and 34° East to 41° East. It shares borders with South Sudan, Ethiopia, Somalia, Tanzania, and Uganda. Its geographical space spans 592,038 km^2, featuring diverse landscapes ranging from coastal plains to the towering peaks of the Kenyan highlands, with Mount Kenya rising to 5,199 meters above sea level being the highest point in the country. The Great Rift Valley, which traverses the central and western regions, divides the highlands into eastern and western sections, leading to varied terrain, including the vast Lake Victoria Basin to the west.

Kenya boasts seven distinct agro-climatic zones, ranging from humid to arid areas, with less than 20% of the land deemed suitable for cultivation. Forest cover across the country remains relatively low, accounting for 8.83% according to the recent mapping efforts employing high-resolution imagery in 2021 (National Forest Resource Assessment Report, 2021).

Kenya's forests have a rich array of plants and animals. Some species endemic to the forest habitats are found nowhere else in the world. Globally, Kenya is classified amongst the ten-mega-biodiverse nations with 35,000 species of flora and fauna. Out of these, Kenya is home to 25,000 animals, 7,000 plant species and 2,000 fungi and bacteria. Our rich biodiversity directly supports Kenya's tourism industry.

The country's forest types include Montane forests, Western rain forest, Coastal forests, Dryland forests and Mangroves. Montane forests are located in the highlands at altitudes above 2000 meters. Western rain forests in western Kenya are tropical rain forests similar to the Guineo-Congolian Forests. Coastal forests are part of the eastern coastal forests and are known for high number of endemic fauna and flora. Mangrove forests being productive wetlands occur in coastal intertidal zones.

These forests are, highly fragmented due to high anthropogenic pressure. Current levels of exploitation of the forests are unsustainable and therefore left unchecked, the forests are likely to be degraded and destroyed. To curb the threat of forest degradation, the Government enacted the Forest Conservation and Management Act (FCMA) 2016 to guide the conservation and management of Kenya Forests. It also provided for the establishment of the Kenya Forest Service with a mandate for development, sustainable management, conservation and protection of forests for socio-economic development of the country.

As currently constituted, under the existing national legislative instruments, forestry sector governance is dynamic and responsive to public demands. Routine shifts in public demands has continued to influence priority forestry sector interventions. At best, international standard practices are continuously being factored into forest management. To provide a peak on the

internal and external factors that are likely to affect forest sector growth, an analysis of strength, weakness, opportunities and threats (SWOT) based on Alfred Humphrey 1960 Stanford Research Institute is here used (figure 1) to quickly analyze the status of forest sector.

The focus is to establish the competitive position of the sector and also inform the development of strategic planning for the growth of the sector. Main drive is to analyze internal factors affecting forestry practices and external factors that would provide opportunity or a threat to forestry development. The, SWOT analysis of Kenya's forest sector reveals the following strengths, weakness, opportunities and threats as contained in figure 1 below.

Forest Sector SWOT Analysis

Strengths

Diverse ecosystem supporting flora and fauna

- Potential for ecotourism development
- Community involvement in conservation
- Livelihood improvement for communities
- Effective and dynamic legislative instruments for sector development
- Conservation ethics that is people driven
- Cultural and spiritual significance.
- Research institutions generating knowledge to support forestry development

Weaknesses

- Deforestation from agriculture expansion, logging and population growth
- Lack of conservation awareness contributing to unsustainable practices
- Land encroachment leading to resource depletion and degradation
- Low funding levels hindering effective iniatives to be implemented

Opportunities

- Carbon credit markets
- Sustainable logging practices
- Community-based forest management
- Employment opportunities
- Nature -based enterpreneurs development
- Sustained provision of water catchment support
- Resilient habitat for wildlife

Threats

- Climate change disrupt ecosystems and increase vulnerability
- Poaching disrupts forest balance and threated endangered species
- Political instability hinders implementation of long term forest management plans
- Inadequate funding for conservation initiatives

Figure 1: SWOT Analysis of Kenya's Forest Sector

Forest management in Kenya traces its official beginning to the era of British colonial rule, commencing in 1895 when Kenya was declared a British Protectorate. Prior to colonialism, indigenous communities managed forests autonomously, employing their own rules and systems to regulate access to and utilization of forest resources. Kenya's first official forest policy was developed in 1957. The policy emphasized principles for the equitable management of forests. However, rapid deforestation saw the forest cover decline from 30% in 1890 to 3% by independence in 1963, a trend partly attributed to railway construction in 1901.

In 1900s, significant forest and nature reserves were established through legal notices for management and protection of the forests. Since then, several new forest reserves have been gazetted. The gazetted forests, categorized as state forests, were developed, protected and managed by the state as provided under Article 69 of the Kenya Constitution 2010. Map 1 Figure 2 here below shows the spread of forest cover within the Country. Evidently, there is massive forest cover fragmentation which complicates protection and management operations.

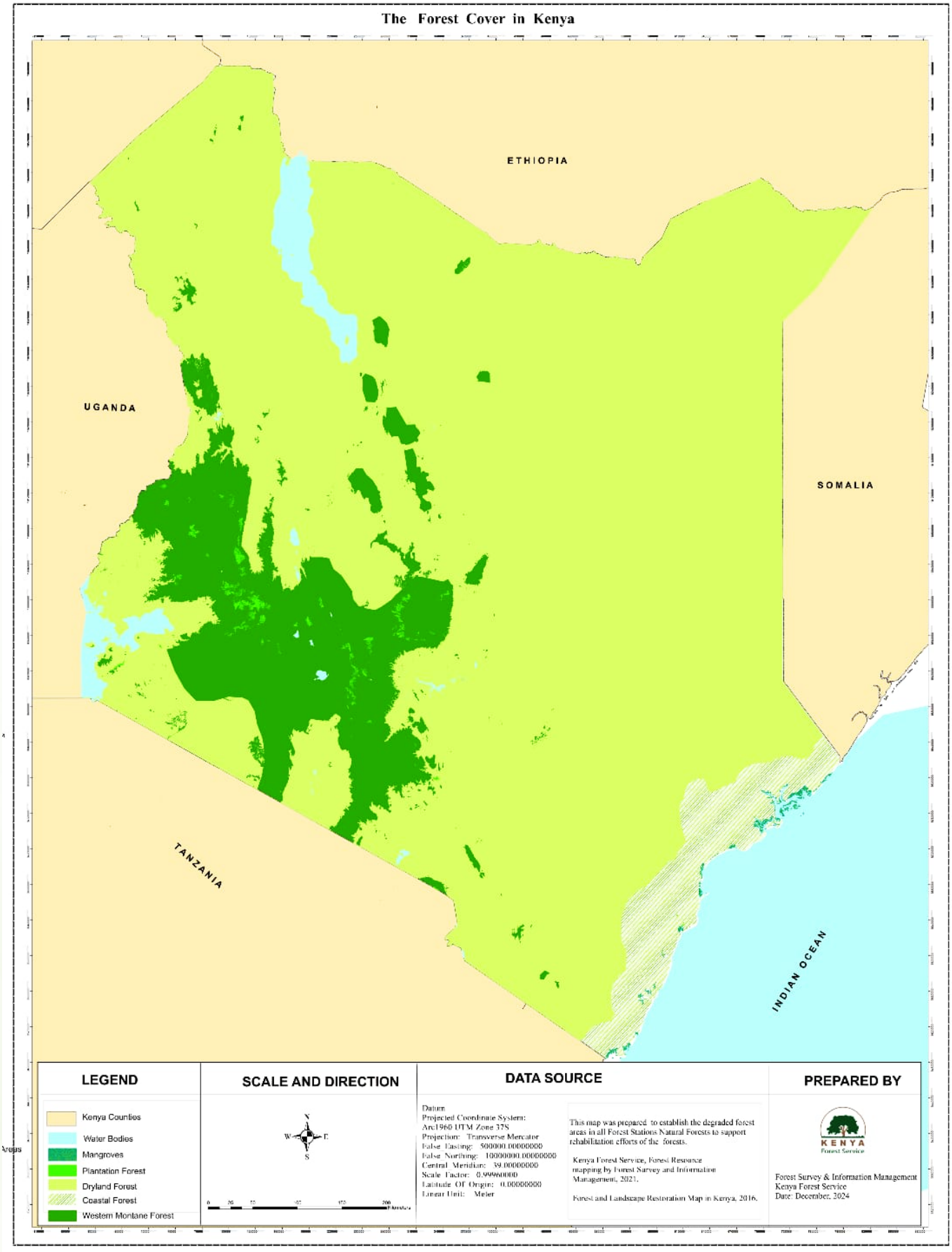


Figure 2: Forest Cover



CHAPTER 3

FOREST GOVERNANCE AND MANAGEMENT

Kenya's forest management laws have evolved significantly since the colonial era. The first regulation, the Ukamba Woods and Forest Regulations of 1897, aimed to reserve forest areas, but was ineffective in curbing deforestation. This led to the East Africa Forestry Regulations of 1902, which transferred management to the Forest Department (FD). A formal policy was later introduced in 1957 that led to the enactment of the Forest Act CAP 385 in 1968. Strategic recommendations made in the Kenya Forest Masterplan 1994, prompted the enactment of the Forest Act, 2005 that established among others the body corporate Kenya Forest Service and ushered participatory forest management. Following the promulgation of 2010 Kenya Constitution, the Forest Conservation and Management Act (FCMA) of 2016 was enacted, which remains in force. Currently, the Act is under review to address emerging forest management issues. In 2023, a new Forest Policy was approved by the Cabinet.

3.1 Forestry under the Constitution of Kenya 2010

The Constitution of Kenya, 2010 recognizes the importance of forests and gives effect to sustainable management of forests as stipulated in Articles 42 and 69. In addition, Article 71 of the Constitution provides for concessions to natural resources including forests. Under the two-tier system of national government, county governments are mandated to undertake forestry functions as stipulated under Article 174. Specific county government functions pertaining to forestry are specified in Schedule 4 of the constitution.

3.2 National Legislative Instruments for Forest Management

Further to the Forest Conservation and Management Act, 2016 (FCMA, 2016), there are other laws and regulations that pertain to forest management in Kenya. These include: Environmental Management and Coordination (Amendment) Act, 2015, the Water Act, 2016, The Wildlife Conservation and Management Act, 2013, Climate Change (Amendment) Act, 2023, National Museums and Heritage Act, 2006, the County Governments Act, 2012, the Energy Act, 2019, the Agriculture, Fisheries and Food Authority Act (AFFA) 2013, the Land Act, 2012 (Revised Edition, 2016) (Revised in 2012), among others.

The FCMA, 2016 is an Act of Parliament which gives effect to Article 69 of the Constitution on sustainable management of forest resources. The FCMA 2016 succeeded the Forests Act, 2005 which introduced major institutional reforms to the forest sector with a focus on improving the forest governance in Kenya. The Act established the Kenya Forest Service as a semi-autonomous government agency responsible for the conservation, management, and protection of all public forests. The Act also developed structures for forest governance



such as the Forest Conservation Committees and the involvement of forest-adjacent communities through Participatory Forest Management (PFM) arrangement.

FCMA 2016 Part IV Sections 30, classifies forests as public forests, community forests and private forests. Public forests are managed by the national government through KFS, Community forests belong to and are managed by the specific communities. Private forests are owned by individuals on their registered land.

3.3 National Planning Processes on Forest Management

Kenya's forest management has over the years been guided by various national planning processes aimed at sustainability in conservation. Key amongst these frameworks is the Forest Policy which provided for increase of forest cover to 10% by the year 2030, the National Climate Change Response Strategy that integrates forests for climate change mitigation, the National Biodiversity Strategy that gives focus to forest biodiversity protection, Vision 2030 and the National Forest Program emphasizing sustainable forest use and economic growth. Local-level plans, such as County Forest Management Plans, facilitates alignment with regional and national priorities on forestry sector development. These frameworks collectively support Kenya's environmental, social, and economic agenda.

3.4 Forest Governance in Kenya

The Ministry of Environment, Climate Change and Forestry oversees forest governance through a multi-tiered structure that begins at the national level, where planning, strategies, operational and technical decisions are made. State Department for Forestry (SDF), under the Ministry of Environment, Climate Change and Forestry (MECCF) provides overall policy guidance and oversight of the forest sector.

At the MECCF, the State Department of Forestry (SDF), provides essential policy guidance and oversight for forest conservation and management across the country. Two primary agencies operate under the SDF: Kenya Forest Service (KFS), responsible for forest conservation and protection; and Kenya Forestry Research Institute (KEFRI), dedicated to forestry research and development. This coordinated approach reinforces Kenya's commitment to sustainable forestry practices, climate resilience, and biodiversity conservation.

3.5 Participatory Forest Management (PFM)

Participatory Forest Management (PFM) in Kenya was introduced through the enactment of the Forests Act 2005 which was later reviewed leading to the enactment of the FCMA 2016. Section 47(1) of the FCMA, 2016 that provides for every public forest, nature reserve, and provisional forest to be managed in accordance with a management plan. The Service bears the responsibility for preparing Management Plans with respect to each public forest, nature reserve and provisional forests (Section 47(2)).

According to the FCMA, 2016 (Section 48 (1), a member of a forest neighboring community may, together with other members or persons resident in the same area, register a Community Forest Association (CFA) under the Societies Act, Cap. 108. Once registered (Section 48 (2)) an Association registered may apply to the Service for permission to participate in the conservation and management of a public forest. Through a Management Agreement forest user rights are conferred to the association which include: collection of medicinal herbs; harvesting of honey; harvesting of fuel woods; grass harvesting and grazing; collection of forest produce for community-based industries; ecotourism and recreational activities; and, participation in establishment of forest plantations through Plantation Establishment and Livelihood Improvement Scheme (PELIS).

Status of CFAs in Kenya confirms 229 have been registered and membership categorized at 87,164 males and 98,375 females. This trend confirms the active roles played by the females in conservation and further asserts the significance of gender parity. To execute their programs, CFA develop Participatory Forest Management Plans (PFMP). As contained in the PFMP Register as at February 2024, 70 PFMPs are active, 49 are under review at various stages while 57 have expired.

3.6 Role of County Governments in forest management

In executing their mandates under the devolved forestry functions, the county governments are required to develop participatory forest management plans under the guidance of KFS. To date, several counties have developed County Forest Management Plans (CFMP) to guide sustainable forestry at the local level. These plans vary in their stages of implementation, with some counties like Marsabit successfully maintaining active plans, while others, including Nyeri and Kilifi, have seen their plans lapse without Forest Management Agreement (FMA) negotiations. Counties such as Taita Taveta and Embu have also faced challenges, with their plans expiring without renewal. Despite these setbacks, the CFMPs play a crucial role in fostering participatory forest management, aligning local efforts with national objectives,

Table 1: Community Forest with Participatory Forestry Management Plans

No.	Region	County	Name of Forest	Area (Ha)	Approval Date	Expiry	Ownership	FMA Status	Remarks
1.	Central Highlands	Nyeri	Karima	108.5	03/11/2010	2014	County	No FMA	Elapsed without FMA negotiations
2.	Coast	Kilifi	Dakacha Woodlands	188.2	24/06/2015	2019	County	No FMA	PFMP Elapsed without negotiations
3.	Coast	Taita Taveta	Sagalla	70	18/04/2016	2020	County	No FMA	Complete awaiting printing
4.	Coast	Taita Taveta	Mwambo	375.5/272.66	05/05/2020	2024	KFS and County	Signed	PFMP In Force
5	Eastern	Meru	Ntugi-Ntumburi	93.3	10/06/2014	2018	County	No FMA	PFMP Elapsed without negotiations
6	Eastern	Meru	Mweru Biankure	184.3	29/03/2016	2020	County	No FMA	PFMP Elapsed without negotiations
7	Eastern	Embu	Kiang'ombe	2104	21/12/2018	2023	County (R)	Expired	PFMP elapsed
8	Eastern	Embu	Kianjiru	1004	07/03/2019	2023	County (R)	Expired	PFMP elapsed
9	Ewaso	Marsabit	Mt Kulal	5,670	17/04/2023	2026	County		In force
10	Mau	Narok	Maasai Mau	46,278	05/10/2010	2020	County	No FMA	PFMP elapsed
11	North Rift	West Pokot	Kamatira	1910	11/04/2016	2020	County	No FMA	PFMP Elapsed

and addressing specific regional forestry needs. Enhanced support and timely updates to these plans are essential for their continued effectiveness in achieving Kenya's forestry goals.

The Promulgation of the Constitution of Kenya in 2010 introduced a two-tier system of government and a new dispensation in the management of forests in Kenya. The Constitution provides for devolved forest governance through the County Governments. Governance of forests on Community land is vested in the respective County Governments. Section 21 of the FCMA, 2016 stipulates the functions of the County Government in the management of such forest resources.

It is noted that 77% of forests are under communities and private ownership, while only 23% is public. Out of these, private plantation areas cover 47% of total plantation forest areas of forests in Kenya. This underpins the significance of private forests for timber production, poles, posts and fuelwood

3.7 Government Institutions with Mandates Supporting Forest Management

In pursuit of collaborative management, Ministries, Departments and Agencies (MDAs) with roles and responsibilities covering forests, forestry practices and environmental conservation. Government agencies with roles and responsibilities touching on forests include: Ministry of Environment, Climate Change and Forestry (MECCF); National Environment Management Authority (NEMA); Kenya Forestry Research Institute (KEFRI); Kenya Meteorology Department (KMD); Kenya Wildlife Service (KWS); Water Resources Authority (WRA); Kenya Marine and Fisheries Research Institute (KMFRI); Wildlife Research and Training Institute (WRTI); National Museum of Kenya (NMK); Directorate of Resource Survey and Remote Sensing (DRSRS); Kenya Space Agency (KSA); Environment and Law Court (ELC); National Land Commission (NLC).

3.8 Challenges of Forest Governance and Management

The rapid dynamics of changes in policy and legislation especially on land tenure at the community level has made forest protection to be problematic. Exemplified by changes in group ranches to new forms of land tenure under the Community Land Act of 2016, ushered major re-organization of land use leading to management complication and unclear benefit sharing arrangements. Encroachment/illegal settlement in forest areas, delayed judgement of filed court cases due to several court injunctions are problematic. Further, legislation giving overlapping mandates with other institutions especially on areas of double-gazettement breeds conflict in management prescriptions. The slow uptake of devolved forestry functions by the counties, 'more than 10 years since the inception of devolution', stifles forestry practices. Funding for the forest programs have been inadequate, thus affecting forest operations, service delivery, capacity development and infrastructure development (staff housing /office spaces/forest roads.

3.9 International and Regional Cooperation

Kenya is a signatory to several international Multilateral Environmental Agreements (MEAs) and Conventions. Some of the agreements and conventions include: Sustainable Development Goals (SDGs) among them SDG 6 (clean water & sanitation), 13 (climate action) and 15 (life on land), Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC), Convention on International Trade in Endangered Species (CITES), United Nations Convention to Combat Desertification (UNCCD), RAMSAR Convention, United Nations Educational, Scientific and Cultural Organization (UNESCO), and United Nations Forum on Forests (UNFF). Kenya is also a party to several regional agreements and conventions that support sustainable forest management among them the African Convention on the Conservation of Nature and Natural Resources, EAC Treaty of 1967, and the African Union (AU) Agenda, 2063.

CHAPTER 4

FOREST COVER TRENDS IN KENYA

The process of monitoring forest resources in Kenya can be traced to the Water Towers mapping project by DRSRS and Kenya Forest Working Group (KWFG) – Changes in Forest Cover in Kenya's Five "Water Towers" 2003 – 2005. In this report, it was noted that forest reserves comprised about 3.3%, of which half were already degraded resulting in an estimated national forest area of 1.7%. The AFRICOVER mapping provided the first wall-to-wall information of forest cover status and estimated forests of Kenya at 7.8% in 2000 and 6.6% in 2008 illustrating a reducing forest cover over time.

Based on the Intergovernmental Panel on Climate Change (IPCC) land use classes, Kenya did a first wall-to-wall mapping in 2013 under the Kenya Forest Preservation Program (FPP) and estimated forest cover as 7.9% in 1990 which reduced to 6.9% in 2010. Noting the limitations associated with manual digitization as used in the FPP, an intensive mapping program was developed under the System for Land -based Emission Estimation for Kenya (SLEEK) based on the Random Forest Algorithm. This intensive mapping program generated 18 -time series wall-to -wall land use maps and estimated forest cover in 2018 as 5.9% of the national area which was a decline from 6.5% in 1995. These statistics were used to; develop Kenya's FRL, with support from JICA, under the Capacity Development Project for Sustainable Forest Management (CADEP-SFM) project, which was submitted to the UNFCCC in 2020. The statistics were also used in updating the FAO FRA 2025 projections and estimated forest sector emission projections in the NDC targets for 2030. Parallel to this, a national forest resources assessment was done in 2021 using high resolution images and estimated forest cover at 8.83% of the national area and tree cover as 12.13% of the national area. Forest area from the survey was 5,226,191.80 ha while tree cover area was 7,180,000.66 ha. These statistics were used to guide the development of the 15 billion trees growing program with Kenya targeting to increase tree cover by 17.87% by 2032. The evident variations in forest coverage statistics underpins changes in mapping algorithms, void in routine assessment and monitoring and slow adoption of modern mapping innovations.

With international support and guided by the latest technology and platforms for mapping forests, the FAO then supported Kenya to adopt the Sample-Based Area Estimation (SBAE) method to map forests, forest cover changes and associated emissions, and has produced statistics for the period 2013 - 2023. The SBAE builds on limitations identified in the Technical Review of Kenya's FRL by the UNFCCC technical expert team and allows Kenya to have a consistent and transparent forest mapping method that is consistent with recent

guidelines for Carbon trading (e.g. Architecture for REDD+ Transactions (ART) and the REDD+ Environmental Excellence Standards (TREES) (ART-TREES) and Verified Carbon Standard Jurisdictional and Nested REDD+ (VCS-JNR). This report provides statistics of forest and tree cover based on the 2021 National Forest Resources Assessment Report but the forest trends assessment used the SBAE method are currently ongoing. It is however important to mention that the process of generating the statistics is still ongoing.

4.1 Types of Forests in Kenya

Kenya has defined its forest as "a minimum land area of 0.5 ha, a minimum of 15% tree canopy cover and potential to reach a minimum height of 2 meters at maturity in situ" through a broad stakeholder consensus for REDD+ (FRL, 2020).

Kenya's forests are classified based on four strata. The three strata (Montane and Western rainforest, Coastal and Mangrove, and Dry land) are based on Kenya's broad ecological zones based on climate and altitude. They define the major biomes/ecological zones in which forests grow and align to the IPCC ecological zones1. The 4th stratum is a management zone and covers the public plantation forests which are managed by the Kenya Forest Service. These strata were used to define the scope of REDD+ Activity.

The gazetted forest area, which is managed by Kenya Forest Service, is estimated at 2.6 million hectares. Table 2 here below provides the estimated areas covered by forests based on land tenure and forest stratification (This changes according to mapping methodology employed). Table 3 gives the estimated grassland areas (glades) in gazetted forests.

Table 2: Forest Type Covers

Forest Types	***Estimated Areas***
Public Forest	2.6 Mil Ha
Community Forest	1.1 Mil ha
Forest Strata	**Estimated Area (ha)**
Montane	1,600,000
Western Rain	90,000
Coastal	550,000
Mangroves	61,000
Dryland	1,200,000
Plantations	152,790



Table 3: Grasslands and Glades in the Forests

S/No.	Conservancy	Grassland and Forest Glades area (ha)	No of livestock - cattle	No of livestock -sheep
1	Central Highlands	46,036	20,421	27,111
2	Coast	24,190	25,050	14,220
3	Eastern	37,370	10,684	21,928
4	Ewaso North	50,372	1,050	12,800
5	Mau	19,185	43,685	34,288
6	Nairobi	3,737	730	5,150
7	North Eastern	9,500	6,330	5,500
8	North Rift	101,308	62,267	164,573
9	Nyanza	3,247	9,243	6,365
10	Western	6,867	4,583	1,344
	Grand Total	**301,812**	**184,043**	**293,279**

Montane Forests: These are forests in high-altitude regions of Kenya (above 1,500m). They are the most extensive and have been described as water towers due to their support to water catchments (DRSRS and KFWG, 2006). They include the Mau forest ecosystem, Mt. Kenya forest ecosystem, Aberdares forest ecosystem, Cherangany forest ecosystem and Mt Elgon forest ecosystem. Mt Kenya is one of the 5 main water towers in Kenya. The vegetation in Mount Kenya forest ecosystem can be classified as indigenous closed canopy and indigenous open canopy. The common indigenous tree species in Mount Kenya region are *Newtonia buchananii, Croton macrostachys, Juniper procera, Ocotea usambalensis, Teclea nobilis, Podocarpus latifolia, Prunus africana* among others. Above the indigenous forest at altitudes between 2,200-3,400 meters is Oldeania alpina (highland bamboo) vegetation mixed with *Podocarpus latifolia.*

The other montane forests include Leroghi, Kirisia, Marsabit, Ndotos, the Matthews Range, Mt. Kulal, the Loita Hills, The Chyulu Hills, the Taita Hills, and Kasigau hills among others. These forests differ in species composition due to climate and altitude. The moist broad-leaved forests occur on the windward sides while the drier coniferous mixed forests are found on the leeward sides (Beentje, 1994). At higher altitudes the highland bamboo *(Oldeania alpina)* predominates. It's within these forests where bulk of forest plantations have been established.

Unique category of montane forests especially in the arid and semi-arid lands include the Cloud forests. These are unique forests found on high mountain ranges and hilltops, typically in arid and semi-arid lands (ASALs). These forests are characterized by unique climatic conditions in which the persistent cloud cover captures moisture from fog, creating a humid environment that is distinctly different from the surrounding arid or semi-arid areas. Key cloud forest regions in Kenya include the Marsabit Hills, Chyulu Hills, Taita Hills, Kirisia Hills, and higher-altitude areas such as Mt. Kenya, the Aberdare Range, Mau Forest Complex, Cherangany Hills and Mt. Elgon.

These forests are critical for Kenya's environmental health, supporting a rich diversity of plant and animal species, many of which are endemic to these regions. For instance, the Aberdare Ranges is home to rare species such as the bongo antelope and the forest elephant, while Mt. Kenya hosts unique vegetation, including bamboo forests and giant heath species. The total forest cover of these highland areas in Kenya is estimated at around 2.6 million hectares, with cloud forests representing a significant portion of this.

Western Rainforest: These are forests with characteristics of the Guineo-Congolian forests and include Kakamega forest, the North and South Nandi forest and Nyakweri forest in Transmara Sub-County. The trees are significantly taller and larger as compared to the other forests of Kenya.

Coastal Forests: These are the forests found in the coastal region of Kenya within a 30 km strip from shoreline. They are part of the larger coastal belt including, Arabuko-Sokoke forest, Shimba hills forest and the forests of Tana River region and Boni-Dodori forest complex. They are dominated by species of *Combretum, Afzelia, Albizia, Ekerbergia, Hyphaene, Adansonia* and *Brachestegia* woodlands and are biodiversity hotspots for endemic species. This class was defined as unique by the Kenya Indigenous Forest Conservation Programme (KIFCON) in Wass (1994).

The Kaya Forests: These forests cover total area of approximately 2,525.4 Ha. The forests are managed under customary rules by the Kaya elders. There are four gazetted Kaya forests under the management of Kenya Forest Service (KFS) namely Kaya Chonyi, Kaya Jibana, Kaya Ribe and Kaya Kambe. Some of the Kayas are also gazetted under National Museums and Heritage Act of 2006 as heritage sites and are managed by communities and the National Museums of Kenya (NMK). These forests have been recognized internationally as world heritage sites under Man and Biosphere (MAB) reserves by the United Nations Educational, Scientific and Cultural Organization (UNESCO). KFS is undertaking the task of identifying, surveying and mapping all Kaya forests along the coastal counties of Kilifi (1,050.00 Ha), Mombasa (17 Ha) and Kwale (1,458.4 Ha.) with involvement of local communities, Kaya Elders and other stakeholders.

Mangrove forests: Mangrove forests cover about 61,271 ha, representing approximately 3.0% of the natural forest cover or less than 1.0% of the national land area. About 59% of these forests occur in Lamu County. There are nine species of mangroves in Kenya which occur on a typical zonation pattern with the seaward side occupied by *Sonneratia alba*, followed by *Rhizophora mucranata, then Bruguiera gymnorrhiza, Ceriops tagal, Avicennia marina, Lumnitzera racemosa* and *Heritiera litoralis* respectively (Kokwaro, 1985; Kairo et al., 2001). Other mangrove species include *Xylocarpus granatum* and *Xylocarpus mollucensis*. The most dominant mangrove species in Kenya are *Rhizophora mucronata* (or mkoko) and *Ceriops tagal* (mkandaa). Root causes of mangrove loss and transformations have been identified as; increased population, weak governance, inadequate awareness of the true value of mangrove ecosystems, high levels of poverty, lack of alternative livelihoods, and inadequate management prescriptions. Mangrove losses in turn have negative impacts on fisheries, shoreline stability, and resource sustainability.

Dryland Forest: These are the forests found in the arid and semi-arid regions of Kenya. They cover approximately 2,050,000 hectares and account for more than 80 percent of the country's eco-tourism interests and a large proportion of the wildlife population (GATSBY, 2014). These forests also provide important climatic and water catchment functions. They are mainly managed by KFS, KWS, private landowners or community-based associations. The tree composition in these forests are dominated by *Vachellia commiphora* species but also include *Combretum molle, Platycephelium voense, Senegalia polyacantha, Vachellia xanthophloea, Ficus sycomorus Tamarindus indica, Vachellia melifera, Manilkara, lannea, Balanites aegyptiaca, Melia volkensii, Euphorbia candelabrum* and *Adansonia digitata*. Another category of these forests also includes riverine forests in dry areas. Their carbon stocks may differ from that of other forests due to leaf shedding, elongated rooting systems and high specific wood density.

The greatest driver of degradation and deforestation of dry land forests is overgrazing, wild fires, infrastructural development, change of land use and fuel wood/ charcoal production, owing to high demand for charcoal in rural and urban settlements across the country. Charcoal producers target specific high-density species, such as *Balanites spp, Vachellia spp* (formerly Acacia) and *Terminalia spp*, which have low regeneration capacity.

Plantation Forests: Plantation forests refer to forests that have been artificially regenerated and are managed on a sustainable basis for the production of wood and other forest products and services for commercial purposes. The forests are established to meet specific silvicultural objectives. These include the production of sawn timber, pulp and paper, electricity poles, construction poles, fencing posts, and fuelwood. Silvicultural

practices are applied to specific management circles to achieve the best results for the desired purpose of establishing the plantation. Exotic tree species are most preferred in the establishment of industrial plantations due to their short rotation period as compared to indigenous ones. Exotic plantation species include cypress *(Cupressus lusitanica, Cupressus macrocarpa) Eucalyptus species (E. saligna, E. globulus, E. regnan, E. camaldulensis), Pinus spp. (P. patula, P. carribea, P. canalinsis, P.radiata), Casuarina equisetifolia, Bischofia javanica.*

Alternatively, several indigenous species have been identified and trial plantations established for the production of timber. They include *Vitex keniensis, Maesopsis eminii, Melia volkensii, Juniperus procera, Podorcabus latifolia*. Inspite of this, existence of a ban on the exploitation of indigenous trees hinders innovativeness to improve our indigenous species for commercial plantation forestry development. At present, approximately 152,790 ha of land is under plantation establishment in the gazetted forest covered with various tree species comprising 12,744 sub compartments. The total area occupied by the buffer zone (Nyayo Tea Zone) is approximately 1,000 ha. Stocked plantations stand at 89.7% while un-stocked is 10%. Table 4 provides the details of plantation forest coverage by species while figures 3 shows distribution by species. The plantations outside gazetted areas, in dryland and private forest cover 103,400 ha (FAO, 2015).

Table 4: Forest Plantation Coverage

Major Species	Area Ha	Percentage (%)
Cupressus lusitanica	74,938.90	49.0
Eucalyptus Spp	16,947.76	11.1
Pinus Spp	28,996.30	19.0
Mixed indigenous	12,013.12	7.9
Plantation mixed Spp	356.92	0.2
Un-stocked area	19,537.16	12.8
Grand Total	**152,790.16**	**100**

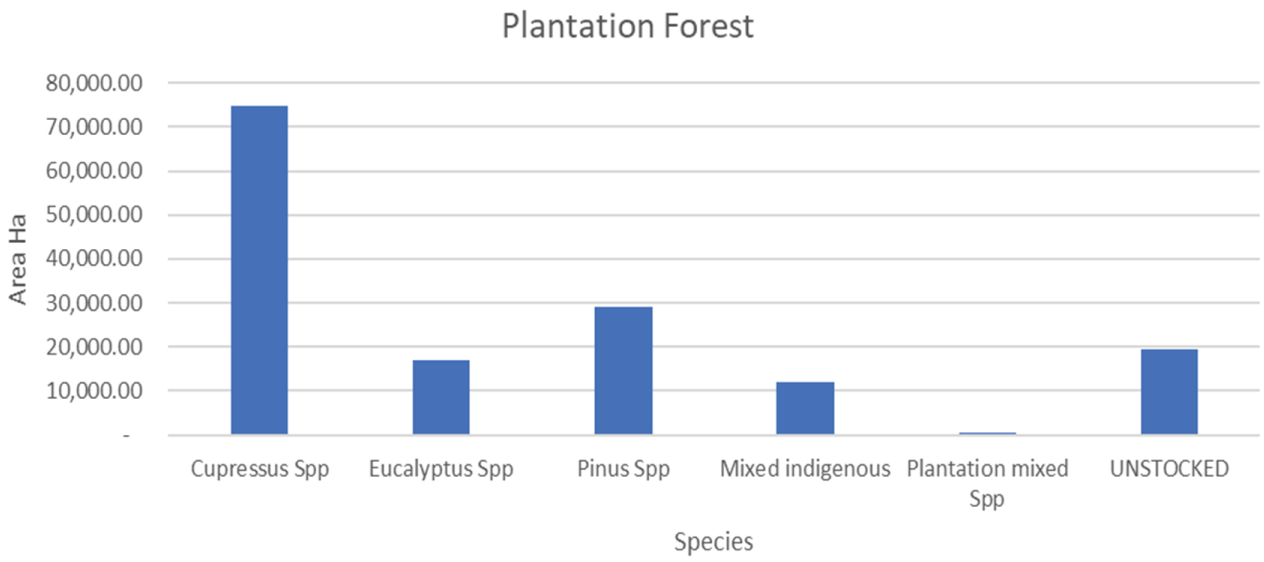


Figure 3: Chart of Plantation Forests Species

4.2 Forest Growing Stock and Biomass

Forest growing stock focuses on the volume of living trees in a forest, while biomass encompasses the total mass of living plant material, including trees and other vegetation. Both scenarios are critical for assessing and managing forest ecosystems sustainably. Stratified sampling was used and forest stock data collected in a Pilot Forest Inventory by Improving Capacity in Forest Resources Assessment in Kenya - ICRAF (KFS, 2016) and CADEP-SFM (JICA, 2017) was used to assign biomass stock to each stratum and sub strata. Data from the pilot inventory that covered all the forest strata was used. The table 5 below has been drawn from the FRL report, shows the weighted average of the data collected from a total of 121 plots where a simple average of the field data for each stratum was used as the Biomass stock for each sub strata.

Table 5: Forest Biomass and Average Carbon Stock

Biomass	1990	2000	2010	2015	2018
Growing Stock Average Volume M^3/ha	130.463	113.70866	120.3113	130.4578	128.4194
AGB stock Average (Tons/ha)	108.33	94.59	100.21	108.38	106.66
BGB Stock Average (Tons/ ha)	36.71	31.73	33.61	36.74	36.15
AGB Carbon Stock Average (Tons/ha)	50.91	44.46	47.10	50.94	50.13
BGB Carbon Stock Average (Tons/ha)	17.25	14.91	15.80	17.27	16.99

4.3 Land Use and Land Cover Classification

Kenya has domesticated the six (6) IPCC land cover classes for reporting emissions from the land sector. This classification has been used in Kenya's Forest Reference Level and the Greenhouse Gas Inventory among other national reports.

The forests are categorized into six strata; five based on agro ecological zones (Montane, Western rainforest, Coastal, Mangrove and Dry land) and one based on management (public plantations). Each of these classes is further categorized by canopy classes; Dense Forest (above 65%) Moderate Forest (40 % to 65%) and Open Forest (15 % to 40%). The table 6 below presents the land use and land cover trends in Kenya from 1990 to 2021. Figure 4 below gives the trends on land-use and land cover. Evidently wetlands have been reduced significantly.

Table 6: Land-Use Land Cover Trends

AREA IN HECTARES								
LAND COVER ('000' HA)	1990	1995	2000	2005	2010	2015	2018	2021
FORESTLAND	3,740.6	3,869.14	3,816.21	3,469.98	3,878.47	3,383.88	3,462.54	3,720.24
GRASSLAND	44,281.4	44,355.5	43,016.5	42,704.3	41,074.1	42,007.1	41,252.1	43,456.0
CROPLAND	3,443.00	3,687.47	4,449.96	4,959.53	6,062.78	6,768.04	6,740.17	7,600.86
WETLAND	1,233.25	1,238.01	1,235.20	1,236.03	1,261.30	1,263.37	1,267.53	709.59
OTHER LAND	6,505.52	6,053.66	6,685.84	6,833.85	6,927.10	5,781.30	6,481.44	3,717.02
TOTAL	59,203.7	59,203.7	59,203.7	59,203.7	59,203.7	59,203.7	59,203.7	59,203.7

SOURCE: NATIONAL FOREST RESOURCE ASSESSMENT REPORT 2021

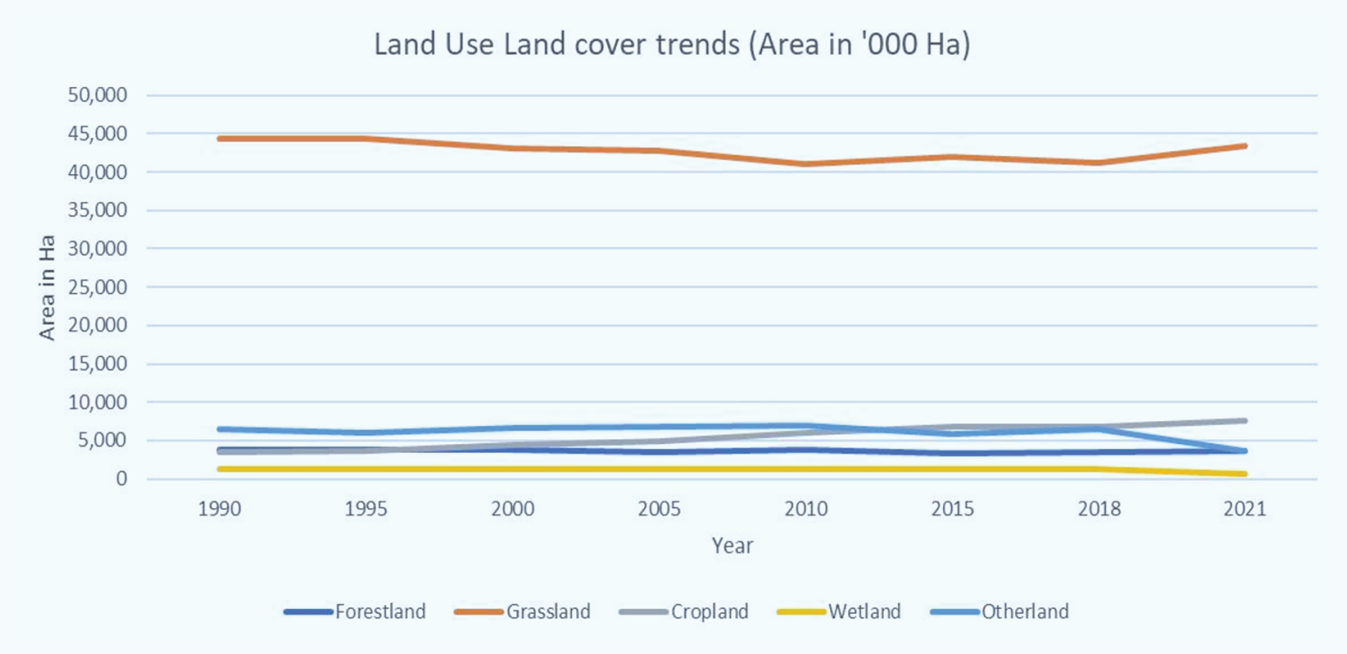


Figure 4: : Land Use Land Cover Trends

4.4 Deforestation and forest degradation

Deforestation is defined as conversion of forest to non-forest land use across all management systems and strata, which does not include the planned and periodic felling of public plantations. On the other hand, degradation is defined as conversion of forest from higher canopy cover density to lower one (FRL 2020). The loss and degradation of forests exacerbate impacts on already vulnerable populations with direct repercussions on livelihoods. Degraded land in Kenya is estimated at 21.6% (Gichenje and Godinho, 2018) with about 12,000 hectares of forest land converted to other uses or lost through natural causes every year (MECCF, 2019b).

Drivers of deforestation and forest degradation have been described in detail in the REDD+ Strategy which classifies them into proximate and underlying drivers. Proximate drivers include: agricultural expansion, wood fuel, unsustainable wood extraction, overgrazing, infrastructure expansion, mining, pest and diseases and fires. Underlying drivers include: population growth, economic growth, policy and legal factors, institutional mandates, political influence, technological development, culture and insecurity. Reversing forest loss and land degradation requires first and foremost addressing the drivers behind this loss and degradation (di Sacco et al., 2021), but also scaling up restoration. Drivers of forest degradation vary in magnitude in line with forest type, geographical locality, environmental conditions, social and economic contexts.

4.5 Biodiversity Conservation

Kenya is a mega bio-diverse country with over 35,000 species of flora and fauna. This diversity is served by the variable ecosystems ranging from marine, mountains, tropical, dry lands, forests and arid lands. In addition to these are some 467 inland lake and wetland habitats covering about 2.5% of the total area. The country's known biodiversity assets include 7,004 plants (577 or 8% endemic), 25,000 invertebrates (21,575 of which are insects), 1,133 birds, 315 mammals, 191 reptiles, 180 freshwater fish, 692 marine and brackish fish, 88 amphibians and about 2,071 species of fungi and bacteria (MEWNR, 2015).

National centers of endemism for Kenya include the coastal center of endemism, recognized globally as the Coastal Forests of Eastern Africa Hotspot, and the isolated mountain peaks of the afro-montane forests, recognized as the Eastern Afromontane Hotspot. The two centers account for over 80 percent of endemic species. A total of 356 vascular plant taxa (species, subspecies and varieties) in Kenya have so far been classified as threatened or near threatened. Of these, 24

taxa (21 species) are critically endangered, 111 are endangered (83 species), 167 are vulnerable (128 species) and 67 are near threatened (56 species).

Threatened species are particularly common in the Fabaceae, Euphorbiaceae and Rubiaceae families. The highest number of threatened species, 95 in all, is found in the coastal forests hotspot, mainly because of habitat fragmentation and the extensive loss of the highly-diverse coastal forest ecosystems such as Arabuko Sokoke forest and the Kaya forests.

Research on biodiversity of our forests is important for the conservation of forests. There were over 100 permits issued to conduct research in the forests on biodiversity between the years 2007-2017 (A compendium of KFS achievement 2007-2017). This confirms the significance of the forests as reserves of our biodiversity which we must conserve for posterity and is yet to be studied.

4.6 Drivers of Forest Degradation

Key drivers of forest degradation in Kenya are agricultural expansion, unsustainable logging, livestock grazing in forests, rapid population growth and inadequate forest governance. Cumulative results of the drivers have led to destructive events that includes: forest fires, poaching of forest products, encroachment into forest land, farming, livestock grazing in the forest and introduction of invasive species.

Forest fire is one of the major threats that Kenya faces in its conservation and management efforts. Forest fires are frequent, especially during the dry seasons from months of December to February. Most fires emanate from slash-and-burn land preparation methods, use of fire during honey harvesting, wildfires, burning of grazing land to allow for pasture regeneration, and arsonists who use fire to divert attention from their illegal activities in the forest. The most affected ecosystems by forest fire are: Mt. Kenya, Aberdares, Mau Forest Complex, Mt. Elgon, and Cherengany. It was noted that from 17th Dec 2023 to 15th Dec. 2024 there were 778 forest fire alerts from the Visible Infrared Imaging Radiometer Suite (VIIRS).

Pests and diseases pose great challenges to the overall health of Kenya's forests. Over the years, with the emerging planetary challenges of climate change, pests and diseases have been mutating resulting in losses from nursery and in the field. In recent times, there has been an increase in the number of pests and diseases attacking the exotic commercial tree species (Eucalypts, Pines and Cypress) prompting research to be undertaken in the development of appropriate mitigation strategies.

Invasive plant species, defined as plants that produce large numbers of offspring, with greater chances of spreading widely (Ratnayake, 2015) are the second leading cause of biodiversity loss worldwide (Wilcove et al., 1998, Gaertner et al., 2009). Invasive species have the ability to alter ecosystem processes (Ehrenfeld, 2010), decrease native species abundance (Blackburn et al., 2004, Gaertner et al., 2009), change community structure (Hejda et al., 2009) and alter genetic diversity (Ellstrand and Schierenbeck, 2000). The common invasive species in Kenyan forests are *Lantana camara, Cestrum aurantiacum* (yellow cestrum), *Solanum mauritianum, Prosopis juliflora* and *Psidium guajava* and dodder *(Cuscuta campestris).*



CHAPTER 5

FOREST AND LANDSCAPE RESTORATION



5.1 Status of Forest Landscape Degradation in Kenya

In recent years, the country has experienced increased degradation both in existing forests and other landscapes. Degradation is estimated to cost the Kenyan economy at least 3% of GDP annually (Mulinge et al, 2016). In Kenya, the average annual forest degradation rate is estimated at 14,934 ha with the deforestation rate at an annual average of 84,716 ha (UNFCCC: FRL, 2019).

The drivers of forest degradation vary in magnitude and forest type. They also vary in geographical, environmental, social and economic contexts. Different drivers of degradation are manifested through various dynamics such as the geophysical aspects, land use practices, socio-cultural activities, political and governance mechanisms. A study conducted on Forest and Landscape Restoration (FLR) across 47 Counties, identified key drivers of degradation including increase in population, poverty, encroachment, overgrazing/ overstocking, land tenure, natural disasters, inadequate information, and socio-cultural barriers, among others (MENR 2016).

The Kenyan government has pledged to restore degraded areas through various global, regional, and national initiatives to combat land degradation. These commitments include the African Forest Landscape Restoration Initiative (AFR100) which is linked to the Bonn Challenge, under which Kenya has committed to restoring 5.1 million hectares of degraded landscapes by 2030.

Through the support of the World Resources Institute, entire Kenya was mapped and an area of 38.8 million hectares was found to be degraded. The area was identified to have restoration potential out of this; a conservative area of 5.1 million hectares was committed for restoration. Figure 5 shows the details of the potential restoration areas including from; degraded and deforested public, community and private forests areas, degraded mangrove areas, riparian lands, farmlands, urban areas, schools and institutions and rangelands.

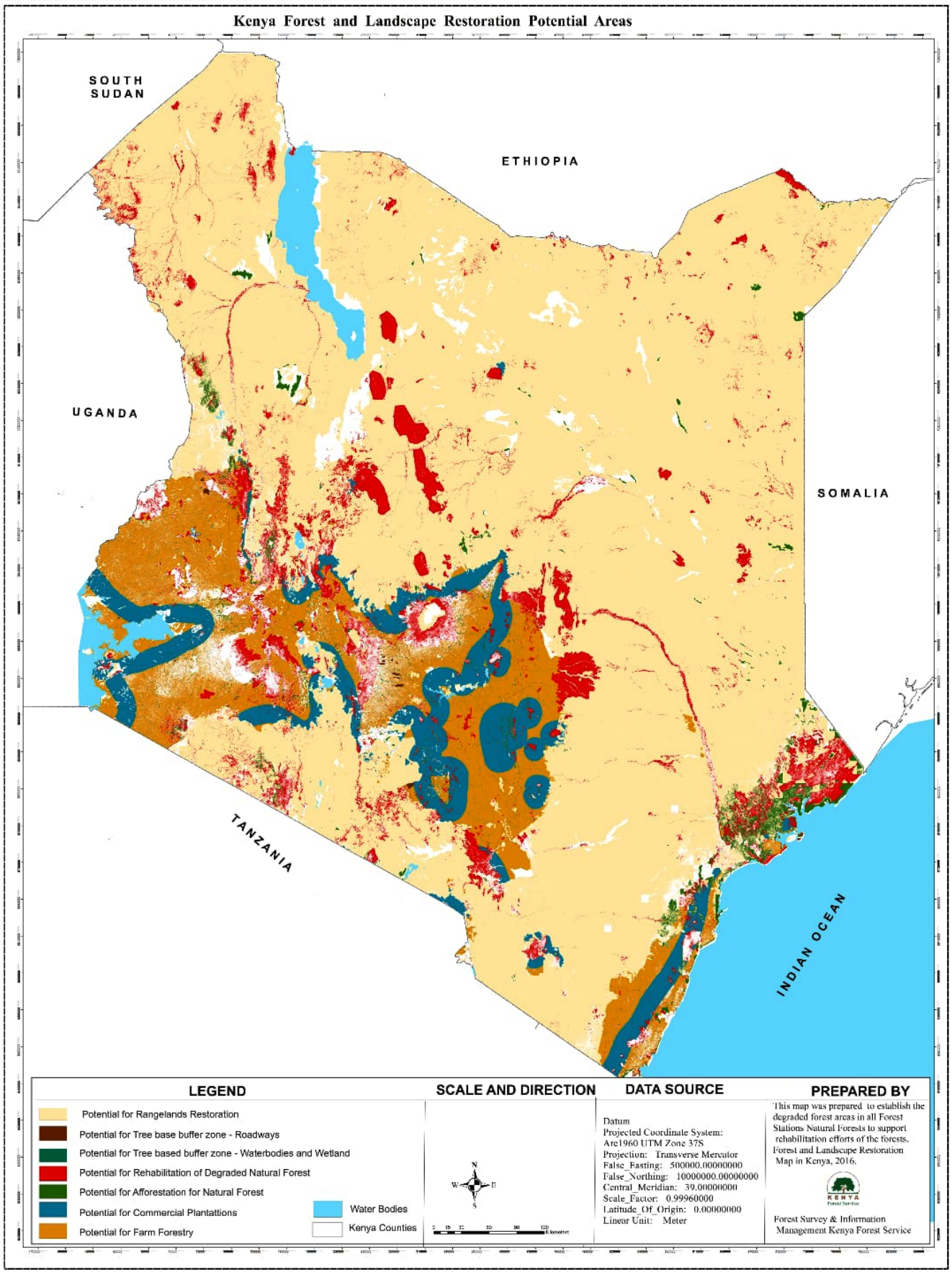


Figure 5: Kenya Forests and Land Scape Restoration Potential Areas

(Source; Technical Report Kenya National Assessment of FLR Report 2016)

5.2 Ongoing Restoration Initiatives

Kenya is actively involved in various programs and projects to restore and conserve its forests and show commitment to addressing forest degradation. Forest restoration in Kenya is a crucial effort to tackle environmental challenges such as deforestation, biodiversity loss, and climate change. It involves a long-term, active process aimed at restoring ecological integrity and improving human well-being across deforested and degraded landscapes.

To enable this, the country has developed a Forest and Landscape Restoration Implementation Plan (FOLAREP) and has drawn a National Landscape and Ecosystem Restoration Strategy, 2023-2032 that aims to grow 15 billion trees by 2032, targeting the restoration of 10.6 million hectares of degraded forests and rangelands. This effort is projected to increase the national tree cover to 30% by the year 2032.

FOLAREP focuses on the restoration opportunities in forestlands, croplands, rangelands, and buffer zones along wetlands as well as strengthening the coordination framework and resource mobilization for its implementation.

The strategy towards the growing of 15 billion trees by 2032 identifies 11 intervention areas as summarized in Figure 6.

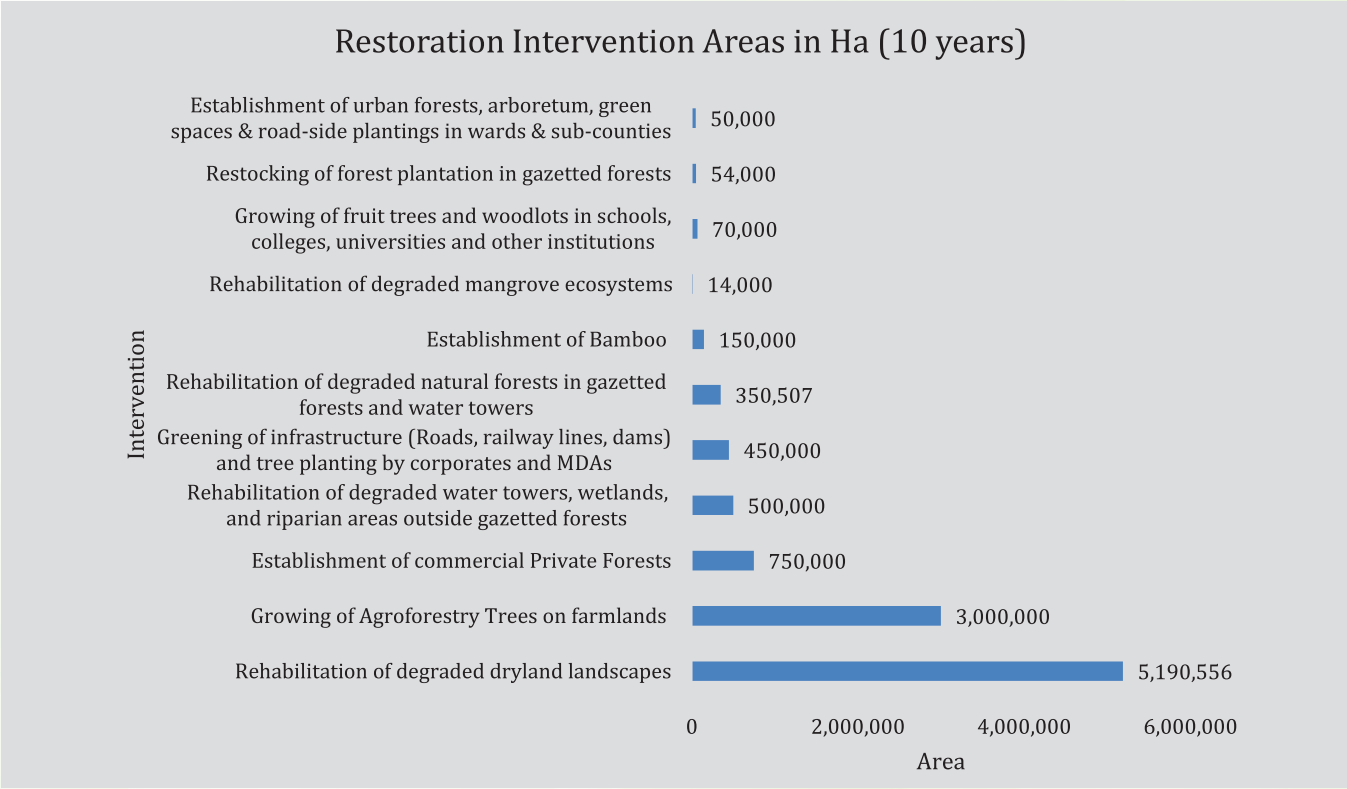


Figure 6: Restoration Intervention Areas for growing 15 billion trees by 2032

In a bid to involve various stakeholders in the restoration of degraded forest areas, the government launched 'Adopt-A- Forest Initiative' in 2015. "Adopt-a-forest initiative" is an innovative concept that enhances the planting and growing of trees across the country. This process involves partners adopting a portion of a forest for rehabilitation, protection, and management for a period ranging from 3 to 5 years. To date, KFS has entered into a framework of collaboration with over 100 partners (both state and non-state actors). This has led to a total of 54,698.68 hectares of forest areas being adopted for restoration as shown in Table 7.

Table 7: Summary of the adopted areas from 2018/2019 FY to 2022/2023 FY

No	Financial Year	State Actors		Non-State Actors		Total No. of partners	Total Area (Ha)
		No. of partners	Area (Ha)	No. of partners	Area (Ha)		
1	2022/2023	1	150	7	30,572	8	30,722.0
2	2021/2022	22	687.6	26	28,998.42	48	29,686.02
3	2020/2021	13	1,785.8	14	22,882.23	27	24,668.03
4	2019/2020	19	391.5	7	170	26	561.50
5	2018/2019	5	51.2	6	85.4	11	136.60
Total		**59**	**2,916.1**	**53**	**82,708.05**	**104**	**54,698.68**

To increase forest conservation efforts and further improve on the restoration efforts, the gazettement of new forest areas has been heightened: through the recent gazettement of 935,042.32 hectares of new public forest areas for the period between 2007 and 2023. In 2023 alone, a total of 5,564.754 hectares of new forest areas have been gazetted as shown in Table 8.

Table 8: Newly Gazetted Forest areas in 2023

S/No.	Forest Name	Area (Ha)	Legal Notice	County
1	Macalder	2494.95	85/2023	Migori
2	Dandu Hill	1779.7	86/2023	Mandera
3	Takaba Hill	1171.92	87/2023	Mandera
4	Garissa Aboretum & Tree Nuresy	8.823	88/2023	Garissa
5	Wote Tree Nursery & Arboretum	1.917	89/2023	Makueni
6	Masalani Tree Nursery	1.484	90/2023	Garissa
7	Chetambe	105.96	91/2023	Bungoma

Currently, there are efforts to gazette degraded Kaya forests so as to enhance their protection. Further, through the 'Greening Schools Initiative', forest sector players that include KFS, aim to partner with educational institutions to plant trees in the learning institutions and promote tree-growing culture through the education of the young generation.

5.3 Forest Landscape Restoration Challenges and Measures

Despite the country being on the right trajectory for the restoration of the degraded ecosystems, there still exist massive gaps to seal before turning around the degradation of our landscapes including the forests. Kenya faces several interconnected barriers that hinder effective Forest Landscape Restoration (FLR) efforts. Governance and policy-related challenges include a lack of harmony among various government policies, laws, and strategies, coupled with weak institutional structures for implementation and the absence of sector-specific policies necessary to guide restoration initiatives. Information barriers are characterized by inadequate data on FLR and ineffective systems for knowledge management and information sharing, limiting awareness of FLR-associated benefits.

Land tenure issues present additional hurdles, with unresponsive tenure systems, unsustainable communal land use practices, ineffective implementation of land use plans, and insecure land tenure rights undermining restoration efforts. Competing land uses and fragmentation further complicate land use planning, making it difficult to integrate FLR goals effectively.



Social barriers such as demographic pressures, resource-based conflicts, cultural malpractices, and gender disparities exacerbate the challenges, while economic constraints, including inadequate financing, weak benefit-sharing mechanisms, inflexible programming for funded projects, and insufficient budget prioritization, limit the scope and impact of FLR initiatives.

Biophysical challenges are intensifying due to climate change, which manifests through droughts, floods, and disease outbreaks, alongside invasive species, extreme land degradation, and declining soil fertility. Lastly, inadequate technological capacity hampers the adoption of advanced tools and techniques that could enhance restoration activities. Addressing these barriers requires a multi-faceted approach that integrates policy reform, stakeholder engagement, technological innovation, and sustainable financing mechanisms.

Kenya being a mega bio-diverse country with over 35,000 species of flora and fauna is served by the variable ecosystems ranging from marine, mountains, tropical, drylands, forests, and arid lands. In addition to these are some 467 inland lake and wetland habitats covering about 2.5% of the total area. Kenya's eight internationally recognized biosphere reserves have six of them situated within the forest reserves. These are; Mt. Elgon, Malindi-Watamu which incorporates the Arabuko Sokoke forest, Gedi ruins, sacred Miji Kenda Kaya forests as an important core zone, Mt. Kulal in Ewaso North Conservancy, Kiunga which includes Boni forest and the associated mangrove forests and Mt. Kenya.

The country's known biodiversity assets include 7,004 plants (577 or 8% endemic), 25,000 invertebrates (21,575 of which are insects), 1,133 birds, 315 mammals, 191 reptiles, 180 freshwater fish, 692 marine and brackish fish, 88 amphibians and about 2,071 species of fungi and bacteria (MEWNR, 2015). National centers of endemism for Kenya include the coastal center of endemism, recognized globally as the Coastal Forests of Eastern Africa Hotspot, and the isolated mountain peaks of the afro-montane forests, recognized as the Eastern Afromontane Hotspot. The two centers account for over 80 percent of endemic species. A total of 356 vascular plant taxa (species, subspecies, and varieties) in Kenya have so far been classified as threatened or near threatened. It is worth to note that out of these, 24 taxa (21 species) are Critically Endangered, 111 are Endangered (83 species), 167 are Vulnerable (128 species) and 67 are Near Threatened (56 species). Threatened species are particularly common in the *Fabaceae, Euphorbiaceae*, and *Rubiaceae* families. The highest number of threatened species, 95 in all, is found in the Coastal Forests Hotspot, mainly because of habitat fragmentation and the extensive loss of the highly diverse coastal

forest ecosystems such as the Arabuko Sokoke forest and the Kaya forests.

As part of the causes of biodiversity loss, among others, is the increasing trend of Invasive Alien Species (IAS). Invasive plant species have been identified as a major cause of forest degradation in Kenya. The total area covered by invasive species has been estimated at 32,556.69 ha. Of this area, an estimated 4,595 ha is under management. The 5 most prevalent invasive species in terms of area covered include *Lantana camara* (10,083.5 ha), *Caesalpinia decapetala* commonly called Mauritius thorn (9,683.8 ha), *Cestrum aurantiacum* (2,680 ha), *Psidium guajava* (1,104.39 ha), and *Prosopis juliflora* (788 ha).

In the Regional Forest Conservation areas, Eastern Conservancy has the largest area occupied by invasive species (20,272 ha) with the main invasive species being *Lantana camara* and Mauritius thorn. North Rift Conservancy has the second largest area covered with invasive species (2,655 ha) with the main invasive species being *Prosopis juliflora*. The Western Region has the third largest area occupied by invasive species (2,233.39 ha) with the main species being *Psidium guajava*. The area in Mau Conservation area covered by invasive species is 2,231 ha with the main species in the conservation area being *Cestrum aurantiacum*. The Central Highlands Conservation area has an area of 1,627.8 ha covered with invasive species, mainly Mauritius thorn.

KFS has been controlling the spread of invasive species through various methods. For example, in the Nairobi region, the method of uprooting has been employed to control the *Lantana camara* in Karura and Ngong Road forests whereas Tree Establishment and Livelihood Improvement Scheme (TELIS) has been employed in Meru and Tharaka Nithi Counties. In Kakamega County communities have been engaged to clear *Psidium guajava* and thus control its spread. The Conservation Areas with the largest areas with invasive species that have been managed are Eastern (2,465 ha), Western (750.5ha), Nairobi (720ha), Central (215.4 ha) and North Rift (200.1ha).

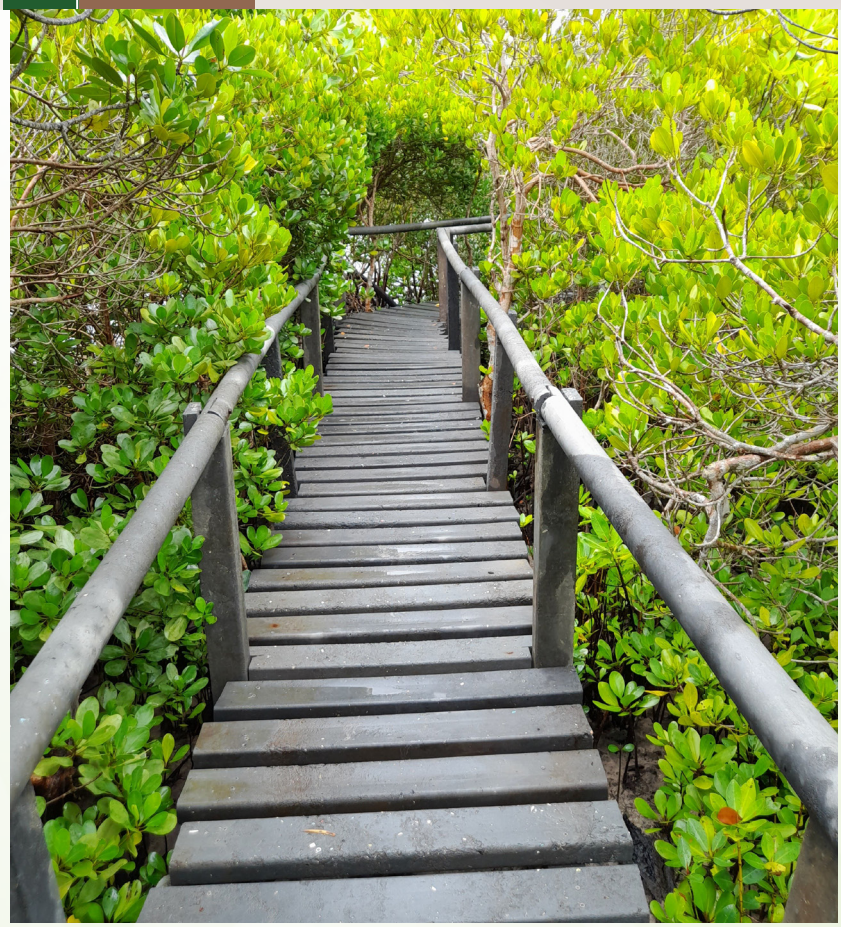
In addressing some of the challenges and barriers to Forest Landscape Restoration (FLR) comprehensively, Kenya should prioritize establishing effective information and knowledge management systems. This includes creating a National FLR Registry as a centralized database to track ongoing initiatives, detailing project locations, funding sources, and progress. Additionally, the development of standardized monitoring tools, leveraging technologies like GIS and remote sensing, will ensure consistent tracking and evaluation of FLR activities. A technical assistance platform dedicated to FLR should also be established to facilitate the exchange of best practices, data, and innovations among stakeholders, fostering collaboration and shared learning.

Technological advancements play a critical role in enhancing FLR efforts. Capacity building for stakeholders in the use of advanced tools such as drones, GIS, and remote sensing for planning and monitoring is essential. Furthermore, Kenya should adopt modern restoration technologies, including the use of seed balls, Assisted Natural Regeneration (ANR), and automated planting systems, to scale up restoration efforts effectively and efficiently. These measures will strengthen FLR initiatives, ensuring their sustainability and success.



CHAPTER 6

FORESTS CONTRIBUTION TO THE ECONOMY



Kenya's forestry sector contributes 3.6% to the GDP, and is one of the sectors identified by the vision 2030 as critical to sustainable development in the country (UNEP 2012). Forests support Kenya's socio-economic sectors that include agriculture and horticulture, tourism, wildlife, and energy. The forests provide intermediate products and services for the industries downstream besides providing goods for consumption by households. The montane forests in particular do not only provide such goods but, in addition, provide a range of services that supply an insurance value to the economy. This insurance value is important, not only to maintain economic resilience to seasonal, environmental and economic changes but also to long-term economic hazards, such as climate change (UNEP, 2012).

To enhance forest contribution to the economy, the following measures shall be undertaken: promoting sustainable logging practices; developing value added forest products; integrating agro-forestry systems; supporting ecotourism initiatives; empowering local communities to manage forests and investing in research and technology development to improve forest productivity.

Forests play an important role in provision of services such as protection of water catchments. The five major water towers are associated with forests of Mt Kenya, Aberdare ranges, Mau Escarpment, Cheranganyi Hills and Mt Elgon. The water from the five water towers is possibly more than 15,800 million cubic meters per year which is more than 75% of the renewable surface water resources of Kenya (UNEP, 2012).

6.1 National wood supply and demand

The natural public forests, public plantations, farm forests, private forests and community forests are the key suppliers of round wood for both domestic and industrial uses in the country. The country has the capacity to sustainably supply 31,372,531 m3 of roundwood that is broken into timber (23.5%), poles (9.7%), firewood (43.5%) and charcoal (23.5%). Wood demand is estimated at 56.2 million m3 per year, based on the per capita consumption of I m3 per year and the current population of 56.2million- (UN population fund, 2024). The demand is summarized as; timber (12.6%), poles (3.8%), firewood (44.9%) and charcoal (39.2%). Timber and pole production are the only products that marginally exceeded demand, however, wood fuel deficits exceeded by 50% of the national supply. This is therefore an indication that domestic wood-fuel users have to resort to unsustainable sources or deplete growing stocks, which subsequently lead to considerable deforestation or in some cases resort to use agricultural residues. The deficits indicate that wood product consumers, especially in the construction industry, have to rely on imports, especially of hardwood for furniture making and softwood for construction activities or use of substitutes such as metals and plastics in various construction activities. The supply and demand potential for key forest products are given in table 9.

Table 9: National Supply and Demand of Key Forest Products

Product	Timber	Poles		Firewood	Charcoal	Grand Total	Grand Total
Potential supply	7,363,414	3,028,907	13,654,022	7,358,717	20,980,2009		31,372,531
Potential demand	5,262,624	1,409,482	18,702,748	16,325,810	35,028558		41,700,664
Net balances	2,100,791	1,619,424	(5,048,726	(8,967,093)	14,048,349)		(10,328,134)

Source: (MEWNR, 2013)

MEWNR (2013) used models based on population and sectoral economic growth, including wood-based consumption centers and yield potentials for the various types of forests, to forecast the supply of wood products in Kenya for 2012-2032. The forecasts for key forest products showed that the supply of timber is to grow by 28.8%, poles by 29.2%, firewood by 15.3%, and charcoal by 16.1% in this period. The overall wood supply was forecasted to increase by 20% from 31,372,530m3 to 34,986.90 m3 for the period as shown in Table 10;

Table 10: National Wood Products Supply Projection for 2012-2026 (1000m3)

Product	2012	2014	2016	2018	2020	2022	2024	2026
Timber	7358.45	7550.89	7723.49	7942.39	8117.71	8352.66	8547.92	8777.35
Poles	3029.65	3102.52	3177.29	3265.30	3357.87	3445.37	3535.49	3618.75
Firewood	13639.88	13845.77	14054.78	14254.17	14451.38	14678.82	14875.43	5064.60
Charcoal	7344.55	7454.29	7566.21	7680.33	7792.73	7909.19	8028.06	152.51
Total	**31372.53**	**31953.47**	**32521.77**	**33142.19**	**33719.69**	**34386.04**	**34986.90**	**5613.21**

Source: (MEWNR, 2013)

Focus on future forest products demand is highly correlated with the economic development, demographic changes, and competition from substitutes in use. According to MEWNR (2013) the demand for wood was projected to increase by 43.2%, poles (58.2%), firewood by (16.1%) and charcoal (17.8%) by the year 2026. The total wood demand was therefore expected to grow by 21.6% from 41,700,660 m3 in 2012 to 46,971.11 m3, in 2024, hence an increase in demand of 5,270,450 m3 However, based on the estimated per capita consumption of I m3 per year and the current population of 56.2million- (UN population fund, 2024), the Wood demand is currently estimated at 56.2 million m3 per annum.

The supply and demand projections clearly indicate that the country will face acute shortages of forest products in the near future, and therefore the need to intensify productivity in public forest plantations and as well bring on board the private and farm forestry sectors into the national supply of forest products. Table 11 gives the wood products demand projection from the year 2016-2026.

Table 11: National Wood Products Demand Projection for 2016-2026 (1000m3)

Product	2012	2014	2016	2018	2020	2022	2024	2026
Timber	5262.62	5465.05	5674.72	5908.44	6120.67	6356.66	6628.14	6802.66
Poles	1409.48	1473.85	1542.10	1613.93	1692.38	1768.05	1854.65	1932.33
Firewood	18702.75	18936.08	19220.67	19559.70	19860.51	20135.65	20441.91	20749.93
Charcoal	16325.81	16615.39	16851.66	17127.07	17415.41	17737.85	18046.41	18398.90
Total	**41700.66**	**42490.37**	**43289.15**	**44209.14**	**45088.97**	**45998.21**	**46971.11**	**47883.82**

Source: (MEWNR, 2013)

6.2 The Total Economic Value of Forest Ecosystem Services

The total economic value of Kenya's forest is difficult to estimate as few ecosystem services have explicit prices informed by valuations done or are traded in an open market. Ecosystem services most likely to be priced in markets are the consumptive, direct-use values such as water. Non-consumptive use values, such as recreation or non-use values, which may include the spiritual or cultural importance of a landscape or species, have often been influential in decision making but these benefits are rarely valued in monetary terms (TEEB, 2010). Some other ecosystem benefits, especially regulating services such as water purification and climate regulation (e.g. carbon sequestration), have only recently begun to be assigned an economic value, referred to as "indirect use values".

According to a study conducted by KEFRI in 2019, the total economic value of ecosystem services from the Mau Forest Complex, Cherengani Hills, and Mt. Elgon shows that the primary ecosystem services provided by forests in provisioning services, which include timber and non-timber products, food production, water and hydro-power account for 71.7% of the total economic value. The regulating services—encompassing carbon sequestration, oxygen generation, and micro-climate regulation—contribute 17.9%. Supporting services, which include soil and nutrient conservation, account for 9.6%, while cultural services, which encompass cultural, spiritual, and bequest benefits, contribute 0.8%.

Further, according to the report, the three ecosystems contribute an aggregate total of 339 billion Kenya Shillings with Mau Contributing 54%, Cherenganyi contributing 12% and Mt. Elgon contributing 34% (Langat et al., 2019)

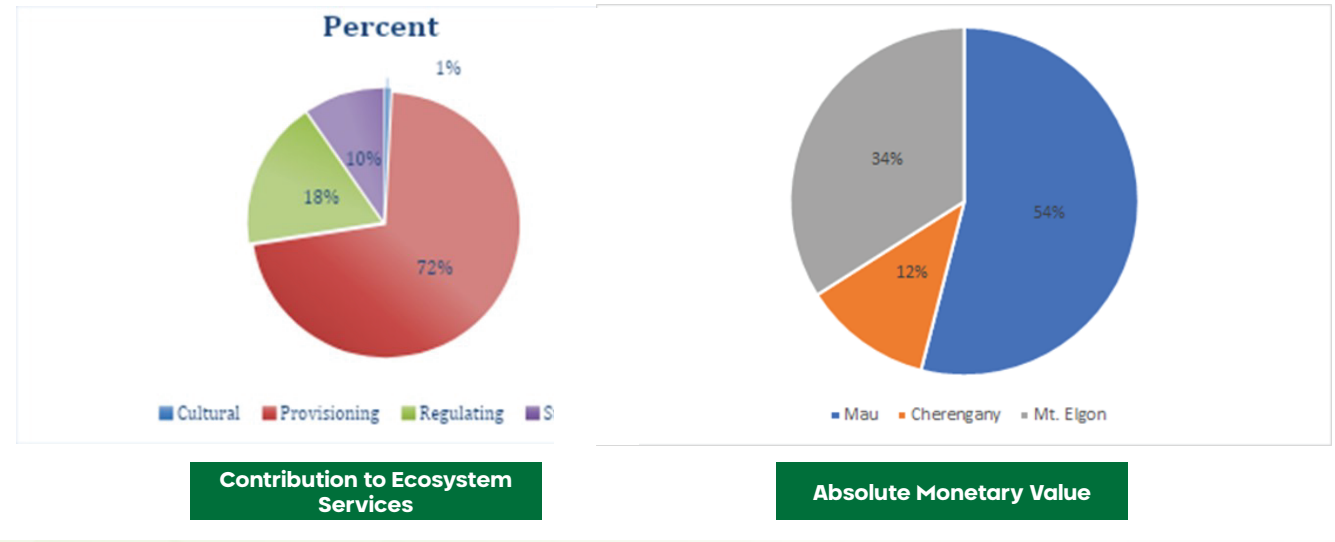


Figure 7: Contribution to Ecosystem and Absolute Monetary Value.

In regard to the Aberdare ecosystem, a study by KEFRI showed that "the actual Net Present Value (NPV) of the Aberdare ecosystem averaged at Kshs. 322 billion without biodiversity and Kshs. 537 billion with biodiversity. For the forest adjacent community, the actual NPV averaged at Kshs. 17 billion without biodiversity and Kshs. 223 billion with biodiversity. Mt. Kenya forest ecosystem services include water supply, energy production, soil conservation, timber, environmental services, non-timber forest products biodiversity conservation and sacred spaces all conservatively valued at Kshs. 262.4 billion (Nature Kenya).

6.3 Forestry Sector Contribution to Other Sectors

The forest sector contributes on average 1.0-1.2% to the overall GDP (KNBS, 2010). In relation to other sectors, the forest sector plays a major role in the wood product industry; the production of saw timber, veneer and construction poles, as well as in the paper industry for the production of pulp, paper and paperboard, and the chemical industry mainly for producing wattle bark extract and charcoal. The forest sector also provides important inputs for construction timber and the food-manufacturing sectors, predominantly industrial firewood for the tea industry, as well as household firewood and charcoal consumption which are significant.

The sector ranks on average at position 14 among all 34 sectors and is at the top of the other primary industries that include agriculture, fishing, and mining and quarrying. When the indirect effects are considered, the significance of the domestic forestry sector rises remarkably from position 14 to rank 9. However, its ranking position has almost continuously deteriorated since 2003, while forest-related product imports are on the steep increase to bridge the gap.

Additionally, according to a study done to analyze the forestry sector contribution to the value-addition in other sectors from 1997 to 2009, the forestry sector generated 30.7% of its total value-added in the chemical industry which was considered to be the highest. The forestry sector also has a big impact on agriculture (15.5%), the wood and paper industry (13.3%), and the construction sector (2.5%). The projection is that these sectors will continue to rely on the forest sector for their growth (UNEP, 2012).

Regarding international trade, Kenya is a net importer of forest products: in 2009 imports of wood and wood-related articles amounted to Ksh. 15.2 billion the major share of which constitutes paper board, but also wood-based panels and pulp. In comparison the value of exports was about Ksh. 2.7 billion. Kenya's major trading partners have been Tanzania 16% of forest imports, South Africa 12%, Sweden 10%, India 8%, China and Egypt 6%. Current trade trend indicates that Kenya mostly exports Eucalyptus spp wood processed into veneers to China and India. In the year 2023, Kenya exported wood articles of wood and charcoal to China and India worth $ 3.9 million and $2.16 million respectively. There is also reported increase in the importation of timber from the Democratic Republic of Congo (DRC) and Angola's Cabinda area due to the construction boom in Nairobi and environs.



6.4 Contribution to food security

Agriculture has remained central to Kenya's economic development, constituting 28% to the country's gross domestic product (GDP) and accounting for 65% of Kenya's total exports earnings. The crop, livestock, and fishery sub-sectors contribute approximately 78%, 20%, and 2% to the agricultural GDP, respectively. The majority of Kenya's population (70%) relies on forests for their well-being (Bulimo, 2023). Forested areas play a critical role in diversifying diets and meeting nutritional needs, particularly for communities that rely on wild foods. Forests and forestry-related activities also help to improve agricultural productivity by conserving soil and water, and enhancing soil fertility (Ministry of Agriculture, Livestock and Fisheries, 2017). Forests and trees play multiple functions in contributing to the livelihoods of Kenyans – particularly women and marginal groups – through their provision of food especially in rural areas. According to the National Forest Resources Assessment Report (2021) and Integrated Food Security Phase Classification (2023), most of Kenya's counties with high food insecurity rates are those with less than 10 percent forest cover (Integrated Food Security Phase Classification , 2023). KFS shows that 59,786 ha of plantation forests have been established, mainly through PELIS, between 2007-2017 (A compendium of KFS achievement 2007-2017) out of which net present value benefit to farmers from the program is estimated at Ksh. 1,272,573/ ha (KEFRI, 2014), a substantial contribution to the income of the forest neighborhood communities translating into improved forest conservation practices.

6.5 The Water Resources Potential in Kenya

The National Water Master Plan 2030 highlights Kenya's projected water demand and availability. In 2010, water demand was 3,218 million cubic meters (MCM) per year, compared to an available 22,564 MCM per year. By 2030, demand is expected to increase to 21,468 MCM per year against a supply of 26,634 MCM per year. In 2010, per capita water availability was just 410 cubic meters per year, well below the global recommendation of 1,000 cubic meters per year, leading to Kenya being classified as a water-scarce country. Due to human activities and climate variability, water availability in space and time has not been guaranteed in the recent years and hence the need to manage and conserve the major water catchment areas.

Kenya's forests play a critical role in water resource supply and conservation. By 2023, 1,018 legal water abstractors operated in the three major water towers, with 515 surface water authorizations issued by the Water Resources Authority. Mt. Kenya accounted for the most authorizations (283), followed by the Aberdares Ranges (190) and the Mau Complex (42), with a combined total discharge of 19,814,574.6 cubic meters per day. Additionally, Cherenganyi, Mt. Elgon and mist forests in

ASAL areas play a critical role in water supply for socio-economic development.

Forests also significantly contribute directly to hydropower generation in Kenya. Hydropower accounted for 45.422% of the total installed capacity which translate to 825.69 MW while geothermal constituted 713.13 MW representing about 39.229% of the total installed capacity (EPRA, 2024). This confirms the central role that the water towers which are located within montane forested ecosystems play in the energy supply.

6.6 Employment Generation

Forests and the forest sector are important sources of employment, livelihoods and incomes for millions across the country, particularly in rural areas. They provide jobs in a wide range of activities related to sustainable forest management, the provision and production of timber and other wood and non-wood forest products, the protection of forest ecosystems and biodiversity, and safeguarding the benefits of gazetted, County, community, and private forests.

The Service, Ministry of Labor and Social Protection, and Research Agencies undertake annual surveys on employment opportunities in the forest sector. It has been estimated that 18,000 to 50,000 direct jobs and an additional 300,000-600,000 indirect jobs are created in the timber industry (ICRAF, 2024). In addition, the Service has registered 233 CFAs with over a million households living within a radius of five kilometers from the forest reserves that depend on forests for cultivation, grazing, fishing, food, fuel wood, honey, herbal medicine, water, and other benefits.

It is estimated that the charcoal industry alone employs about 700,000 people in production, transport and trade who support more than 2 million family members (Mutimba, 2005) Furthermore, it is important to consider the local disparity in fuel use: over 90% of rural households use firewood for cooking and heating while 80% of urban households depend on charcoal as a primary fuel source (EPZA 2005). As at December 2024, 1,566 registered forest-based industries were operating in Kenya. These include 851 timber harvesting firms, 679 fuelwood operators,10 plywood producers, and 26 pole treatment plants. These industries support rural economies, reduce poverty, and enhance skills within communities and provide employment opportunities to the youth.

6.7 Contribution to GDP and Export Revenue

While the intangible benefits have not been adequately quantified, the sector contributes in excess of Ksh 20 billion worth of goods to the economy annually. Directly and on records, Kenya's forest sector contributes an estimated KES 8 billion (USD 55 million) annually to the GDP, primarily through timber products, non-timber forest products (NTFPs), and ecotourism. In 2023, Kenya exported forest products valued at approximately KES 3 billion (USD 20 million), primarily timber and plywood, to regional and international markets. This export revenue is expected to grow by 8% annually with ongoing investments in value-added processing and forest certification. The Key Investment Areas includes:

The domestic demand for timber is increasing by 5% per year, creating a strong market for investment in timber and value-added processing that include; furniture production, treated wood for construction and pulp and paper industry that holds estimated potential demand for paper products growing at 6% annually. Kenya's forests are an important carbon sink, capturing an estimated 2.5 million metric tons of CO_2 annually therefore with growing global interest in carbon markets, Kenya's forests present valuable opportunities for investors in carbon offset and reforestation projects capable of generating Ksh 1 billion (USD 6.6 million) in annual carbon credits that can be used to support global climate goals and Kenya's reforestation efforts.

Forest-based ecotourism generates Ksh 10 billion (USD 66 million) annually, driven by Kenya's iconic landscapes like Mt. Kenya, Aberdare Ranges, and Mau Forest. Driven by strong demand ecotourism development should expand especially in underdeveloped forest areas, through eco-lodges, nature trails, and wildlife safaris. Data available at KFS, indicates there are 116 licensed ecotourism & recreation facilities in public forests by December 2023.



6.8 Wood Forest Products

Kenya produced 25 million cubic meters of wood in the year 2020. Out of these, 22.5 million cubic meters were sourced from hardwood species. In public forests the predominant tree species that provide wood products (timber, plywood, pulp wood, poles, fuel wood and charcoal) include pines and cypress (86%), eucalyptus (10%). Only 4% of the wood products are derived from indigenous hardwood and softwood plantations (Food and Agriculture Organization of the United Nations [FAO] 2015). Forest plantations managed by KFS primarily provide saw logs, pulpwood and fuel wood and transmission poles. The plantations produce an estimate of 2,181,400 m3 of wood products annually (Ototo & Volsky 2018).

It is estimated that about 90% of Kenyan rural households use wood-fuel either as firewood or charcoal (MoE, 2002). Wood-fuel meets over 93% of rural household energy needs whilst charcoal is the dominant fuel in urban households (Theuri, 2002; Kituyi, 2008). Wood fuel and charcoal production are two important forest activities that account for 94% of roundwood extraction from forests and woodlands in the country. The wood fuel per capita consumption is estimated at 742kgs/year, translating into 34.3 million metric tons; with firewood share being 15.1 million metric tons and charcoal 16.5 million metric tons (MENR, 2013).

One of the major consumers of industrial firewood is the tea sector which is a major contributor to both GDP and foreign exchange. The tea sector in Kenya consists of the smallholder farmers affiliated to Kenya Tea Development Agency (KTDA) that has 65 factories that account for 80% of the tea output in the country. The large-scale tea growers are affiliated to Kenya Tea Growers Association (KTGA) that has 29 factories and accounts for 20% of the tea produced in the country. Firewood use in tea processing has triple benefits because it increases profitability of the sector by cutting costs, saving on foreign exchange and increasing overall incomes to tea growers who also supply firewood to affiliate factories. In 2010 the tea sector demand for firewood stood at 1,592,000 m3 with an estimated value of Kshs.2.2 billion, with KTDA accounting for 60% equivalent to its share of tea output.

6.9 Non-Timber Forest Products

Non-Timber Forest Products (NTFPs) consist of a range of products extracted from forests and woodlands that include fruits, leaves, bark, gums and resins, among others, for use in subsistence and trade. NTFPs have emerged as critical products that support livelihoods of marginalized communities for income and social benefits.

Gums and resins are among the most valuable dryland woodland resources to Arid and Semi-Arid Lands (ASALs) communities. Gum arabic is obtained from *V. senegal* and *V. seyal* while gum resins such as myrrh are produced from Commiphora species and frankincense from *Boswelia neglecta*. Nearly all gums and resins produced in Kenya are exported in raw form; only small quantities are processed locally into essential oils.

The country, on average, exports about 460 MT per year that peaked in 2000 to 1,130 MT that was valued at USD 2.6 million (Chikamai and Casadei, 2005). The global demand for Gum arabic is about 100,000 MT projected to grow to 150,000 MT by 2020. Kenya has the potential to annually produce 3,000 MT of gums and 3,500 MT of resins as compared to the current production levels of 400-500 MT for gum arabic and 1,000MT of gum resins. At an average export price KES 120 per kilogram the country earns KES 36 million per year.

In Kenya, *Prunus africana* grows in the major forests and its bark products are used in treatment of prostate cancer that is common with the aging population. The Prunus bark is traded in various forms such as dried bark, bark extracts, herbal concoctions, capsules and tonics (Schippmann, 2001). A recent study in western Kenya (Gachie et al, 2014) shows that *Prunus africana* is one of the widely retained or planted indigenous tree species in smallholder farms, and with mean density of 0.8 trees per household.

Sandalwood *(Osyris lanceolata)* is a widely distributed species in the rocky areas of drylands in Kenya ranging from Kwale in the Coast, to Pokot in Rift Valley and Marsabit in Eastern Kenya. The wood contains highly valued essential oils by Muslims, Hindus, Buddists and Chinese for its sweet fragrance. In Kenya the sandalwood products are used to treat various ailments but such traditional uses in the past have not adversely impacted on its wild populations. However, recent entry of merchants into the sandalwood business mostly for export to Tanzania and India has led to accelerated exploitation across the country. Sandalwood propagation has faced challenges due to poor seed germination and saprophytic behaviors that need a host plant to survive its early stages of growth.

Baobab *(Adansonia digitata)* is an iconic multi-purpose tree of the semi-arid and sub-humid zones of sub-Saharan Africa whose leaves, fruit, seeds and trunk provides a variety of uses that include water storage, medicine, oils, and clothes. The production of baobab pulp and leaves is almost entirely sourced from trees growing naturally in woodlands. Baobab products have growing markets in the country, Europe and the US.

Tamarindus indica commonly known as Tamarind tree is one of the most important multi-purpose tropical fruit tree species that grows in ASALs and coastal areas of Kenya. In Kenya many communities use tamarind fruit to treat many ailments such as abdominal pain, diarrhea and dysentery, among others, since the fruit is rich in phytochemicals. The plant has potential for commercial utilization in medicinal and pharmacologic activities.

6.10 Cultural Services:

Forests in the country provide valuable cultural services. They are of immense cultural significance, providing traditional medicine, spiritual sanctuaries, and are spaces for communal gatherings and ceremonies. They are also important reservoirs of biodiversity by being critical habitats of diverse flora and fauna. The forests therefore play a pivotal role in fostering community cohesion and preserving collective identity. Indigenous knowledge systems embedded within these forests passed down through generations to maintain the delicate balance between humans and nature contribute to biodiversity conservation and sustainable management practices,

CHAPTER 7

TECHNOLOGICAL INNOVATIONS

In Kenya, technological innovations have emerged as vital allies in the nation's efforts to conserve its diverse forest ecosystems. These advancements are essential in combating threats like deforestation and illegal logging while promoting sustainable conservation practices. Key innovations covered in the chapter include use of: Digital Platforms; National Forest Monitoring and Reporting System; Unmanned Aerial Vehicles and Automated River Gauging System.

7.1 Digital Platforms

Digital transformation has emerged as a catalyst for innovation and efficiency in Kenya's ongoing efforts to modernize forest management practices. Through the adoption of digital tools and platforms, such as e-registration systems for Community Forest Associations (CFAs), forest industry investors, e-citizen services like Mpesa, and e-tree nurseries, the forestry sector is undergoing a profound transformation, enhancing governance, transparency, and sustainability.

Digital registration platforms have revolutionized the registration of CFAs and forest industry investors in Kenya. By transitioning from manual paperwork to online registration systems, stakeholders can now register and manage their operations more efficiently and transparently. These platforms streamline administrative processes, reduce paperwork, and ensure accurate record-keeping, facilitating greater accountability and compliance with regulatory requirements. Moreover, digital registration enhances stakeholder engagement by providing convenient access to information and services, fostering collaboration and participation in forest management initiatives.

The integration of e-citizen services, such as mobile payment solutions like Mpesa, has further streamlined forest management processes in Kenya. By enabling citizens to make payments for forestry-related services electronically, Mpesa reduces the reliance on cash transactions, minimizing the risk of corruption and improving financial transparency. Digital transformation has also revolutionized the management of tree nurseries in Kenya by adopting tree nurseries e-registration. These digital platforms facilitate tree nurseries' registration, monitoring, and management, providing stakeholders with real-time insights into seedling production and distribution.

In the ongoing battle to safeguard Kenya's precious forest resources, the Jaza Miti App has emerged as a powerful ally, empowering citizens and authorities alike in the quest for sustainable conservation. Developed in response to the pressing need for community engagement and participation in forest monitoring, this innovative mobile application is instrumental in driving Presidential directives, such as the goal of achieving 15 billion trees growing by 2032, while simultaneously aiding in the preservation of Kenya's forests.

7.2 National Forest Monitoring and Reporting Systems

The National Forest Monitoring System (NFMS) is Kenya's central hub for collating, analyzing, and disseminating forest-related data. This integrated platform aggregates data and information from various sources, including earth observation data, ground-based monitoring and socio-economic indicators from the Kenya National Bureau of Statistics to provide a comprehensive overview of the status of the country's forests. By offering stakeholders access to up-to-date information and spatial analysis tools, the National Forest Monitoring System enhances transparency, accountability and collaboration in forest governance, driving more informed decision-making and fostering greater stakeholder synergy.

The National Forest Monitoring System (NFMS) is also vital in international reporting. Aligned with the objectives to the report on biodiversity conservation, as provided under the United Nations Framework Convention on Climate Change (UNFCCC) COP decisions 4/CP.15, 1/CP.16, and 11/CP.19, Kenya's NFMS is pivotal in mitigating climate and promoting sustainable development. Various projects and partners actively support forest monitoring efforts in Kenya to bolster conservation and sustainable management practices. Notable initiatives include participation in the REDD+ program, which targets greenhouse gas emissions reduction from deforestation and degradation, supported by the UNDP, JICA, FAO and the World Bank through Forest Carbon Partnership Facility (FCPF).



Figure 8: Kenya National Forest Monitoring System (NFMS)

https://experience.arcgis.com/experience/9dada12d7cfa498680e333de8ccf9f07/page/Home/

The European Union (EU) in particular contributes through its Forest Law Enforcement Governance and Trade (FLEGT) Action Plan in combating illegal logging and promoting sustainable forest management in Kenya. The Global Forest Watch (GFW), in collaboration with organizations like the World Resources Institute (WRI), provides valuable tools and data for monitoring deforestation and related activities. Furthermore, partnerships involving the Kenya Wildlife Service (KWS) ensure the protection of forest habitats, which is crucial for wildlife conservation. Finally, numerous NGOs and civil society organizations, such as the Green Belt Movement (GBM), Nature Kenya, and WWF, actively participate in community-based monitoring, advocacy, and capacity building for sustainable forest management in Kenya.

With the introduction of online forest monitoring platforms utilizing earth observation data, such as the Earth Observation (EO) Lab, JJ Fast, and the Forest Information Platform, Kenya is pioneering innovative solutions to address the challenges of deforestation, illegal logging, and habitat degradation using modern technologies. The Earth Observation Lab is a cornerstone in Kenya's forest monitoring efforts, leveraging satellite imagery and remote sensing technology to monitor changes in forest cover, land use, and biodiversity.

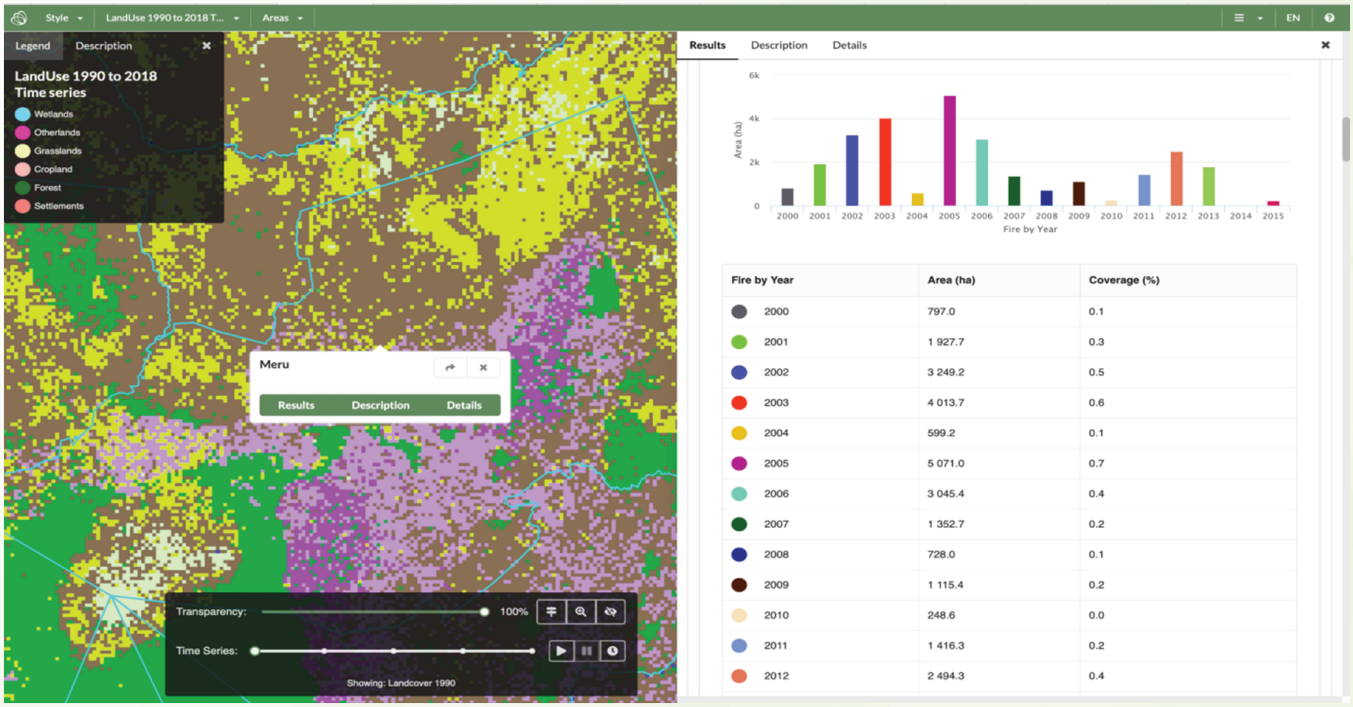


Figure 9: Kenya Forest Service Data Centre

https://kenyaforestservicedata.kfs.ourecosystem.com/

Through the use of the EO Lab Platform, KFS is able to benefit from the deployed advanced algorithms, artificial intelligence, and machine learning techniques to analyze earth observation data rapidly. By processing vast amounts of satellite imagery and sensor data, JJ Fast detects forest disturbances, predicts potential threats, and assesses forest health indicators with unprecedented speed and accuracy. This proactive approach enables our forest managers to respond swiftly to emerging challenges, allocate resources efficiently, and implement preventive measures to mitigate the impact of illegal activities on Kenya's forests. The case of monitoring deforestation in Mau Narok is illustrated here in figure 10.

KFS also uses the Forest Alerts System to detect and address forest-related issues, such as wild forest fires, illegal logging, encroachments, and other emergencies. Currently the Forest Alerts System is strategically being piloted in eight counties that include: Lamu, Bomet, Kilifi, Kwale, Makueni, Kericho, Kakamega, and Baringo. This cutting-edge technology involves deploying advanced tools and emphasizes citizen science as a vital component. It also

involves training Forest Rangers and local communities to use mobile GIS tools to carry out real-time forest disturbance reporting. The reports are received through a live dashboard at the Kenya Forest Service headquarters' command and control centers. The success of this initiative is underscored by observed substantial reduction in the number of incidents across these eight counties.

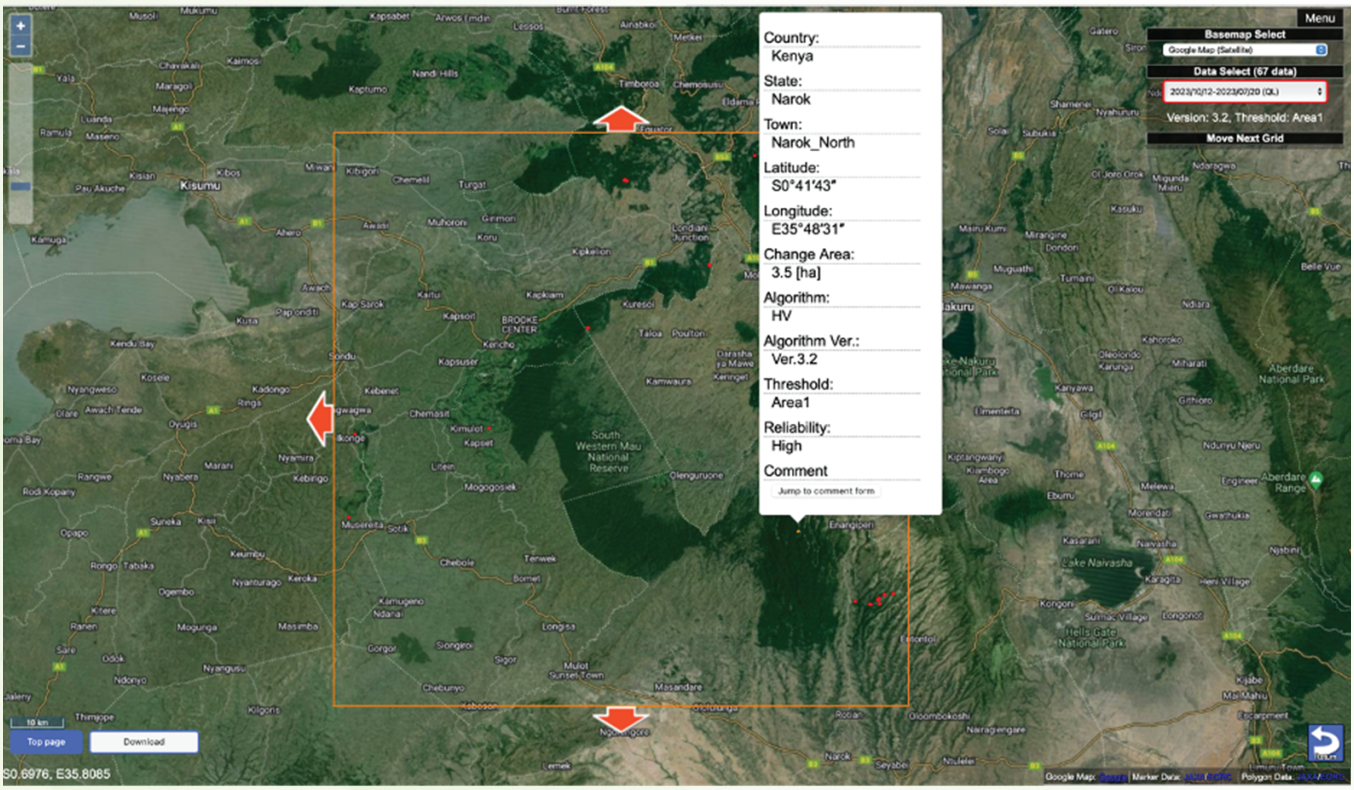


Figure 10: Monitoring Deforestation in Mau Narok

As depicted in figure 11, the Forest Alerts System is seamlessly connected to a live dashboard at the Kenya Forest Service headquarters' command and control centers. This centralized hub provides real-time monitoring of incidents and is routinely facilitating swift responses to emerging threats. The integration of citizen science into this monitoring process enhances the system's effectiveness, creating a dynamic and adaptive framework for forest conservation.



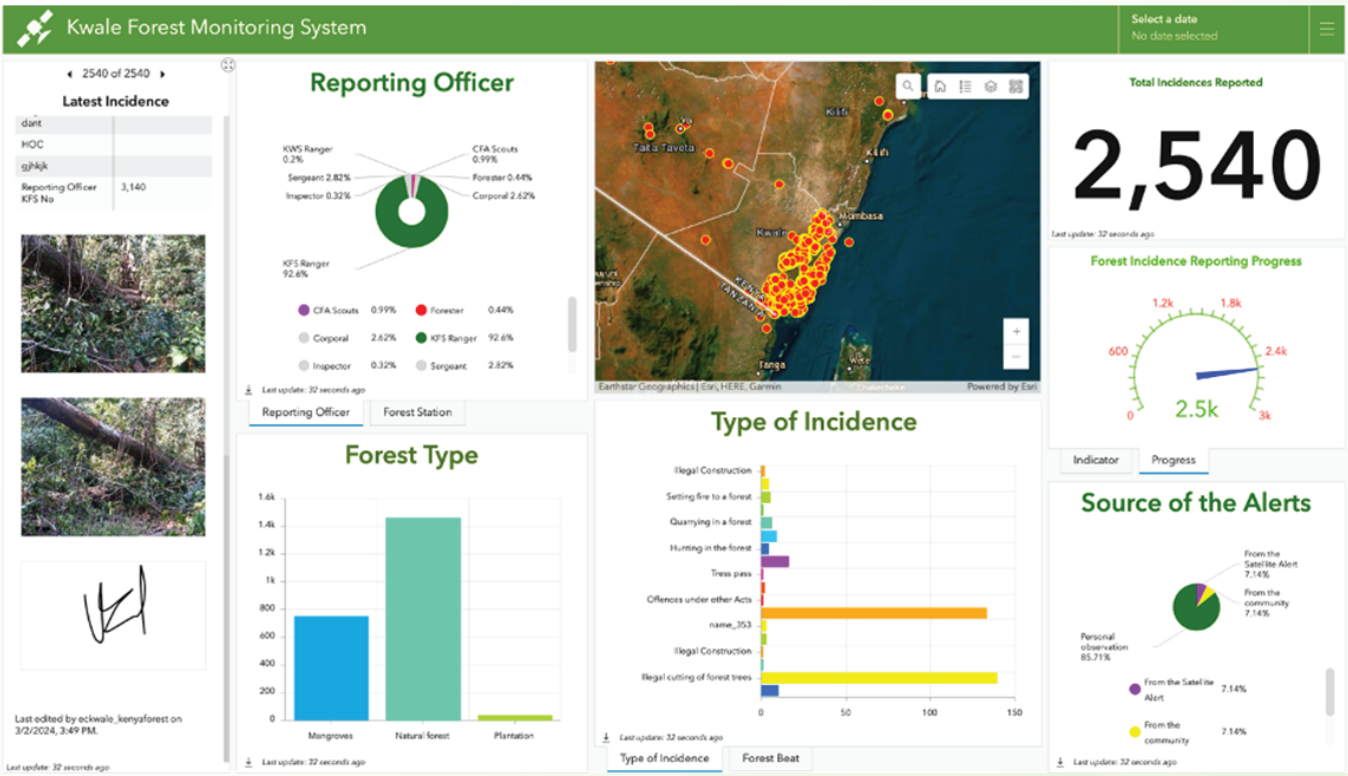


Figure 11: Live Dash-Board for Kwale County

Additionally, management of forest fires entails use of modern Chap trucks for clearing fire brakes, field observation made using the fire towers and report monitored and received at the fire command center at KFS Headquarters Karura. Figure 12 below depict the setup.



Chap-trucks

Clearing Fire Brakes



Fire Command Centre

Monitoring and Reporting



Fire Communication Mast

Observation and Reporting

Figure 12: Chap-trucks, Command Center and Fire Mast

Implementing the Forest Alerts System and citizen science initiatives has yielded tangible results. Forest disturbances and incidents, particularly illegal tree cutting, have significantly decreased in the selected counties. Technological innovation and community involvement have proven to be a formidable force in mitigating threats to Kenya's forests.

The Forest Resource Information Management Platform offers a comprehensive mapping solution that precisely delineates and visualizes various elements within forest ecosystems, including roads, rivers, boundaries, plantations, biodiversity hotspots, and more. This platform integrates advanced geodatabase management and web GIS technologies, empowering foresters and high-level managers to access and analyze critical spatial data for informed decision-making.

The platform's data visualization capabilities enable users to access interactive maps and visualizations, enhancing their understanding of complex spatial relationships. This fosters informed decision-making at various levels of forest management, allowing stakeholders to prioritize conservation efforts, allocate resources effectively, and plan sustainable development initiatives based on reliable spatial data and analysis.

7.3 Unmanned Aerial Vehicles (UAVs) - Drones

This is the technology in use by KFS and other partners in monitoring forest change, destruction and fire. In the pursuit of effective forest management and conservation, Kenya has therefore embraced the use of Unmanned Aerial Vehicles (UAVs), commonly known as drones, as invaluable tools for monitoring and surveillance. The adoption of UAV technology has revolutionized the way forests are monitored, providing unprecedented access to remote and inaccessible areas while offering high-resolution imagery and data crucial for informed decision-making. By providing enhanced surveillance capabilities, enabling rapid assessment and response, and fostering community engagement, UAVs are helping to protect Kenya's invaluable forest ecosystems for future generations.

The drone are used for but not limited to the following: To determine extent of deforestation; Monitor overall health of forests; Detect forest fires and allows rapid response to prevent or manage forest fires; Prevent illegal logging activities even in remote areas; Create detailed maps of forested areas for better understanding of forest topography, biodiversity, and overall structure; Assist in biodiversity assessment by collecting data on plant species, canopy cover, and other ecological parameters; Provide a visual representation of the impact of deforestation and help in educating and raising awareness among the community and public. Expertise is required to effectively use UAVs. KFS as shown in figure 13 is at the forefront of deployment of UAVs for forest assessment and monitoring. In the same program, it's projected that UAVs shall foster community engagement and participation in forest monitoring efforts. By involving local communities in drone-based surveillance activities, authorities can empower citizens to become active stewards of their natural resources.



UAV Prepare to Monitor Forest



Training of UAV Pilots



UAV Monitoring Forest Conditions

Figure 13: Unmanned Aerial Vehicles Getting Ready for Monitoring



7.4 Automatic River Gauging System

Monitoring water flow regimes in river basins as well as land use changes is crucial. It is only then that effective water availability can be quantified and future water management options put in place. Towards this end, KFS has installed five telemetric stations along the Kimakia River, Sagana River, Kathita River, and Njoro River to monitor and collect more reliable river flows in relation to forest ecosystem protection and conservation. The water level in Kimakia River and Sagana River during the heavy rains in May 2024 are automatically re-laid to KFS Headquarters for analysis.



CHAPTER 8

FORESTS AND CLIMATE CHANGE

Forests in Kenya are deeply intertwined with climate change, playing dual roles as contributors to the phenomenon and as critical elements in mitigation and adaptation strategies. Deforestation and forest degradation in Kenya release greenhouse gasses, particularly carbon dioxide, into the atmosphere. These conversions stem from various factors such as agricultural expansion, logging, infrastructure development, and unsustainable land management practices, exacerbating global warming and intensifying climate change impacts.

Conversely, climate change poses substantial threats to Kenya's forests. Rising temperatures, altered precipitation patterns, and more frequent extreme weather events like droughts and floods disrupt forest ecosystems, leading to tree mortality, reduced productivity, and heightened susceptibility to pests and diseases. Such climate-induced stresses weaken forest resilience, potentially resulting in dieback and biodiversity loss. Despite facing challenges, Kenya's forests serve as significant carbon sinks, absorbing and storing atmospheric carbon dioxide through photosynthesis. Well-managed forests have a substantial capacity for carbon sequestration, helping mitigate climate change by offsetting emissions from various sectors.

Kenya has initiated diverse measures to combat deforestation and forest degradation and increase carbon sinks, aiming to mitigate climate change. These include policies and strategies for sustainable forest management, conservation of protected areas, afforestation and reforestation programs, community-based forest management, and payment for ecosystem services schemes.

8.1 Forests and Greenhouse Gas (GHGs) Emissions

Kenya's forests are integral to the country's efforts to fulfill its Nationally Determined Contributions (NDCs) under the Paris Agreement, which seeks to combat climate change and limit global temperature rise. These forests contribute significantly to reducing greenhouse gas (GHG) emissions in Kenya through various mechanisms. Firstly, they act as vital carbon sinks, absorbing carbon dioxide (CO_2) from the atmosphere during photosynthesis and storing it within their biomass and soils. Annually, Kenya's forests sequester (according to the CARDAMOM model) 140 million tons of carbon dioxide equivalent against a global figure of 1.5 billion tons of carbon dioxide equivalent released into the atmosphere through deforestation and forest degradation. By conserving existing forests and promoting sustainable forest management practices, Kenya can prevent the release of stored carbon and maintain its capacity as a carbon sink.

Under the Enhanced Transparency Framework (ETF) for international reporting, Kenya has monitored and tracked greenhouse gas emissions from the Land Use, Land-

Use Change, and Forestry (LULUCF) sector, covering the period from 1990 to 2022. This process is crucial for assessing the country's progress in reducing emissions within the sector, as well as meeting its international climate commitments.

The general trend of emissions in the LULUCF sector indicates an increasing trend over the reporting period with estimated emissions of 46,846.3279 Gg CO_2 equivalent in 2022. Emissions in the forestland category show a general increasing trend in emissions, measured in gigagrams of CO_2 equivalent, rising from 56.18 Gg CO_2 eq in 2001 to 2,680.76 Gg CO_2 eq in 2022, as illustrated in Figure 14 (for Forestland Remaining Forestland and Land Converted to Forestland).

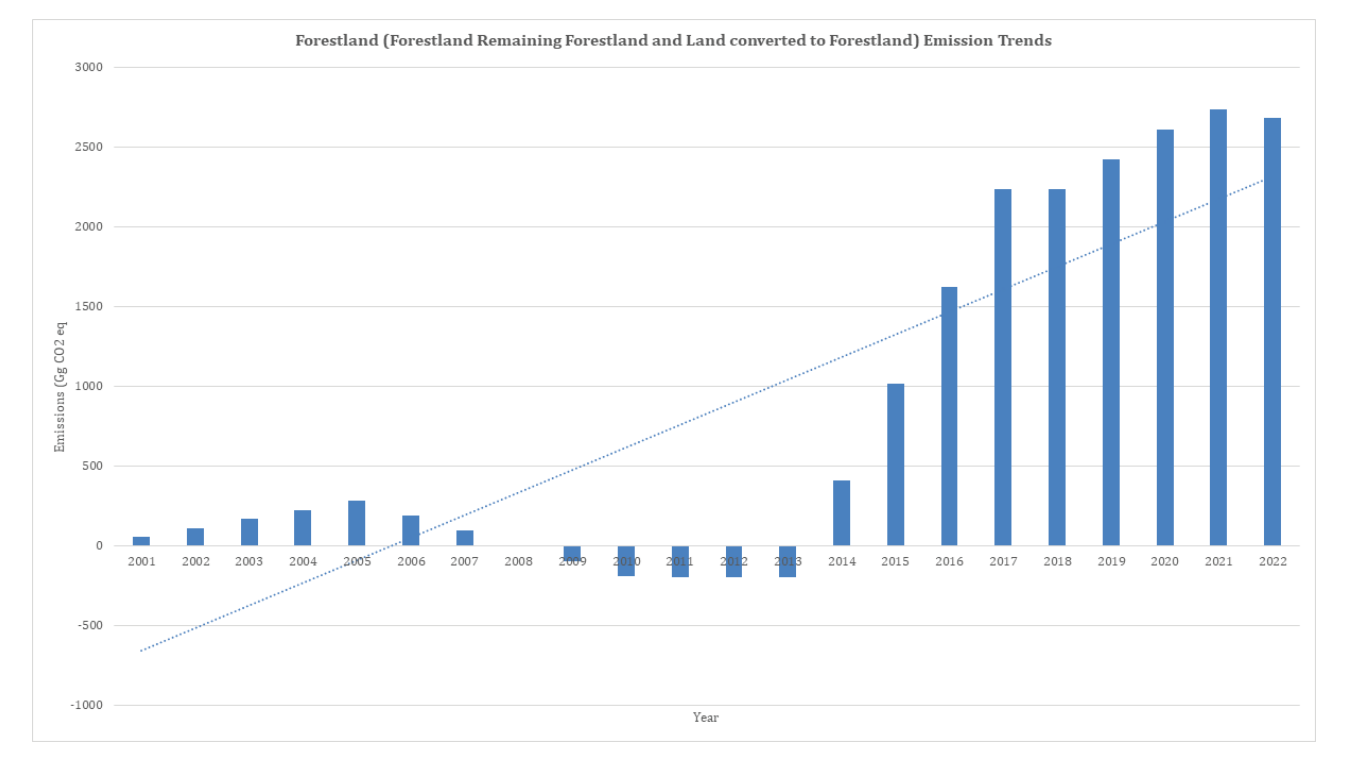


Figure 14: Emissions from the Forestland Category of LULUCF Sector

Land conversions to Forestland were majorly reported from Cropland and Grassland while conversions to Cropland were mostly from Forestland, Wetland, and Grassland with conversions from the Grassland category being converted more to Cropland. On the other hand, conversions to Grassland were from Forestland, Cropland, Wetland, and Other-land with conversions from Forestland having the greatest contribution. The figure 15 presents annual emissions (in Gg CO_2 equivalent) from various land-use change categories over the period from 2001 to 2022.



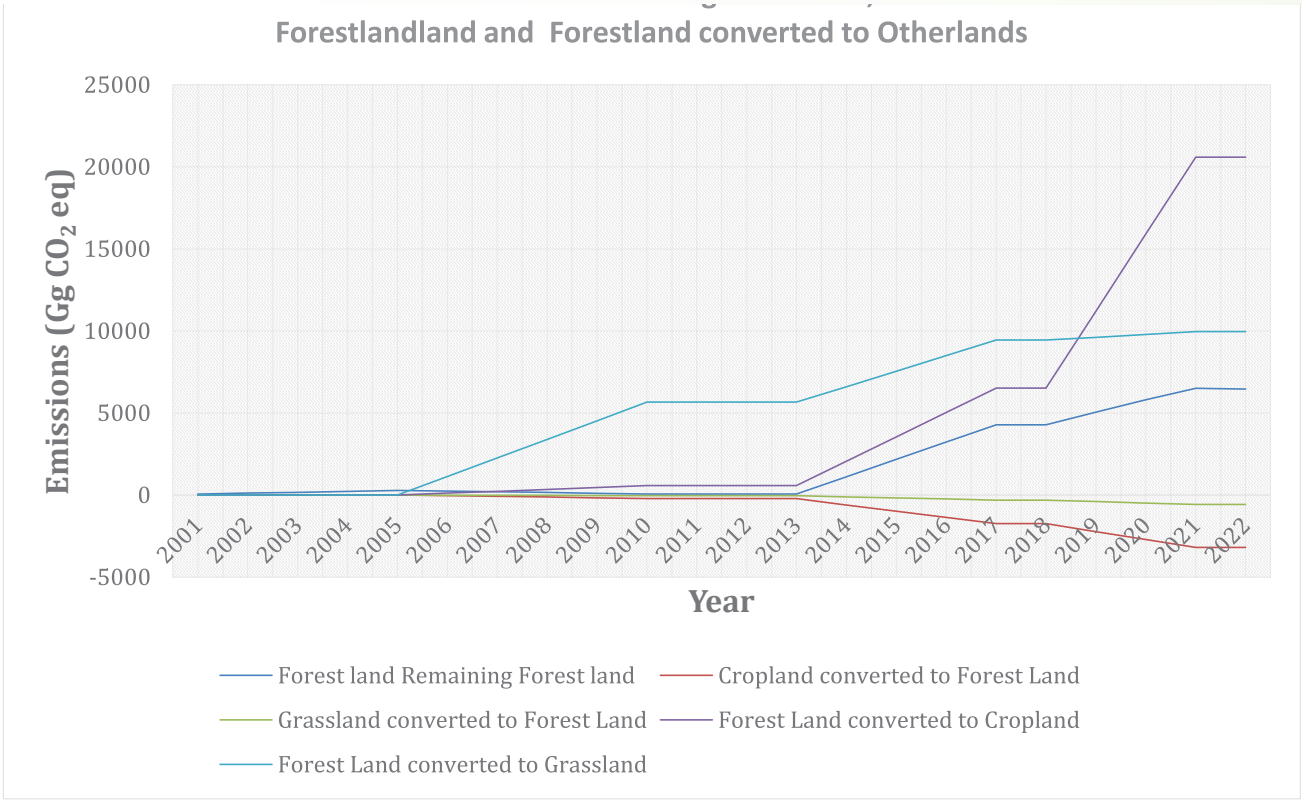


Figure 15: Emission trends in Forestland remaining Forestland, Land converted to Forestland and Forestland converted to Other-land

Emissions from Forestland Remaining Forestland started at 56.18 Gg CO_2 eq in 2001 and increased steadily over the years. A significant rise occurred in 2014, with emissions jumping from 1,119.19 Gg CO_2 eq that year to 6,447.88 Gg CO_2 eq by 2022.

In the case of Cropland Converted to Forestland, negative emissions began in 2006 at -35.78 Gg CO_2 eq and continued to decline progressively. By 2022, these emissions reached -3,192.73 Gg CO_2 eq, indicating that this activity is effectively contributing to carbon sequestration.

Similarly, Grassland Converted to Forestland started exhibiting negative emissions in 2006, beginning at -7.97 Gg CO_2 eq and gradually declining to -574.39 Gg CO_2 eq by 2022.

For Forestland Converted to Cropland, emissions first appeared in 2006 at 114.89 Gg CO_2 eq and rose sharply thereafter, peaking at 20,589.28 Gg CO_2 eq in 2022. This category represents the largest source of emissions in the dataset.

Emissions from Forestland Converted to Grassland also commenced in 2006 at 1,131.72 Gg CO_2 eq, with consistent growth over time, reaching 9,960.17 Gg CO_2 eq in 2022.

Key observations from the data reveal that the largest emissions stem from the conversion of forestland to cropland, followed by the conversion of forestland to grassland. On the other hand, land-use changes involving the conversion of cropland or grassland to forestland resulted in negative emissions, underscoring their role in carbon sequestration. Forestland that remains as forestland also contributed increasingly to emissions, particularly after 2014.

This data highlights the critical need to minimize forest conversion to cropland and grassland while promoting afforestation and reforestation activities to enhance carbon sequestration efforts.

With the current Strategy to restore 10.6 million hectares of degraded landscapes by 2032, an estimate of the sequestration potential of the

15 billion tree planting program up to the year 2050 modelling was done based on target action areas of the strategy and carbon accumulation curves based on the Chapman Richards growth curve. The four scenarios presented based on the success of growing the proposed trees ranging from 1-80%; 2-50%; 3-25% and 4-10% shall sequester by 2050 total of 475,980,438 tons of CO_2 equivalent; 297,487,773 tons of CO_2 equivalent; 148,743,887 tons of CO_2 equivalent and 59,497,555 tons of CO_2 equivalent respectively. Figure 16 illustrates the potential carbon credits that can arise from the implementation of the 15 billion tree program based on the scenarios described above.

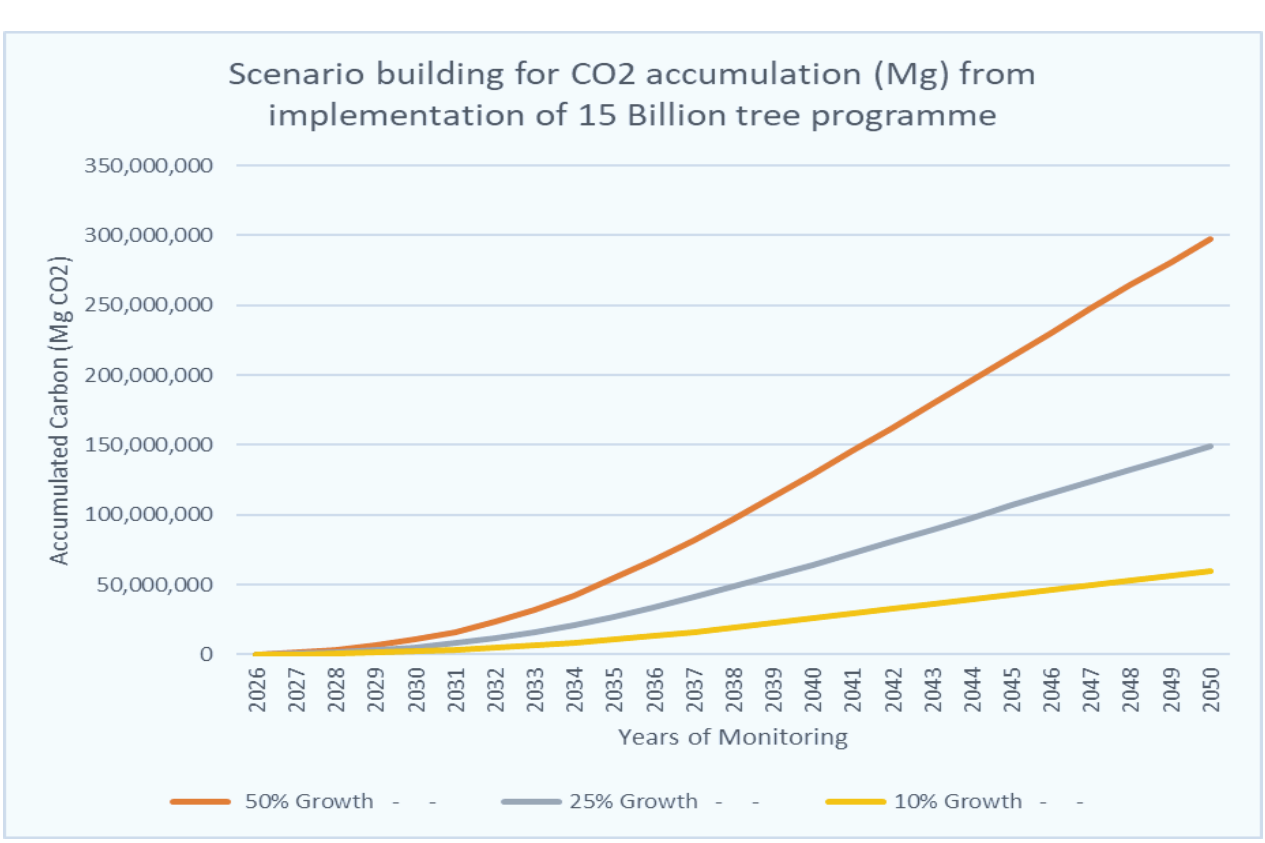


Figure 16: CO_2 Accumulation from Implementation of 15 Billion Tree Program

8.2 Impacts of Climate Change on Forest Ecosystems and Water Towers

Over the recent years, there have been diverse climate change impacts on Kenyan forests. The most significant of these impacts are flooding and landslides, which together account for more than 66% of the observed effects. Flooding emerges as the most prevalent issue, constituting 39.2% of all recorded events. This highlights the urgent need for effective water management and flood mitigation measures in forested areas to safeguard these ecosystems. Landslides are of major concern, representing 27.5% of the impacts. This suggests that soil instability in forest regions is a significant issue, likely worsened by heavy rainfall and deforestation. Mudslides also present a considerable threat, accounting for 17.6% of the impacts. These events are often triggered by the same conditions that lead to landslides, compounding the risks to forested areas. Drought, responsible for 9.8% of the impacts, signals the growing risk of water scarcity, which can severely affect forest health and the ability of these ecosystems to regenerate. Though less frequent, siltation and windfalls still pose some challenges, representing 3.9% and 2.0% of the impacts, respectively. Siltation affects Mangroves, while windfalls impact tree stability, both of which are critical to maintaining the overall health and resilience of forests.

The distribution of climate change hazards across various regions reveal that the Central Highlands experiences the highest number

of events. This is followed by North Rift and Mau regions which also report significant occurrences, indicating these areas are particularly vulnerable and heavily disturbed. The Coast region follows with moderate impacts together with both Eastern and Western Regions. Ewaso North, North Eastern, Nairobi and Nyanza depict minimal impacts.

A Climate Change Vulnerability Assessment (CCVA) by the Climate Prediction and Application Center of the Intergovernmental Authority on Development (ICPAC-IGAD) examined the impacts of climate change on three of Kenya's vital water towers: the Mau Forest Complex, Cheranganyi Hills, and Mt. Elgon. The study highlighted critical findings for the water and agricultural sectors in these regions: Temperatures rise in the water towers are projected to increase significantly, reaching up to 5°C by the 2070s. Even under the best-case scenario, temperatures could rise by 1.4 to 2+°C, which would still have substantial impacts on local ecosystems. Rainfall patterns are expected to become more variable. Overall rainfall is projected to decrease, with reductions in the March-May rainy season and increases in the October-December rains. Climate vulnerability indices differ between and within the water towers. Mt. Elgon is projected to have the lowest vulnerability among the three, but it is also likely to experience the largest seasonal shifts in rainfall patterns. The vulnerability index, derived from exposure, sensitivity, and adaptive capacity metrics, indicates that without intervention, conditions in these water towers are expected to worsen, threatening water resources, biodiversity, and agricultural stability. Figure 17 depicts the scenarios.

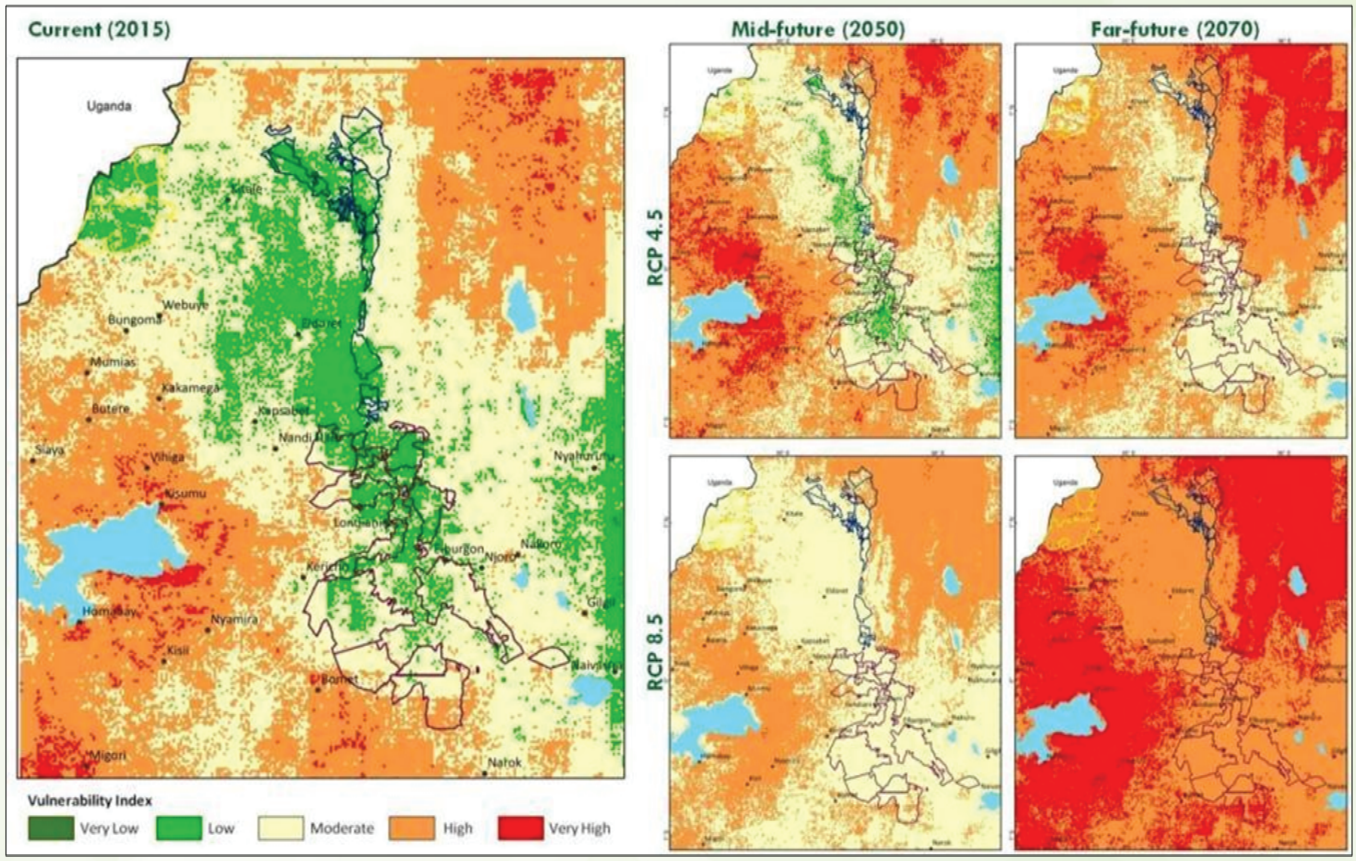


Figure 17: Vulnerability Index for Three Water Towers 2050-2070 Reference Point

(Source: Climate Change Vulnerability Assessment Report, KEFRI/USFS, 2018)



8.3 Status of REDD+ Readiness in Kenya

Kenya has actively pursued the necessary prerequisites for participation in REDD+, demonstrating significant progress in its readiness efforts through the establishment of a Forest Reference Level (FRL), the development of a National Forest Monitoring System (NFMS), the development of a Safeguard Information System, and the formulation of a comprehensive National REDD+ Strategy . Each of these components plays a crucial role in Kenya's readiness for REDD+ implementation.

Through the support of JICA, Kenya is currently updating its National Forest Monitoring System to enhance forest data management and meet international standards. Additionally, FAO and Conservation International (CI) are assisting in updating the Forest Reference Level (FRL) to align with the evolving requirements of the global carbon market.

Given the ongoing REDD+ projects in the country, implementing REDD+ nesting has become a priority. REDD+ nesting integrates subnational REDD+ projects into a national framework, enabling coordinated implementation, streamlined accounting, reporting, and equitable benefit-sharing across various levels of governance. Kenya has been actively exploring nesting opportunities to align subnational initiatives with its national REDD+ strategy and objectives.

Nesting will strengthen the government's ability to execute its national REDD+ strategy by effectively addressing deforestation and forest degradation at multiple scales. It also creates pathways to access diverse financing sources, ranging from public climate funds to private-sector carbon investments.

The allocation of Forest Reference Emission Levels (FREL) within Kenya's REDD+ framework serves several essential purposes. It ensures that individual projects contribute meaningfully to the national goals of reducing emissions from deforestation and forest degradation. Additionally, the use of standardized methodologies for establishing baselines promotes equity among projects, fostering consistency in measuring avoided deforestation across the board.

Notably, the drafting of the Forest Conservation and Management (REDD+ Nesting) Regulations, 2024, has been completed with support from United Kingdom Partnering for Accelerated Climate Transitions (UKPACT) through Conservation International (CI). The regulations are now set to undergo the necessary legal processes before gazettement.

Additionally, Kenya is developing a National REDD+ Registry with the support of Conservation International (CI). This registry will enhance transparency and coordination in managing REDD+ initiatives nationwide.

8.4 Forest Carbon Projects in Kenya

Kenya, in the voluntary space- even before the country prepared the four elements required for REDD+ implementation under the UNFCCC, has been actively involved in implementing REDD+ (Reducing Emissions from Deforestation and Forest Degradation) projects and other carbon projects aimed at mitigating climate change, conserving forests, and promoting sustainable land management practices. REDD+ projects in Kenya focus on reducing emissions from deforestation and forest degradation while promoting sustainable forest management, conservation, and enhancement of forest carbon stocks. These projects often involve collaboration between government agencies, local communities, non-governmental organizations (NGOs), and international partners.

Kenya hosts several significant carbon projects operating on a voluntary basis at site level, each varying in size and focus. The Kasigau Corridor REDD Project – Phase I Rukinga Sanctuary, initiated in 1998, covers 30,169 hectares and focuses on REDD (Reducing Emissions from Deforestation and Forest Degradation). The Mikoko Pamoja Mangrove Restoration in Gazi Bay, which began in 2013, is an Afforestation Reforestation and Revegetation (ARR)/REDD project spanning 117 hectares, aimed at both afforestation/reforestation and reducing emissions through mangrove restoration. The Kasigau Corridor REDD Project - Phase II Community Ranches is an extension of the first phase, launched in 2010 and significantly larger, covering 169,741 hectares. The Chyulu Hills REDD+ Project, initiated in 2013, is the largest of these projects, encompassing 410,533 hectares and combining afforestation, reforestation, and emissions reduction activities. Lastly, the Vanga Blue Carbon Project started in 2019, spans 460 hectares and focuses on ARR/REDD efforts to restore and protect coastal blue carbon ecosystems. The Chyulu Hills REDD+ Project is the largest,





covering over 410,000 hectares, while the Mikoko Pamoja Mangrove restoration in Gazi Bay is the smallest at 117 hectares.

The International Small Group and Tree Planting Program (TIST) is one of the Afforestation Reforestation and Revegetation (ARR) carbon projects in Kenya that is focused on afforestation and reforestation efforts in various regions, including areas like the Rift Valley, Mount Kenya, and the Maasai Mara. By engaging local communities in tree planting and sustainable land management practices, the project aims to enhance carbon sequestration and improve environmental and socio-economic conditions.

Another ARR carbon project within the forestry sector is the Kenya Agricultural Carbon Project (KACP). KACP is a Vi Agroforestry ARR carbon project in Kenya focusing on enhancing agroforestry practices across several regions, including the Rift Valley, Western Kenya, and parts of Central Kenya. This project aims to mitigate climate change through the establishment and management of agroforestry systems that integrate trees into agricultural landscapes. The project has contributed to significant carbon sequestration, with estimated emission reductions of over 2 million tons of CO_2 equivalent annually.

Kenya has recently passed the Climate Change Amendment Act of 2023, paving the way for the establishment of a comprehensive National Carbon Registry (which is expected to be linked with the REDD+ Registry). This registry serves as a centralized platform for tracking and managing carbon emissions and removals across various sectors of the economy.

CHAPTER 9

PRIORITY INTERVENTION FOR SUSTAINABLE FOREST MANAGEMENT

The Forest sector contributes both tangible and intangible benefits of enormous proportions to Kenyan society. Despite this importance, forests are under tremendous pressure from a growing population and therefore innovative strategies are required to support their sustainability. While the country has made significant efforts towards achieving sustainable conservation and management of her forest resources. This is exemplified by the increase in national forest cover from 5.9% to 8.83%, and the rise in tree cover to 12.13% over the past decade. However, this status report indicates that a great deal of work lies ahead as the country works towards embracing technological innovations in order to effectively address emerging challenges associated with climate change, nature-oriented conservation, equitable sharing of forest resources, and robust monitoring, verification and reporting on forestry data and information.

The identified intervention gaps that needs to be addressed are: Inadequate capacity in forest resource assessment and monitoring; Inadequate processes in forest certification; Low investment in mechanization of forest operations; Low uptake of automation in forestry services; Weak linkages and partnerships in research, Inadequate training and extension; Inadequate investment in urban forestry and avenue planting; Inadequate funding of forestry operations and processes; Low uptake of nature-based solutions in the forestry sector; Weak access and benefit sharing mechanisms; Weak monitoring, verification and reporting systems.

Resulting from the above gaps, measures to propel forestry into sustainable development includes: Development and adoption of a forest certification framework; Mechanization of forest operations; Enhancement of investment in Green Spaces, Urban Forestry, strengthening; Improved partnership in research, training and extension; Adequate mobilization of resources for management of forests and Accelerated uptake of nature-based solution. Result is a firm foundation for sustainable forest management.

9.1 Developing a Forest Certification Framework

In the envisioned future of Kenya's forestry sector, forest certification will play a pivotal role in ensuring the responsible management of the precious natural resources. Certification programs encompass a holistic approach that covers various aspects of forest management, including nurseries, forest management practices, chain of custody, and timber traceability.

9.2 Mechanization of Forestry Operations

Mechanization in forest operations enhances efficiency, productivity, and safety in activities such as seedling production, silviculture, and



harvesting. By utilizing advanced machinery and technologies, forest management practices shall be significantly improved in support of sustainable forest management. Mechanization shall be adopted to promote tree seedling production, silvicultural practices and harvesting operations.

9.3 Enhancing Investments in Green Spaces, Urban Forestry and Avenue Planting

Green spaces, urban forests and avenue parks are of a profound significance to the environment. They offer numerous benefits to urban residents, improve air quality, regulate temperatures, and provide recreational spaces for various activities, fostering social well-being and community engagement. They also serve as hubs for cultural events, promoting social cohesion and connection to nature. In spite of tremendous efforts already made in creating parks within our cities, there is room to expand and create green space in all our urban and market places.

The country's highways shall be made green corridors through avenue tree planting. The aim is for Kenya Forest Service to partner with the Kenya National Highway Authority (KeNHA), the Tourism Fund, the Kenya Forestry Research Institute, devolved governments and other relevant stakeholders to design and develop a pilot project to promote avenue tree planting targeting approximately 1,000 km along Kenya' major highways in the next decade.

9.4 Strengthening Linkages and Partnerships in Research, Training and Extension

Strengthening partnerships in research, training, and extension is key to advancing Kenya's forestry sector. Collaborations between research institutions, government, and private industry so as to drive innovation in sustainable forestry and conservation practices, while expanding training and extension services and equipping local communities and professionals with critical skills. The enhanced linkages help build local



capacity, promote knowledge sharing, and support Kenya's sustainable development and climate resilience goals.

In order to generate robust data, technologies and information to inform investments in sustainable forest management, the Kenya Forest Service will strengthen collaboration and partnerships with a number of stakeholders in research, training and extension. Some of the key institutions that KFS will strengthen its collaboration with include:

- Kenya Forestry Research Institute – Overall forestry research
- Kenya Agricultural and Livestock Research Organization – Fruit trees research
- Kenya Marine and Fisheries Research Institute – Mangroves research
- Kenya Plant Health Inspectorate Service - Phytosanitary functions
- Kenya Tea Research Institute - Tea estates
- Wildlife Resources Training Institute – Wildlife management
- Kenya Forestry College – Londiani - Forestry Technical Training and extension
- International Centre for Research in Agroforestry – Agroforestry

9.5 Resource mobilization for forest operations and processes

Adequate resources, both financial and human, are crucial for effective forest conservation and management. Ensuring sufficient funding and skilled personnel supports the implementation of innovative solutions, enforcement of regulations, and engagement with local communities. Securing adequate financial resources is essential for acquiring modern equipment, maintaining infrastructure, training personnel, and conducting research and development. Financial support from government budgets, international donors, and private sector investments is vital for sustaining long-term conservation efforts.

9.6 Adopting Nature Based Solutions

Adopting Nature-Based Solutions (NBS) in forest management is essential for enhancing Kenya's climate resilience, biodiversity conservation, and ecosystem services. Solutions like reforestation, agroforestry, and sustainable forest management help restore degraded lands, support local economies, and improve water and soil health. With supportive policies and incentives, the forestry sector can widely adopt NBS, balancing environmental

protection with socio-economic benefits for sustainable development

Central to NBS is ecotourism which is envisioned as Kenya's cornerstone of sustainable conservation efforts, offering a harmonious blend of nature-based experiences and responsible travel practices. This vision, aligned with "The Forest We Want," sees forests not only as thriving ecosystems but also as destinations for immersive exploration and rejuvenation. Through activities that include guided nature walks and cultural experiences, visitors are invited to connect with Kenya's diverse forest landscapes, fostering appreciation and stewardship for these vital ecosystems. By embracing ecotourism principles, Kenya can realize a future where forests are not only preserved but also celebrated as essential components of its natural heritage, offering meaningful experiences for visitors while promoting the well-being of both people and nature.

Through innovation, education, and collective action, we have the opportunity to create a future where forests thrive, biodiversity flourishes, and communities prosper. The Forest We Want is not just a distant dream but a tangible reality that we can achieve by working together towards a shared vision of a sustainable and resilient future for Kenya's forests.



CHAPTER 10

CONCLUSION AND RECOMMENDATIONS



In summary, the key findings from the analyses provided in this Forest Status Report-Kenya supports policy dynamics, legislative evolution, technical and operational decisions for sustainable forest management and conservation. The report provides a comprehensive assessment of the status of forests across the nation, offering valuable insights into the challenges and opportunities facing forest ecosystems. Through rigorous data collection, analysis, and stakeholder engagement, the report highlights the importance of sustainable forest management in achieving environmental, social, and economic objectives.

Key findings from the report underscore the urgency to address: deforestation; degradation; biodiversity loss; Weakness in forest governance; Need to improve collaboration with research institutions and community organizations. Despite concerted efforts to conserve and manage forest resources, ongoing threats such as illegal logging, encroachment, and climate change continue to exert pressure on forest ecosystems. However, amidst these challenges, the report also identifies promising opportunities for improvement.

Recommendations outlined in the report emphasize the need for enhanced collaboration, capacity building, and promoting technological innovation to strengthen forest monitoring, management, and conservation.

It is evident that the sustainable management of Kenya's forests is not only vital for biodiversity conservation and ecosystem services but also for the livelihoods and well-being of local communities. As custodians of these invaluable natural resources, it is imperative for stakeholders to work together towards the shared goal of preserving and restoring forest ecosystems for present and future generations. Strengthening and embracing technological innovations such as Remote Sensing and Geographic Information Systems (GIS), is critical towards leveraging technology in forest monitoring processes to enhance accuracy, timeliness, and cost-effectiveness, thereby improving overall efficiency.



Enhancing collaboration and partnerships among government agencies, research institutions, civil society organizations, and local communities is vital for a comprehensive approach to forest management. Joint initiatives shall facilitate data sharing, joint monitoring efforts, and collaborative research, ultimately enhancing collective understanding of forest dynamics. Active engagement of local communities in forest monitoring and management activities is paramount for promoting stewardship and sustainability. Empowering communities to take ownership of forest resources fosters a sense of responsibility and ensures the long-term conservation of forest ecosystems.

Reviewing existing forest policies and legislation so as to align the same with current environmental challenges and international commitments is crucial. Effective implementation of forest policies is fundamental for achieving sustainable forest management objectives and addressing emerging issues. At the same time, launching public awareness campaigns and educational programs will increase understanding of the importance of forests and promote sustainable management practices among the general public. Educating individuals on their role in forest conservation efforts is key to fostering a culture of environmental stewardship. Summary of the key recommendations for the sustainable development of forests sector are as follows:

- Natural resource accounting is currently in a developmental stage in Kenya. The result is reflected in the low reported value of forests contribution to GDP estimated at 3.6%. Urgently the country needs to implement System of Environmental Economics Accounting (SEEA) framework to track and value our the natural capital that includes forests, wildlife, water and minerals.
- To get the value of the biological tree assets in the country there is an urgent need to carry out national forest inventory to inform present and future trends. This will provide investment areas in the forest sector and provide impetus and incentives for the public and private sector to invest in forestry. National forestry inventory will inform and drive the 15 Billion trees growing for ecosystem and landscape restoration

strategy to achieve 30% tree cover by 2032,

- Sustainable management of Kenya's forests shall support biodiversity conservation, provision of direct income and ecosystem services, livelihoods improvement and well-being of local communities. As custodians of these invaluable natural resources, it is imperative for stakeholders to work together towards the shared goal of preserving and restoring forest ecosystems
- Strengthen and embrace use of technological innovations such as Remote Sensing, and Geographic Information Systems (GIS), for forest conservation, management, development and protection. Leveraging technology in forest monitoring processes shall enhance accuracy, timeliness, and cost-effectiveness, thereby improving overall efficiency.
- Enhance collaboration and partnerships among government agencies, research institutions, civil society organizations, and local communities for a comprehensive approach to forest management. Joint initiatives will facilitate data sharing, joint monitoring efforts, and collaborative research, ultimately enhancing collective understanding of forest dynamics. Active engagement of local communities in forest monitoring and management activities is paramount for promoting stewardship and sustainability. Empowering communities to take ownership of forest resources fosters a sense of responsibility and ensures the long-term conservation of forest ecosystems.
- Review existing forest policies and legislation to align them with current environmental challenges and international commitments. Responsible agencies shall therefore effectively implementation forest legislations and regulations to achieve sustainable forest management objectives and address emerging issues.
- Launch public awareness campaigns and educational programs to increase understanding of the importance of forests and promote sustainable management practices among the general public. Educating individuals on their role in forest conservation efforts is key to fostering a culture of environmental stewardship.
- Establish framework for regular monitoring and evaluation of forest management interventions which is essential for assessing their effectiveness and identifying areas for improvement. Continuous monitoring allows for adaptive management approaches to be implemented in response to changing forest conditions.
- Ensure adequate allocation of financial, human, and technological resources to support forest management and conservation. Adequate resources are fundamental for maintaining the integrity of forest ecosystems and achieving sustainable development goals.
- To address challenges and barriers to Forest Landscape Restoration (FLR), there is an urgent need to prioritize establishment of effective information and knowledge management systems. This includes creating a National FLR Registry as a centralized database to track ongoing initiatives, detailing project locations, funding sources, and progress.

By implementing these recommendations, Kenya can strengthen its forest management, development and conservation for local, national, regional and global good towards sustainable forest management and conservation practices. In conclusion, the Forest Status Report - Kenya serves as a call to action, urging policymakers, practitioners, professionals, and citizens alike to prioritize the protection and sustainable management of Kenya's forests.

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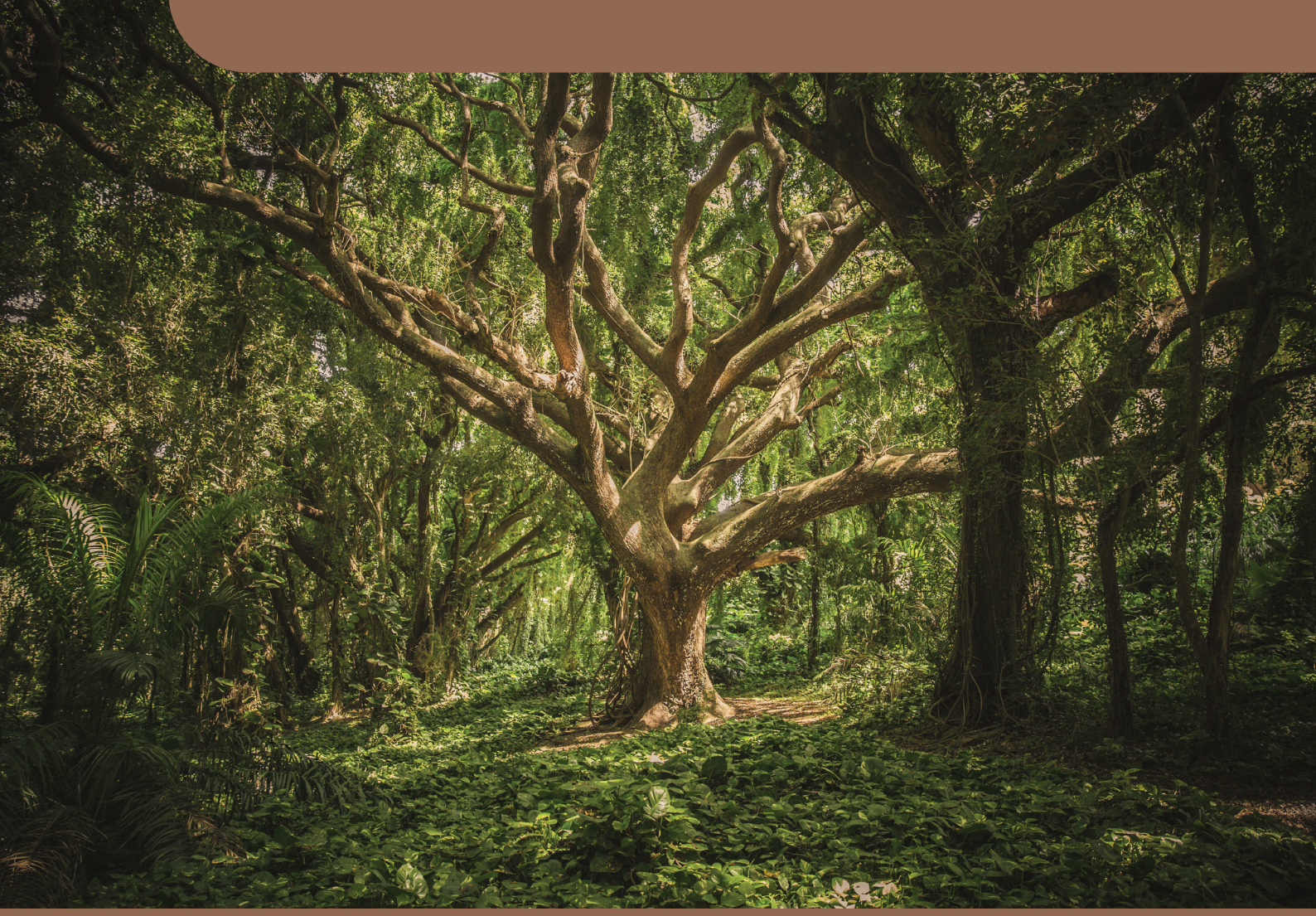












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